UNITED STATES MARINE CORPS
Repair Division
Marine Corps Logistics Base
Albany, Georgia 31704

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STANDING OPERATING PROCEDURE NR.54-83

From: Director
To: Distribution List

Subj: RADIAC Calibration Program

Ref:
(a) Title 10, Chapter I CFR
(b) MCO P4400.19B
(c) NAVMED P5055
(d) MCO P4400.105B
(e) TI-6665-25/1
(f) TI-5960-15/2A
(g) BO 5100.4H
(h) BO 5100.1F
(i) NAVSHIPS 93704 Technical Manual for RADIAC Calibrator Set AN/UDM-1A
(j) Nuclear Regulatory Commission Byproduct Material License 10-00287-04
(k) MCO P4733.1
(l) SOP NR. 39-82
(m) BO 4733.1
(n) TI-4733-15/9A
(o) SI-00080-15/1
(p) NAVFACINST 5100.15

Encl:
(1) Operating and Emergency Procedures for the AN/UDM-1A RADIAC Calibrator Set
(2) Procedure for Leak Testing the AN/UDM-1A RADIAC Calibrator Set
(3) Duties and Responsibilities of the RADIAC Calibration Safety Officer
(4) Summary of Records Required
(5) Summary of Reports Required

1. Purpose. To establish standing operating procedures and to assign specific duties and responsibilities for the safe handling, operating, storage, and disposition of radioactive material and equipment associated with the RADIAC Calibration Program.

2. References. The information and instructions contained in references (a) through (p) establish and describe the Marine Corps Calibration Program and procedures for the safe operation.

use, handling, and storage of radioactive materials. The information contained in these references will be repromulgated in this operating procedure only to the extent necessary to clearly establish a radiological safety program applicable to RADIAC calibration operations. References (a) through (p) have been included in part in this order to provide a concise list of reference material relative to RADIAC calibration operations. An explanation of each reference is provided below:

a. Reference (a) (Title 10, Chapter I, Code of Federal Regulations) establishes rules and regulations for the safe use, application, handling and storage of radioactive materials as determined by the Nuclear Regulatory Commission. (NRC requirements for byproduct material licensing are included.)

b. Reference (b) (MCO P4400.19B--MARCORSUPMAN, Vol. I, Chapter 6, Procurement, Control, and Disposal of Radioactive Material) contains definitions, detailed instructions, and procedures for the procurement, control, and disposal of radioactive material.

c. Reference (c) (NAVMED P5055-Radiation Health Protection Manual) establishes regulations applicable to all Naval activities possessing or utilizing sources of ionizing radiation which may affect the health of personnel. The radiation protection standards contained therein apply to all personnel in the Naval establishment who handle, use, or dispose of sources of ionizing radiation.

d. Reference (d) (MCO P4400.105B, Radioactive commodities in the DOD Supply Systems) contains interservice policy, outlines mandatory procedures, and identifies the responsibilities of organizational elements and key personnel worldwide, which are necessary to effect radiation protection standards for the control of radioactive commodities under DOD cognizance.

e. Reference (e) (TI-6665-25/1, Marking RADIAC Equipment) contains the procedures for marking RADIAC equipment, parts, and subassemblies which incorporate radioactive material.

f. Reference (f) (TI-5960-15/2A, Handling, Storage, and Disposition of Radioactive Electron Tubes) provides instructions for the handling, storage, and disposal of electron tubes containing radioactive material and guidance for the first aid treatment of personnel receiving wounds from broken radioactive tubes.

g. Reference (g) (BO 5100.4H, Sealed Source Radioactive Material Emergency Procedural Safeguards) provides emergency

procedural safeguards to protect security, disaster control, and/or fire fighting personnel in the event of fire or other emergency occurring in facilities containing "sealed sources" of radioactive material.

h. Reference (h) (BO 5100.1F, Base Safety Program) establishes the requirement for periodic physical examinations of all personnel subject to exposure to ionizing radiation.

i. Reference (i) (Technical Manual for RADIAC Calibrator Set AN/UDM-1A) provides installation, operation, and maintenance instructions for the AN/UDM-1A RADIAC Calibrator Set.

j. Reference (j) (Nuclear Regulatory Commission (NRC) Byproduct Material License 10-00287-04) authorizes the use and possession of AN/UDM-1A RADIAC calibrator sets (three) in accordance with statements, representations, and procedures contained in current NRC applications and amendments.

k. Reference (k) (MCO P4733.1, Marine Corps Test, Measurement, and Diagnostic Equipment (TMDE) Calibration and Maintenance Program (CAMP)) establishes Marine Corps policy, provides information and guidance, and prescribes the general procedures to be followed in the conduct of the Marine Corps Calibration Program.

l. Reference (l) (SOP NR. 39-82, Marine Corps Test, Measurement, and Diagnostic Equipment (TMDE) Calibration and Maintenance Program (CAMP)) establishes Repair Division policy and assigns certain duties and responsibilities to Calibration Branch as well as to the calibration supported organizations.

m. Reference (m) (BO 4733.1, Marine Corps Test, Measurement, and Diagnostic Equipment (TMDE) Calibration and Maintenance Program (CAMP)) establishes procedures and assigns responsibilities for the handling, inspection, repair, modification, and calibration of test and measuring instruments and equipment organic to the Base; in stock (Ready-Line/Storage Quality Control); upon issue to the FMF, posts and stations; and on a reimbursable basis for off-Base customers as directed.

n. Reference (n) (TI-4733-15/9A, RADIAC Instruments Calibration Requirements) provides instruction relative to calibration intervals and calibration procedures to be utilized for RADIAC instruments.

o. Reference (o) (SI-00080-15/1, Disposition of MX-1083C()/PDR-27 Radioactive Test Source RADIAC Set, AN/PDR-27) directs and provides instructions for disposal of the MX-1083()/PDR-27 Radioactive Test Source and transmits and

authorizes the use of an operational test procedure using natural background radiation.

p. Reference (p) (NAVFACINST 5100.15 Radiological Affairs Support Program) establishes ionizing radiation safety standards and requirements, provides licensing requirements, and provides guidance in the establishment, management, and maintenance of effective local radiological safety programs.

