NRC FORM 313
(12-71)
10 CFR 30, 32, 33, 34,
35 and 40

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED BY OMB
3150-0120
Expires 8-31-88

APPLICATION FOR MATERIAL LICENSE

RECEIVED
NRC

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

APPLICATIONS FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

U.S. NUCLEAR REGULATORY COMMISSION
DIVISION OF FUEL CYCLE AND MATERIAL SAFETY, NMSS
WASHINGTON, DC 20555

88 NOV 23 A 8:13

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS, IF YOU ARE LOCATED IN:

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

U.S. NUCLEAR REGULATORY COMMISSION, REGION I
NUCLEAR MATERIALS SAFETY SECTION B
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406

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

U.S. NUCLEAR REGULATORY COMMISSION, REGION II
NUCLEAR MATERIALS SAFETY SECTION
101 MARIETTA STREET, SUITE 2900
ATLANTA, GA 30323

IF YOU ARE LOCATED IN:

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

U.S. NUCLEAR REGULATORY COMMISSION, REGION III
MATERIALS LICENSING SECTION
799 ROOSEVELT ROAD
GLEN ELLYN, IL 60137

ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
MATERIAL RADIATION PROTECTION SECTION
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TX 76011

ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION V
NUCLEAR MATERIALS SAFETY SECTION
1450 MARIA LANE, SUITE 210
WALNUT CREEK, CA 94596

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

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

- [ ] A. NEW LICENSE
- [ ] B. AMENDMENT TO LICENSE NUMBER _____
- [X] C. RENEWAL OF LICENSE NUMBER 53-00706-02

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

State of Hawaii, Department of Defense
Civil Defense Division
3949 Diamond Head Road
Honolulu, Hawaii 96816

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

Radiological Instrument Maintenance & Calibration Facility
3949 Diamond Head Road
Building 90
Honolulu, Hawaii 96816

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Richard M. Sakuma

TELEPHONE NUMBER: (808) 735-0008

SUBMIT ITEMS 5 THROUGH 11 ON 8½ x 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

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

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

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

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

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSE FEES (See 10 CFR 170 and Section 170.31)
FEE CATEGORY: 10 CFR 170.11(a)(9)
AMOUNT ENCLOSED: 0 EXEMPT

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

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

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

SIGNATURE - CERTIFYING OFFICER	TYPED/PRINTED NAME	TITLE	DATE
	ROY C. PRICE, SR.	Vice Director of Civil Defense	11/21/88

9002090354 891023
REG5 LIC30
53-00706-02 PDR

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	COMMENTS	APPROVED BY
Rem	Nov-2-V	EXEMPT	FEE EXEMPT 170.11(a)(4)	M. Bonnie
AMOUNT RECEIVED	CHECK NUMBER			DATE 1/19/89

ITEM 5: RADIOACTIVE MATERIAL

(a) ELEMENT AND MASS NUMBER	(b) CHEMICAL AND/OR PHYSICAL FORM (Manufacturer and Model, No of Sources)	(c) MAXIMUM AMOUNT WHICH WILL BE POSSESSED AT ANY ONE TIME
1. Cobalt 60	1. Sealed Source (Federal Emergency Management Agency CDV-784)	1. Not to exceed 30 millicuries per set.
2. Cesium 137	2. Sealed Source (U.S. Radium Corporation, Model 713-W.C.)	2. Not to exceed 32 millicuries per source.
3. Cesium 137	3. Sealed Source (Minnesota Mining and Manufacturing Company, Model 4D6E)	3. Not to exceed 1 millicurie per source.
4. Cesium 137	4. Sealed Source (Oak Ridge National Laboratory, Model ORNL-DSK-2384	4. Not to exceed 130 curies per source.
5. Cesium 137	5. Sealed Source (Nuclear Chicago Corporation, Model OCD-S-104	5. Not to exceed 16 millicuries per source.

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

The types of sources listed in ITEM 5 will be used, respectively, as follows:

1. Used in sealed capsules for low-range instrument familiarization, demonstrating, radiation detection and monitoring training.

2. Used in U. S. Radium Corporation, CDV-798 Model 6, Calibration Unit for medium-range (0-300 mr/hr) calibration of civil defense survey instruments.

3. Used in Minnesota Mining and Manufacturing Company, CDV-757 Model 1, Barrier Shielding Demonstrator Unit for demonstrating the effects of radiation using time, distance and shielding.

4. Used in Oak Ridge National Laboratory, CDV-794 Model 2, Shielded Calibration Unit for high-range (.4-400 r/hr) calibration of civil defense survey instruments.