3. Definitions

a. Radiation Source: Any material, equipment, or device which generates or is capable of generating ionizing radiation.

b. Ionizing Radiation: The electromagnetic or particulate emanations produced by radiation sources. These emanations can cause ionization; i.e., the ejection of electrons from atoms. Ionization within cells or tissues of the body can occur as the result of exposure to alpha particles, beta particles (electrons), neutrons, protons, or other atomic or sub-atomic particles, or gamma rays, X-rays, or other electromagnetic waves capable of ejecting electrons from atoms.

c. Rem: An equilibration of the dose of ionizing radiation to the body in terms of its estimated biological effect, relative to an absorbed dose of one roentgen of high voltage X-rays. The rem shall be the unit of dose for record purposes.

d. Rad: The unit of absorbed dose.

e. Roentgen (r): That amount of X or gamma radiation which will produce 2.083×10^9 ion pairs in 1 cc of air under standard conditions. For the purpose of this operating procedure, one roentgen of X or gamma radiation is considered to deliver one rad.

f. Radioactive Contamination: The pollution or contamination of any object or area by the deposition, impingement, infiltration, ingestion, or dissolution of radioactive substances in excess of any radioactivity naturally present in or on those objects or areas. An object or area is considered to be contaminated when the loose radioactive surface contamination exceeds 100 micromicrocuries as measured on a dry filter paper wiped over an area of 100 square centimeters, unless a different limit as approved by the NRC.

g. Radiation Area: Any area to which access shall be limited as deemed necessary by cognizant authority and in which appropriate precautionary measures are taken to protect personnel from exposure to radiation or radioactive materials. A radiation area includes any area accessible to personnel in which there exists:

(1) Ionizing radiation at such dose rate levels that a major portion of the body, head, trunk, active blood-forming organs, gonads, or lens of the eye could receive in any one hour in excess of 5 mrem, or in any five consecutive days a dose in excess of 100 mrem.

(2) Airborne radioactive materials, composed wholly or partly of licensed material, in concentrations in excess of the amounts specified in Table I of Appendix B, Title 10, Part 20, of the Code of Federal Regulations, reference (a).

h. High Radiation Area: Any area accessible to personnel in which there exists ionizing radiation at such energy level that a major portion of the body, head, trunk, active blood-forming organs, gonads, or the lens of the eye could receive in any one hour a dose in excess of 100 mrem.

i. RADIAC Calibration Safety Officer: The individual designated to provide consultation and advice on the hazards associated with ionizing radiation and the effectiveness of measures to control these hazards. This individual shall be technically qualified by virtue of education and/or professional experience to assure a capability commensurate with the assignment.

j. RADIAC: RAdiation Detection Identification And Computation.

k. Additional definitions relative to radiation, radioactive material, and RADIAC calibration are contained in references (a), (b), (c), (d), (k), and (l).

4. Information

a. License Material

(1) RADIAC Calibrator Set AN/UDM-1A, located in the RADIAC Calibration facility, is under the direct control of the Head, RADIAC Calibration and Repair Unit, a licensed radioactive materials handler. Use of this source for the calibration of RADIAC devices is authorized by the Nuclear Regulatory Commission under the renewable Byproduct Material License number 10-00287-04.

(2) Additional RADIAC Calibrator Sets or other inactive licensable radioactive material may be stored in Building 2702 (Radioactive Material Storage Facility) as required. However, appropriate license amendments are necessary prior to acceptance for storage or transfer.

b. Security

(1) The AN/UDM-1A RADIAC Calibrator Set is permanently installed in Building 2700, which is a specially designed concrete block building surrounded by an eight-foot high security fence, the gates of which are always locked except during the entry or exit of authorized personnel. Conventional radiation signs are posted prominently on the fence and on the gate entrance to Building 2700. The RADIAC Calibrator Set is labeled with the conventional radiation warning signs.

(2) The AN/UDM-1A Calibrator will be locked with a locking device on the remote operating controls while not in active use and will remain in the above described building at all times.

(3) The keys to the RADIAC Calibrator Set AN/UDM-1A, Buildings 2700 and 2702, and to the chain-link fence, will be kept in the key locker, Calibration Branch Office, and may be drawn by the licensed by-product material handlers identified in reference (j).

c. Radiation Protection Guides

(1) Each individual, prior to occupational exposure to ionizing radiation, shall provide the Base Medical Branch with all information relative to any previous occupational radiation dose to permit compliance with references (a) and (c).

(2) The maximum dosage which any individual shall be permitted to receive (references (a) and (c)) in a radiation area shall not exceed:

(a) 1.25 rem in any calendar quarter;

(b) 5 rem for the calendar year; or

(c) 100 millirem in any seven-day period.

(3) The radiation protection guides listed above shall be considered as the maximum dose permitted and not a working limit. Every effort shall be made to maintain radiation doses as far below these limits as practicable.

d. Personnel Dosimetry

(1) Each person present during RADIAC calibration operations and/or who maintains, operates, leak tests, or otherwise handles sealed sources or radioactive material, shall wear a photodosimetry film badge and two low-range (0-200Mr) self-indicating dosimeters.

(2) Film badge holders and photosimetry film shall be obtained from the Base Medical Branch. Other personnel monitoring devices and RADIAC equipment shall be provided by Calibration Branch.

(3) Photodosimetry film badges and dosimeters shall be stored in the facilities provided in Calibration Branch Office (Building 2200) at the end of each working day and when not in use.

(4) Each photodosimetry film badge will be clearly marked with the name and employee number of the individual to whom it is assigned.

(5) Photodosimetry film badges will be delivered to the Base Medical Branch on or before the third working day of each month for analysis.

(6) RADIAC calibration personnel shall be removed from exposure to radiation by the RADIAC Calibration Safety Officer, when necessary, to keep individual doses from exceeding the standards established above.

(7) Any dose received shall be considered to be to the whole body.

(8) Pocket dosimeters utilized are pencil-shaped ionization chambers calibrated to discharge at a predictable rate when exposed to ionizing radiation. Special care must be taken to prevent the dosimeter from coming in contact with liquids or from being jarred unduly. If damage to a dosimeter occurs or is suspected, the RADIAC Calibration Safety Officer should be notified.

(9) If either or both of an individual's dosimeters should read off-scale (over 200mr), work will be stopped at once and the RADIAC Calibration Safety Officer shall be notified. The RADIAC Calibration Safety Officer will then:

(a) Arrange for immediate processing of the individual's film badge by the Base Medical Branch to determine if any over-exposure has taken place.

(b) Remove the individual from any additional exposure pending resolution of the situation.

(c) Inspect and test the suspect dosimeter(s) and determine whether or not they are faulty.

(d) Determine whether or not the individual involved may safely return to RADIAC calibration work.

e. Instruction of Personnel. RADIAC calibration personnel and other persons requiring frequent access to the RADIAC calibration area (Building 2700) shall be thoroughly indoctrinated in the potential hazards and the precautions and procedures to minimize exposure. This training shall be the responsibility of the Head, RADIAC Calibration and Repair Unit, Calibration Branch.

f. RADIAC Calibration Training

(1) Training of RADIAC calibration technicians will be accomplished by utilizing the facilities available at the Naval Schools Command, Treasure Island, San Francisco, California. The five-week Joint Armed Forces RADIAC Maintenance Course conducted by that organization provides the formal training required for NRC licensing. Personnel completing this course and RADIAC calibration assistants will be required to complete a ninety hour on-the-job local training program consisting of the following:

(a) Principles and Practices of Radiation Protection. Forty hours of classroom instruction which will include the study of Title 10, Part 20, "Standard for Protection Against Radiation"; Part 30, "Rules of General Applicability to Licensing of Byproduct Material", Part 34, "Licenses for Radiography and Radiation Safety Requirements for Radiographic Operations"; and a study of the "Safe Handling and Use of Encapsulated Radioisotopes for RADIAC Calibration" in which the characteristics, hazards, and units of gamma radiation are explained.

(b) Radioactivity Measurements, Standardization, and Monitoring Techniques and Instruments. Twenty hours will be devoted to the study of radiation monitoring instruments. This will include film badges, direct reading dosimeters, the Model 592B Victoreen Survey Meter, and the AN/PDR-27J. Instructions in the operation of these instruments and their limitations will be included. The units of radiation and quantity measurement will be covered.

(c) Calculations Basic to the Use of Radioactive Isotopes. Ten hours will be spent in the calculations of working distances, shielding, inverse square law, and maximum dosages permitted.

(d) Biological Effects of Radiation. Ten hours will be spent in classroom instruction on this subject, which will include: The External Dose Hazard, an Explanation of Ionization, Radiosensitivity of Tissue, and the Effects of Dose Rates.

(e) RADIAC Calibrator Set AN/UDM-1A. Ten hours will be devoted to the explanation of the operation of the Calibrator, how it is used, its hazards, and safety devices.

(2) Descriptions of licensed byproduct material handlers' training and experience are identified in enclosure (3).

Upon completion of the foregoing instructions, a written test will be administered to all personnel in the class to determine their working knowledge of radioactive sources and the Calibrator Sets. It will be necessary that they correctly answer eighty percent of the test questions before they will be given on-the-job training. Personnel selected for on-the-job training will be given additional training on the questions they failed to answer correctly, and subsequently will be re-examined to make certain they understand the material covered.

g. Medical Qualifications. Any person considered for assignment to duty in the RADIAC Calibration Program shall receive appropriate medical examination, including complete physical and baseline hematology, in accordance with references (a), (b), and (h), before assignment and at intervals determined by the Base Medical Officer.

h. Survey Instruments and Dosimeters. Each RADIAC instrument organic to the Base used for radiation surveying in conjunction with RADIAC calibration and radiography operations will be calibrated at intervals not to exceed three months. Personnel dosimetry devices utilized by calibration and/or radiography personnel will be calibrated at intervals not to exceed six months.

i. Instrument Status. Repair Division RADIAC instruments and devices in a REJECT, INACTIVE, or SPECIAL CALIBRATION status, or overdue for calibration, shall not be used for radiation surveys or personnel dosimetry in connection with the licensed byproduct material held in this Division.

j. Labels and Tags. Marine Corps Calibration Program labels and/or tags affixed to RADIAC instruments shall not be removed or altered by other than Calibration Branch personnel.

5. Action

a. The Calibration Branch will:

(1) Manage the Division's RADIAC Calibration Program in accordance with the requirements established in references (a) through (p).

(2) Maintain and operate RADIAC devices and calibration standards for the inspection, repair, calibration, and leak testing of RADIAC survey meters and related RADIAC devices and equipment in accordance with enclosures (1) and (2), and references (g) and (k).

(3) Inspect, repair, modify, and calibrate RADIAC instruments and devices using the procedures contained in enclosures (1) and (2) and references (f), (g), (h), (k), (l), (m), (n), and (o).

(4) Prepare and publish a monthly Calibration Schedule for all RADIAC devices and instruments organic to the Base which require periodic inspection and calibration.

(5) Determine the calibration requirements of RADIAC devices and instruments.