5. Used in Nuclear Chicago Corporation, CDV-790 Model 3, Calibration Unit for low-range (0-40 mr/hr) calibration of civil defense instruments.

ITEM 7: INDIVIDUALS RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE

1. NAME OF RESPONSIBLE INDIVIDUAL - RICHARD M. SAKUMA

   a. Richard M. Sakuma is the Radiological Safety Officer and is responsible for: administering and monitoring a radioactive material management, control and safety program on all Federal Emergency Management Agency owned licensed radioactive byproduct materials; and conduct of the day-to-day radiation safety program and ensuring compliance with applicable NRC regulations and terms and conditions of the license.

   b. Named responsible individual also performs and/or supervises the instrument calibration procedures.

2. TRAINING FOR RESPONSIBLE INDIVIDUAL

   a. Formal Training

October 1967	Basic Radiation Health Course (211), 2 weeks (80 hours), Southwestern Radiological Health Laboratory, Las Vegas, Nevada.
June 1968	Use of CDV-794 Model 2 Calibrator, three-day course, California Disaster Office, RADEF Maintenance Shop, Sacramento, California.
August 1973	Radiological Monitoring for Instructors, 1 week, Civil Defense University Extension Program, University of Hawaii.
September 1973	Radiological Defense Officers Course, 1 week, Civil Defense University Extension Program, University of Hawaii.
November 1979	Radiological Emergency Response Operations Training Course, 1 week 3 1/2 days, Office of State Programs, U. S. Nuclear Regulatory Commission, Nevada Test Site, Mercury, Nevada.
May 1988	Basic Health Physics Course, 1 week, Louisiana State University, Baton Rouge, Louisiana.

   b. The Basic Radiological Health Course (211) completely satisfies ITEM 7, 2(a), of the Guide for the Preparation of Applications for Licenses for the Use of Radioactive Materials in Calibrating Radiation Survey and Monitoring Instruments, dated June 1985.

   c. One week on-the-job training, which encompassed hands-on experience in calibrating civil defense monitoring and measuring instruments using calibration units listed in ITEM 5, was conducted by

the Office of Emergency Services' RIM&C staff, Sacramento, California, in 1967.

d. The Federal Emergency Management Agency (FEMA) Joint Regional Conference/Training held once a year provides updates on instrument calibration techniques, new instrumentation information, and experiences shared with other states in improving calibration operations. FEMA National and the Radiological Instrument Test Facility also provide up-to-date information and instructions related to licensed materials, maintenance and calibration.

3. EXPERIENCE FOR RESPONSIBLE INDIVIDUAL

The named responsible individual has 20 years experience in the use and handling of Federal Emergency Management Agency radioactive materials listed in ITEM 5.

RELATED EXPERIENCE

SEPTEMBER 1967 - PRESENT

Serves as the Radiological Safety Officer, and is responsible for administering and monitoring a radioactive material management, control and safety program on all Federal Emergency Management Agency owned licensed radioactive by-product materials.

Plans and implements radiation safety and protection procedures for the State Civil Defense facility. Responsible for enforcing day-to-day radiation safety rules and regulations within the facility, and those areas within the State where civil defense radioactive training source sets are stored. Monitors the use and safe handling of training sources during training, and controls the movement of radioactive materials within the State.

Schedules and conducts leak tests on all sealed sources listed under our current NRC materials license 53-00706-2. Determines the presence of leakage by using laboratory counting techniques and equipment.

Ensures that all licensed material receipts, transport documents, leak test records, radiation surveys and personnel radiation exposure records are accurate and on file.

Maintains, repairs and calibrates radiological monitoring and survey instruments.

Updates and maintains NRC license.

ITEM 8: TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS

1. The following is the outline of the training program provided for individuals that frequent the restricted area:

   a. Common Types of Nuclear Radiation

      (1) Gamma

      (2) Beta

      (3) Alpha

      (4) Hazards (contamination)

   b. Radiation Protection

      (1) Time

      (2) Distance

      (3) Shielding

   c. Radiation Detection Instruments

      (1) Types of instruments

      (2) Instrument familiarization (hands-on)