(6) Maintain adequate records and files to provide a history of the condition, repair, modification, and calibration of RADIAC devices and calibration standards.

(7) Determine and assign the duties and responsibilities of the RADIAC Calibration Safety Officer. Duties and responsibilities of the RADIAC Calibration Safety Officer, as well as a description of the qualifications of the individual currently assigned, are contained in enclosure (3).

(8) Initiate the request for renewal or amendment of the NRC Byproduct Material License number 10-00287-04 as required. Specific details concerning the preparation and submission of byproduct material license applications, amendments, or renewals are provided in reference (p).

(9) Perform the leak testing and analysis of the removable radioactive contamination from the AN/UDM-1A RADIAC Calibrator Set in accordance with enclosure (2).

(10) Determine and submit the RADIAC calibration training requirements to the Division Training Officer.

(11) Ensure that the requirements for physical examinations for personnel engaged in RADIAC calibration operations, as outlined in references (c), (b), and (h), are met.

(12) Maintain and submit the records and reports required by references (a), (b), (k), and (l), as listed in enclosures (4) and (5).

(13) Suitably label/tag all RADIAC instruments and devices in accordance with reference (m) in one of the following categories:

(a) CALIBRATED

(b) SPECIAL CALIBRATION

(c) REJECT

(d) INACTIVE

(e) CALIBRATION NOT REQUIRED

(14) Maintain an adequate supply of calibrated dosimeters (0-200 mr range) to provide each RADIAC calibration technician, RADIAC calibration assistant, radiographer, and radiographer's assistant with two calibrated dosimeters plus an additional quantity to exchange for dosimeters submitted for calibration and inspection. The additional quantity of dosimeters maintained should be sufficient to ensure uninterrupted RADIAC calibration and radiography operations.

b. The Base Medical Branch's responsibilities include:

(1) Furnishing and processing film badges as required and reporting film badge readings monthly, or as may be required.

(2) Performing the medical examinations required by references (c) and (h).

(3) Preparing and maintaining DD Form 1141 for each person occupationally exposed to ionizing radiation.

(4) Evaluating the occupational exposure history of each individual and advising the Director, Repair Division, when action is necessary to limit an individual's exposure to ionizing radiation. Reference (c) applies.

(5) Making the annual "Personnel Exposure to Ionizing Radiation" report and the "as required" reports of over exposure to ionizing radiation, as outlined in enclosure (12) of reference (h).

c. The Division Training Officer will:

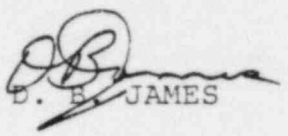
(1) Schedule the Division RADIAC Calibration Training Course or arrange for training at the Naval Schools Command, Treasure Island, San Francisco, California, as needed to meet Calibration Branch training requirements. Such scheduling for

local training should include arranging for instructors, facilities, course materials, etc.

(2) Coordinate training requirements with Quality Control Branch prior to implementation. (With the exception of twenty hours of instruction in radiography and on-the-job training, the Radiography Training Course and the RADIAC Calibration Training are basically the same.)

(3) Prepare and maintain the syllabus for the Division RADIAC Calibration Training Course.

6. Changes. This SOP is an integral part of Byproduct Material Licence number 10-00287-04 and may be revised only through appropriate license amendments.



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OPERATING AND EMERGENCY PROCEDURES FOR THE AN/UDM-1A RADIAC CALIBRATOR SET

1. Purpose. The purpose of this enclosure is to:

a. Establish the standard operating procedures for the operation of the AN/UDM-1A RADIAC Calibrator Set located in Building 2700.

b. Establish the emergency procedures to be followed in the event of a fire or accident in Building 2700.

2. General Operating Procedures

a. A Licensed Byproduct Material Handler identified in reference (j) will be responsible for the operation of the AN/UDM-1A RADIAC Calibrator.

(1) The Licensed Byproduct Material Handler is responsible for ensuring that Building 2700 is properly secured when the radiation source is left open after normal duty hours and that the Repair Division Security Officer is notified that one of the personnel identified in reference (J) must be contacted to gain access to Building 2700 during these hours.

b. Prior to entrance to the RADIAC Calibration facility, the Licensed Byproduct Material Handler calibration technician and his assistant will visually check to ensure that no unauthorized personnel are within the fenced area around Building 2700.

c. Upon entrance to the RADIAC Calibration facility the following will be accomplished by the Licensed Byproduct Material Handler and his assistant:

(1) Shut and lock the gate on the chain-link fence.

(2) Place two currently calibrated pocket dosimeters and a film badge in left shirt pocket or attach to the clothing on the upper left portion of the body.

(3) Check the operation of the Victoreen Model 592A Survey Meter and the AN/PDR-27J.

NOTE

Should the Victoreen Model 592B or the AN/PDR-27J Survey Meter become inoperative during RADIAC calibration operations, the RADIAC Calibrator Set will be secured and locked until the meter has been repaired or replaced.

(4) Inspect the primary power distribution switch box to insure that the audible and visual alarm systems are energized (switch numbers 4 and 6 respectively).

(5) Test the visual alarm system by unlocking the remote operating controls of the AN/UDM-1A and operating each control while observing the red warning lights. The three lights should remain lit while either or both controls are moved from the "closed" or minimum radiation level positions.

(6) Test the audible alarm system by interrupting the light beam at the inside of either entrance to the high radiation area. The audible alarm should ring during the period the light beam is interrupted with the red warning lights lit.

NOTE

Should either the visual or audible alarm system be found inoperative, the AN/UDM-1A will be secured and locked. Operation of this device will not be permitted until the alarm systems have been repaired and properly tested by the RADIAC Calibration Safety Officer.

(7) Secure and lock both operation controls to the minimum level position on the AN/UDM-1A and measure the surface radiation level of the AN/UDM-1A using the Victoreen Model 592A Survey Meter. The reading obtained should not exceed 65 mr/hr and will be recorded in the AN/UDM-1A Utilization Log.

d. Calibration Operations

(1) At no time will RADIAC calibration personnel enter the high radiation area while the source is open (i.e., red warning lights on) to observe or adjust an instrument under calibration. The only person authorized to enter the high radiation area when the red warning lights are lit is the RADIAC Calibration Safety Officer or his authorized representative. Such authorization shall be limited to currently licensed individual users. Entrance is authorized only for the accomplishment of leak testing and/or to troubleshoot or repair the AN/UDM-1A operating controls or related devices should they become inoperative.

(2) RADIAC instruments will be inspected, repaired, and leak tested as necessary prior to calibration.

(3) RADIAC instruments to be calibrated using the AN/UDM-1A will be placed on the RADIAC alignment stand.

(4) Records and reports relative to calibration matters; e.g., calibration checklists, production reports, etc., will be maintained for each instrument serviced in accordance with references (k), (l), and (m).

(5) Upon completion of calibration operations and after the RADIAC Calibrator Set has been secured and locked, the radiation level at the surfaces of the sources shall be measured and recorded in the Utilization Log.

(6) The dosimeter readings (two for each technician) will be logged in the appropriate Utilization Log and the log will be signed by the RADIAC calibration technician in charge.

3. Emergency Procedures

a. Reference (g) describes the detailed "Emergency Procedural Safeguards" to protect the security, disaster control, and/or fire fighting personnel in the event of fire or other emergency occurring in the facilities housing "sealed sources" of radioactive material.

NOTE

A Victoreen Model 592B or an AN/PDR-27J Survey Meter will be located in Shop 681 Building 2200 for use by emergency personnel.

b. In the event of a fire or other emergency in Building 2700 and/or 2702, the RADIAC Calibrator Set AN/UDM-1A will be secured and locked, and the RADIAC Calibration Safety Officer, if not present, will be notified.

c. Reports necessary in the event of damage to or loss of the RADIAC Calibrator Sets, or unmonitored personnel exposure, etc., are described fully in enclosure (5) of this order.

d. In the event of an emergency in an area adjacent to the RADIAC Calibrator Sets, such as a fire or an accident involving RADIAC calibration personnel, immediately accomplish the following:

(1) Return all RADIAC Calibrator Sets to the minimum radiation level position. Lock the remote operating controls of the AN/UDM-1A.

(2) Perform a physical radiation survey of the RADIAC Calibrator Set to insure that source is in the shielded position.

(3) Remove the RADIAC Calibrator Set from the danger area, if possible.

(4) If the RADIAC Calibrator Set cannot be removed from the danger area, the following will be accomplished:

(a) Perform a physical radiation survey to determine if a 2-mr/hr level is exceeded at the fence line.

(b) If a radiation level in excess of 2-mr/hr exists at the fence line, determine the location of the 2-mr/hr isodose line and post signs bearing the radiation symbol and the words CAUTION - RADIATION AREA. Rope off the area to prevent personnel entry.

(c) Determine the 100-mr/hr isodose line and place signs bearing the radiation symbol and the words CAUTION - HIGH RADIATION AREA.

(d) Notify the Provost Marshal and/or Fire Department, as appropriate.

e. In the event of an accident involving the RADIAC Calibrator Set, immediately accomplish the following:

(1) Return all sources to the minimum radiation level position. Lock the remote operating controls on the AN/UDM-1A.

(2) Do not use the RADIAC Calibrator Set again until the RADIAC Calibration Safety Officer has made a complete inspection and grants approval for use.

(3) In the event the sources cannot be returned to the minimum radiation position, the RADIAC Calibration Safety Officer will notify the following personnel:

(a) Head, Calibration Branch - Extension 5367/5368

(b) Provost Marshal - Extension 5183/5181

(c) Fire Department - Extension 5333

(d) Base Medical Branch - Telephone 439-5986

(e) Director, Repair Division - Extension 5301/5302

f. In the event of an accident which involves the exposure of unmonitored personnel, the RADIAC Calibration Safety Officer shall determine the approximate personnel exposure and take appropriate safety measures to insure that additional personnel are not exposed. A report shall be prepared in accordance with the instructions contained in enclosure (5).

PROCEDURE FOR LEAK TESTING THE AN/UDM-1A RADIAC CALIBRATOR SET

1. Purpose. The purpose of this enclosure is to:

a. Establish the procedures to be followed in the semiannual testing of the AN/UDM-1A RADIAC Calibrator Set.

b. Provide additional information relative to leak testing, analysis, and the monitoring of the AN/UDM-1A RADIAC Calibrator Set.

c. Publish a list of personnel authorized to perform the leak testing of an AN/UDM-1A RADIAC Calibrator Set.

2. Background. There is normally no radioactive contamination problem associated with the use of sealed sources in a radiography or RADIAC calibration program. However, if the source capsule should fail because of wear, corrosion, radiation damage, mechanical damage, or for other reasons, the radioactive material inside the capsule might escape and produce a hazard to those who come in contact with the material. Sealed sources have failed, and for this reason paragraph 34.25 of Part 34 of reference (a) requires that each sealed source be tested for leakage at intervals not to exceed six months.