      (3) Radiation detection

   d. Description of Radiation Sources and Devices in the Facility

   e. Radiation Protection Program

      (1) Security and safety measures

      (2) Reporting procedures

2. NAMES OF FREQUENTING INDIVIDUALS

   a. Kathlene Waterhouse - Secretary

   b. Benjamin Almadova - Facility Custodian

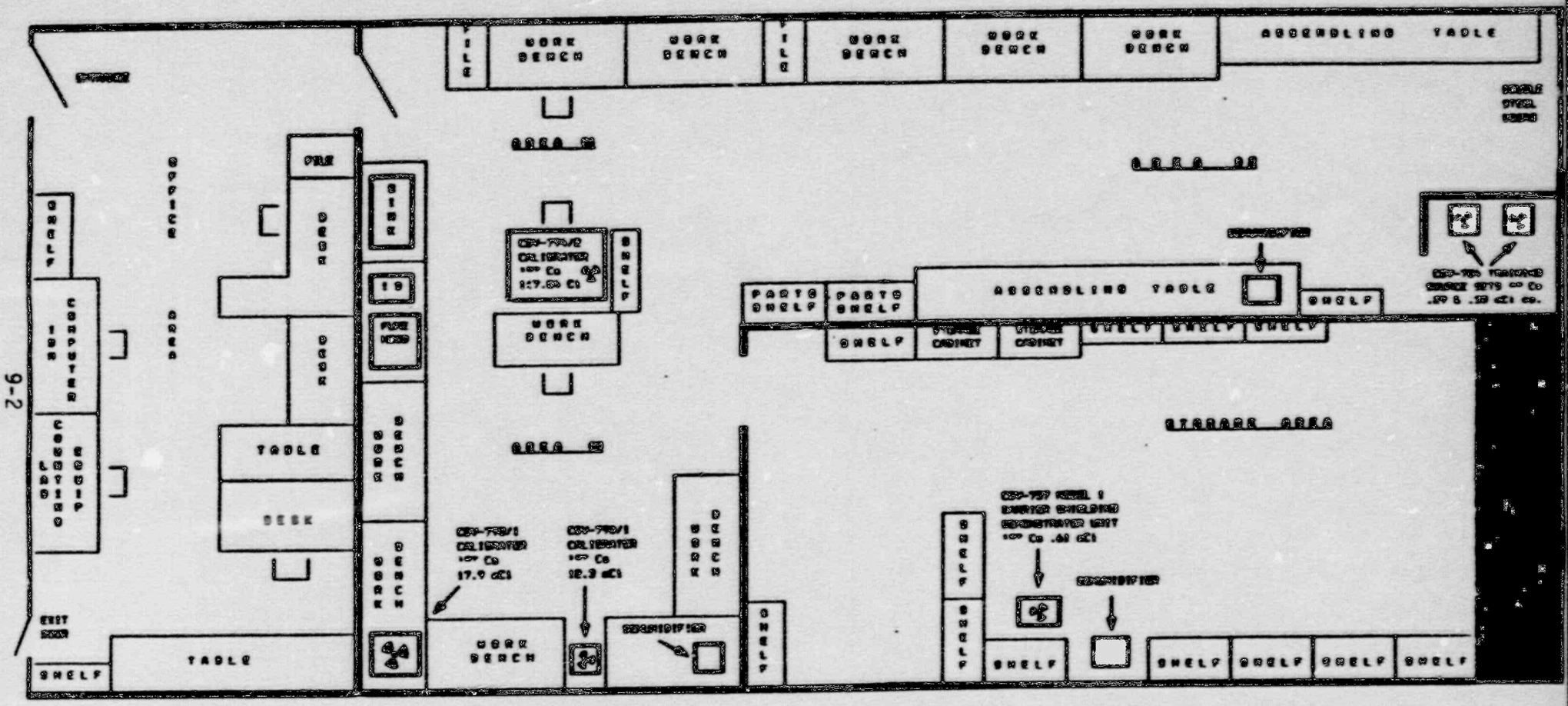
ITEM 9: FACILITIES AND EQUIPMENT

PART I

FACILITY: Radiological Instrument Maintenance and Calibration Facility, Building 90, 3949 Diamond Head Road, Honolulu, HI 96813

Sealed sources encased in Calibration Units, Barrier Shielding Demonstrator Unit, and capsules in training source sets are housed and secured in the State Radiological Instrument Maintenance and Calibration Facility. This facility is a grouted hollow tile/metal frame structure. Keys are available to the facility custodian and Radiological Safety Officer. See attached floor plan. Also, see Item 9, Part V, for description of CDV-784 Cobalt 60 sealed source use and storage on the islands of Kauai, Maui and Hawaii.