3. General

a. Leak testing, repair, tagging, opening, modifying, or any other handling of this device, shall be performed by one of the licensed byproduct material handlers identified in reference (j) when authorized by the RADIAC Calibration Safety Officer.

b. The RADIAC Calibration Safety Officer is responsible for the maintenance of the Source Leak Test Data Sheet (Attachment (1)) for the leak tests performed on the RADIAC Calibrator Sets. His signature under each entry is required to indicate that the leak test was properly conducted and the results accurately computed and recorded. Sample calculations showing the conversion of leak test results to the required microcurie units are provided in Attachment (2), as well as the method of determining the detector efficiency.

c. The analysis of the smears obtained during the leak test of the RADIAC Calibrator Sets will be accomplished with equipment capable of detecting the presence of less than 0.005 microcuries of removable contamination on the sealed source, listed as follows:

(1) Nuclear Chicago Binary Scaling Unit Model 183B

(2) Nuclear Chicago GM Detector Model D-33

(3) Nuclear Chicago Preset Timer Mode T-1

(4) Nuclear Chicago Manual Sample Changer Model 3053

(5) Nuclear Chicago Solid Source Kit Model SK-3

4. Leak Test Procedure for the AN/UDM-1A RADIAC Calibrator Set

a. Verify that the source positioning control and the aperture plug control are locked in the position to provide maximum attenuation of the radiation beam.

b. Measure the radiation level at the surface of the AN/UDM-1A RADIAC Calibrator Set with a currently calibrated Victoreen Model 592A Survey Meter. The reading obtained should not exceed 65 mr/hr. If the reading obtained exceeds 65 mr/hr, do not proceed with the leak test. Follow the instructions in paragraph 4.i. of this enclosure.

c. Open the aperture plug by operation of the aperture plug control.

d. Lightly saturate a 1-inch disc of #50 filter paper with a decontamination solution such as "RADIAC wash" and wipe the inner sides of the aperture using a suitable device (leak test tool) to hold the filter paper. EXTREME CAUTION must be observed in order to prevent personnel exposure to the main beam of the source while the aperture plug is removed.

e. Close the aperture plug when the wipe is completed.

f. Monitor the "contaminated" filter paper for gross contamination, using a Victoreen Model 592A Survey Meter set on the 0-10 mr scale. If a steady indication on the survey meter is obtained, gross contamination should be assumed and the instructions contained in paragraph 4.i. should be followed.

g. If gross contamination is not indicated, place the "contaminated" filter paper in a clean planchet. Insert the planchet in a plastic container (petri dish) to facilitate handling prior to counting.

h. Follow the general operating procedure outlined in the Nuclear Chicago Binary Scaler and Instruction Manual and, using the method illustrated in the calculations provided in attachment (2) of this enclosure, determine the activity of the removable contamination contained on the paper in the radioactive waste disposal container provided. If any appreciable contamination is indicated, the planchet and plastic container should be disposed of in the same manner.

i. Should any leak test reveal the presence of 0.005 microcuries or more of removable radioactive material or if gross contamination is indicated during the preliminary steps of the leak test procedure, the following action must be taken.

(1) Immediately remove the AN/UDM-1A RADIAC Calibrator Set from service and tag it, identifying the reason(s) therefor.

(2) Notify the following personnel:

(a) RADIAC Calibration Safety Officer
Extension 5370

(b) Head, Calibration Branch
Extension 5367/5368

(c) Director, Repair Division
Extension 5301/5302

(d) Chairman, Base Isotopes Committee
Extension 5367/5368

(3) The RADIAC Calibration Safety Officer will conduct a survey to determine if and to what extent contamination may have spread to personnel, equipment, or facilities and decontaminate or establish appropriate control measures as necessary.

(4) Decontaminate and repair or dispose of the RADIAC Calibrator Set in accordance with Commission regulations.

(5) Forward a written report within five days to the Director, Region II, Office of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, 230 Peachtree Street, Suite 818, Atlanta, Georgia, 30303, and to the Commandant of the Marine Corps, Code LMA-3.

SOURCE LEAK TEST DATA SHEET
(SAMPLE)

SURVEY DATA	Test Conducted By	OLSON
	Date	12 Jul77
	Time	1500
	Source Serial No.	102
	Location of Source	2200
	Isotope	Cs 137
	Activity at Date of Mfg	5.6C
	Assay Date of Activity	7 Jun 56
COUNTING DATA	Counted By	OLSON
	Date	13 Jul 77
	Time	0930
	Scaler No.	007438
	Type Counting System	Beta-Gamma
	Voltage	1050
	Eff. of Scaler	2.00%
CALCULATION DATA	Total Count	362
	Total Counting Time (Min.)	10
	CPM	36.2
	Scaler Bkg.	16.3
	Corrected CPM	19.9
	DPM	995
	Activity (Microcuries)	.000448

/s/ J. W. OLSON
7 May 79

Attachment (1) to
Enclosure (2)

SAMPLE CALCULATIONS

1. The procedure to determine the detector efficiency of the counting system, follows:

a. Measure the background of the detector unit in counts per minute (CPM) and record.

b. Compute the disintegration rate of the cesium 137 calibration source (part of the SK-3 Source Sample Kit) in disintegrations per minute (DPM) and correct for the change in source strength with time.

c. Measure the calibration source in counts per minute and record.

d. Subtract the background count from the count obtained using the calibration source, and divide the result by the calculated disintegration rate of the calibration source and multiply by 100:

$$\text{EFF (\%)} = \frac{\text{CALIBRATION SOURCE COUNT} - \text{BACKGROUND COUNT}}{\text{COMPUTED CALIBRATION SOURCE DISINTEGRATION RATE}} \times 100$$

EXAMPLE:

If the calibration source count = 30 CPM, background count = 10 CPM, and the calculated calibration source DPM = 1000.

$$\text{Efficiency} = \frac{30 - 10}{1000} \times 100 = 2.00\%$$

2. To determine the activity of wipe (in microcuries):

a. Measure the background of the detector unit in CPM (counts per minute).

b. Count the wipe sample (counts per minute).

c. Subtract the background count from wipe sample count and divide result by percentage of efficiency. (Result will be in actual disintegrations per minute (DPM).)

d. Divide DPM by 2.22×10^6 (the number of disintegrations per minute which equals one microcurie).

DUTIES AND RESPONSIBILITIES

OF THE

RADIAC CALIBRATION SAFETY OFFICER

1. The RADIAC Calibration Safety Officer identified in reference (j) is directly responsible for all aspects of RADIAC calibration operations and radiation safety. He will:

a. Conduct a quarterly inventory of sealed sources possessed under Byproduct Material License number 10-00287-04 and maintain an appropriate record of such inventory.

b. Ensure that a licensed RADIAC calibration technician directly supervises any operation involving the movement, maintenance, leak testings, and/or use of the AN/UDM-1A RADIAC Calibrator Set possessed under the Byproduct Material License number 10-00287-04.

c. Ensure the security of the AN/UDM-1A RADIAC Calibrator Sets located in Buildings 2700 and 2702. The AN/UDM-1A located in Building 2700 will be secured at all times except during RADIAC calibration operations. The gates on the eight-foot high chain-link fence around Buildings 2700 and 2702 shall be shut and locked at all times to ensure maximum security and protection to unmonitored personnel.

Building 2702, which is used solely for the storage of AN/UDM-1A RADIAC Calibrator Sets, shall be secured and locked at all times. Entrance to this building shall be limited to RADIAC calibration personnel only for the purpose of leak testing, quarterly inventory, and routine inspection. CAUTION-HIGH RADIATION signs shall be posted and maintained on the doors of Building 2700 and 2702 and on the chain-link fence around the RADIAC Calibration facility.

The keys for (1) the gates on the outer chain-link fence,
(2) inside fence gate to Building 2702,
(3) Building 2702,
(4) Building 2700, and
(5) the locks associated with the RADIAC Calibrator Sets located in Building 2700

will be kept in the key locker located in the Calibration Branch Office and may be drawn by licensed byproduct material handlers identified in reference (j).

d. Ensure strict adherence to the operating and emergency procedures outlined in enclosure (1).

e. Ensure that a sufficient number of calibrated RADIAC survey meters and pocket dosimeters are available for RADIAC calibration and radiography operations. Ensure that only currently calibrated RADIAC survey meters and dosimeters are used by RADIAC calibration personnel.

f. Ensure that required personnel dosimetry equipment (two 0 - 200 mr full-scale pocket dosimeters and one film badge for each person) is properly charged and worn as appropriate by all RADIAC calibration personnel.

g. Maintain the records and prepare and disseminate the reports as required. (See enclosures (4) and (5).)

BYPRODUCT MATERIAL HANDLERS TRAINING AND EXPERIENCE

1. Descriptions of Mr. Rodriguez's and Mr. Robinette's training and experience as related to Byproduct Material License Number 10-00287-04, amendments 24 and 25 respectively, are as follows:

a. Training

	RODRIGUEZ	ROBINETTE
(1) Principles and Practices of Radiation Protection	20 hours	30 hours
(2) Radioactivity Measurement Standardization and Monitoring Techniques and Instruments	120 hours	60 hours
(3) Mathematics and Calculations Basic to the Use and Measurement of Radioactivity	20 hours	25 hours
(4) Biological Effects of Radiation	20 hours	25 hours

The formal training for Mr. Rodriguez indicated above was obtained during attendance at the Joint Armed Forces RADIAC Maintenance School, NAVSCOLCOM, Treasure Island, San Francisco, California. Course completion date was 1 October 1982.

The formal training for Mr. Robinette indicated above was obtained during attendance at the U. S. Army Chemical School, Fort McClellan, Alabama. The Radiological Safety Course 7KF3 was completed 30 September 1980. The Radiological Monitor Course was completed at the Staff College Battle Creek, Michigan on 17 March 1978.

b. Experience

(1) Mr. Rodriguez

(a) Twelve months experience as a RADIAC Calibration Technician, using 120 curies of CS-137 (AN/UDM-1A RADIAC Calibration Set), at the Marine Corps Logistics Base, Albany, Georgia.

(2) Mr. Robinette

(a) Nine months experience calibrating RADIAC instruments using Calibrator Set AN/UDM-2. Certification as Radiological Protection Officer (RPO) for AN/UDM-2 by CERCOM under NCR License 29-01022-08, 21 April 1981.

SUMMARY OF RECORDS REQUIRED

1. The following records will be maintained by the RADIAC Calibration Safety Officer:

a. A record showing the receipt, transfer, or disposal of any byproduct material licensed or required to be licensed in accordance with reference (a) and used in the Repair Division RADIAC Calibration Program.

b. A record of the quarterly inventory of all sealed sources received and possessed under NRC License number 10-00287-04.

c. A record showing the names, addresses, and telephone numbers (work phones and home phones) of all RADIAC calibration personnel.

d. A utilization log for AN/UDM-1A RADIAC Calibrator Set showing:

(1) A description (make, model, and serial number) of each RADIAC Calibrator Set.

(2) Dates utilized.

(3) The identity of the operator and assistant.

(4) The radiation level at the surface of the Calibrator Set taken prior to operation of the source and at the end of the work day.

(5) The radiation level at the operator position taken prior to operation of the source.

(6) Signature of licensed operator.

(7) The radiation dose in millirem received by each RADIAC calibration technician as indicated on his dosimeters. The reading on each of the two dosimeters worn by the individual will be recorded.

e. Form NRC-4--"Occupational External Radiation Exposure History". This form is used for estimating the previously accumulated occupational dose received by an individual and must be completed and signed by the individual before he may be permitted to work in the RADIAC calibration area. Form NRC-4 will be completed for each individual whether or not he has had any previous occupational exposure. In "no previous exposure" situations the word "none" will be inserted in item 5 and the work "zero" in items 11 and 13(b) of the form.

f. Form NRC-5--"Current Occupational External Radiation Exposure". Two copies of Form NRC-5 will be maintained for each individual exposed, one to keep a running record of individual weekly doses received as indicated by pocket dosimeter and a second to keep a running record of individual monthly doses received as indicated by film badge. The daily (pocket dosimeter) exposures shown on the appropriate Utilization Log will be summed up weekly and entered on the first form. Monthly film badge readings, provided by the Base Medical Branch, will be entered on the second. A new form NRC-5 will be opened for each individual each calendar quarter. Forms NRC-4 and NRC-5 are maintained by the Repair Division to provide a basis for responsive management action in emergencies or when individual accumulated doses approach prescribed limits.

NOTE

Forms NRC-4 and NRC-5 are required for each RADIAC calibration technician. In addition, a Form NRC-4 and a Form NRC-5 will be opened for each other individual required to be monitored in accordance with reference (a).

g. A record of leak results for the sealed sources tested is kept in units of microcuries. If no contamination is detected, it will be recorded as less than .005 microcuries.

2. The following record will be maintained by the Base Medical Branch in accordance with Chapter 5 of reference (c):

a. DD Form 1141--"Record of Occupational Exposure to Ionizing Radiation". The Base Medical Branch shall prepare and maintain DD Form 1141 for each person occupationally exposed to ionizing radiation. This form is used by the custodian of medical records to record the monthly radiation dose received by each individual as obtained from monthly film badge readings, and its use is required in lieu of Forms NRC-4 and NRC-5. DD Form 1141 thus is the official medical record of an individual's occupational exposure to radiation.

3. The above records will be made available for review by the Nuclear Regulatory Commission and other authorized inspecting officials as required.

4. Records of individual radiation exposure shall be preserved until a date five years from termination of the individual's employment. (See paragraph 20.401 of reference (a).) Former employee's radiation exposure history shall be provided the employee in accordance with paragraph 20.409 of reference (a).

SUMMARY OF REPORTS REQUIRED

1. The following reports will be made by Calibration Branch as required:

a. A report by telephone and telegraph to the Director, Region II, Office of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, 230 Peachtree Street, N.W., Suite 818, Atlanta, Georgia 30303, telephone (404)526-4503, shall be made immediately after the occurrence of any theft or loss of radioactive material becomes known. See paragraph 20.402 of reference (a).

b. A report in writing shall be made to the above addressee within thirty days after the occurrence of any theft or loss of radioactive material becomes known. A written report shall also be made of any substantive additional information which becomes available, within thirty days after the acquisition of such information. See paragraph 20.402 of reference (a).

c. A report by telephone or by written communication shall be made to the above addressee within two days following receipt of any information reasonably indicating that this facility, or basic component of this facility, fails to comply with regulatory requirements relating to substantial safety hazards, or that this facility, or basic component of this facility, contains a defect which could create a substantial safety hazard. If the initial report was by other than written communication, a written report shall be submitted to the above addressee within five days after the information is obtained. Three copies of each report shall be submitted to the Director, Office of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555. See paragraph 21.21 of reference (a).

d. A report by telephone and telegraph to the addressee identified in paragraph 1.a. shall be made immediately if an incident involving radioactive material possessed by Repair Division may have caused or threatens to cause (see paragraph 20.403 of reference (a)):

(1) Exposure of the whole body of any individual to 25 rem or more of radiation;

(2) Damage to property in excess of $200,000;

(3) The loss of one working week or more in the operating facilities affected.

e. A notification by telephone and telegraph within twenty-four hours shall be made to the addressee identified in paragraph 1.a. if any incident involving radioactive material

possessed by the Repair Division may have caused or threatens to cause (see paragraph 20.403 of reference (a)):

(1) Exposure of the whole body of an individual to 5 rems or more of radiation; exposure of the skin of the whole body of an individual to 30 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms to 75 rems or more of radiation;

(2) Damage to property in excess of $2,000;

(3) The loss of one day or more of the operating facilities affected.

f. In addition to the notifications required by paragraph 20.403 of reference (a) as described in 1.d. above, a report shall be made in writing within thirty days to the Director, Office of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555 (with a copy to the addressee listed in paragraph 1.a. above) which provides the following information:

(1) Each exposure of an individual to radiation in excess of any applicable limit in Part 20 of reference (a) or in excess of any applicable limit shown in paragraph 2 of enclosure (1).

(2) Any incident for which notification is required by paragraph 20.403 of reference (a), as described in paragraphs 1.d. and 1.e..

(3) Levels of radiation (not involving excessive exposure of any individual) in an unrestricted area in excess of ten times the applicable limit. Since the dose rate may not exceed 2 mr/hr (the applicable limit) in an unrestricted area, this report is required only if the dose rate in an unrestricted area exceeds 20 mr/hr.

g. In the event that any leak test reveals the presence of 0.005 microcurie or more of removable radioactive material, the sealed source shall be considered to be leaking and a report in writing shall be filed within five days with the Director, Office of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, describing the test results, equipment involved, and the corrective action taken. A copy of this report will be forwarded to the addressee shown in paragraph 1.a..

h. A written report shall be made monthly to each individual for whom monitoring is required (see attachment (1) to enclosure (5)). The information reported shall be obtained from the individual's film badge report, and shall include the individual's cumulative radiation dosage as well as his monthly reading. See paragraph 19.13 of reference (a).

MONTHLY OCCUPATIONAL EXTERNAL RADIATION EXPOSURE REPORT

DATE_____

NAME_____

SOCIAL SECURITY NUMBER_____

PERIOD OF EXPOSURE_____

DOSE FOR THE PERIOD (rem)_____

CUMULATIVE DOSAGE (rem)_____

LICENSEE_____

This report is furnished to you under the provisions of the Nuclear

Regulatory Commission regulation 10 CFR Part 19. You should preserve this report for further reference.

Attachment (1) to
Enclosure (5)