RADIOLOGICAL MAINTENANCE AND CALIBRATION FACILITY
BUILDING 90



9-2

ITEM 9: FACILITIES AND EQUIPMENT (continued)

PART II

EQUIPMENT: CDV-794 Model No. 2 Calibrator

1. The CDV-794 Model No. 2 calibrator, shown in Figure 1-1, contains a gamma radiation source that provides four intensity levels for calibrating portable radiation survey instruments. Inside the calibrator, the radiation source has a fixed position relative to the survey meter under test. The specific strength of the radiation field in the exposure chamber is controlled through a rotary attenuator. The instruments are properly positioned in the chamber with fixtures. While a survey meter is in the radiation field, it is calibrated via remote controls and meter readings observed directly through a lead-glass window in the exposure chamber door. All CDV-715 and CDV-717 survey meters are adjusted with the remote controls. Other type survey meters are calibrated by the zero adjust method or by approximation.

2. The main components of the calibrator are identified in Figure 1-2. The primary shield assembly is the principal unit. It contains the source in a depleted uranium shield that attenuates radiation to a safe level when the source is unexposed, and supports the mechanical and electrical mechanisms for controlling the radiation of the source. Adequate shielding is provided on all sides of the radioactive source and exposure chamber. The shielding reduces the exposure rate on external surfaces to a maximum of 2 mr/hr.

3. The exposure chamber is a special lead-shielded compartment for calibrating and testing CD radiation survey meters. It is closed by a door with a lead-glass window that protects the operator from the radiation levels in the chamber and provides direct visual observation during instrument calibration. For access to the exposure chamber, the door is rolled to the left. A mechanical interlock prevents it from being moved unless the source is safely shielded.

4. The stand (Figure 1-3) consists of two tubular-steel, A-shaped frames joined by a tubular cross-member. The cabinet is bolted to a gusset on each A-frame to give the stand rigidity. Leg spread stabilizes the calibrator and leg pads distribute floor loading. The leg pads are drilled to accommodate casters.

5. The cabinet (Figure 1-3), a rectangular steel box, encloses all the calibrator's basic parts and is bolted to the stand. A steel plate divides the cabinet into two compartments. The right compartment contains the exposure chamber. The left compartment contains the primary shield housing, the mechanical interlock, the remote controls, the electrical circuitry, and the control panel assembly. A rail assembly is fitted flush with the top of the cabinet and encases it.

Two covers, hinged to the rail assembly, join when closed. They protect the controls and the window and door of the calibrator and, when locked, prevent unauthorized use.

6. The primary shield assembly (Figure 1-4) is depleted uranium metal cast in three parts: main shield, attenuator disc, collimator. The configuration of the housing attenuates radiation to 2 mr/hr at every normally accessible surface except the radiation path into the exposure chamber. Bored into the main shield are two parallel, cylindrical holes (Figure 1-2). The attenuator-disc shaft is fitted into the upper hole and the source is confined in the lower hole.

7. The attenuator disc (Figure 1-4) is a radiation shield set in the recess between the main shield and the collimator. The disc has five circular, equally-spaced absorption areas near its circumference. Each area is cast conically to a specific metal thickness that produces the required intensity level in the exposure chamber. The absorption areas have corresponding detents on an index ring at the circumference of the disc. The detents center the absorption areas in the radiation beam, control the exposure-chamber door lock, and actuate the attenuator switch in the indicator lamp-group circuit.

8. The collimator, mounted in front of the attenuator disc, has a cast conical hole that shapes the radiation beam entering the exposure chamber. The chamber side of the collimator hole has a shoulder around it that fits into a mating hole in the divider plate and in the adjacent lead shield of the exposure chamber.

9. The source is pelletized cesium chloride encapsulated in a double stainless steel jacket (Figure 1-5). It is sealed in a cylinder-shaped tungsten plug that is inserted into a stainless steel tube within the main shield, and is then bolted and safety-wired. The source is thus rigidly positioned and is not subject to damage by outside forces.

10. The CDV-794 Model 2 calibrator will always be housed and operated in the maintenance and calibration facility, Building 90. Personnel listed in ITEM: 7 will supervise the instrument calibration procedures. Other personnel previously trained in its operation will be permitted to operate the calibrator only under the supervision or in the presence of the named "Responsible Individual," listed in ITEM: 7.

11. When the calibrator is in use, the operator will not leave the unit unattended. Upon completion of tests and calibration or if the operator intends to leave the area, the following steps will be taken to secure the calibrator.

    a. Rotate the radiation-level selector wheel to the safe position.

    b. Place the chamber door over the control panel by rolling it to the left.

c. Turn off the main power at the switch on the left end of the calibrator, observe that the main power indicator lamp and chamber lamp are off.

d. Close lower and upper covers, lock the calibrator and remove the key.

12. The conventional trefoil radiation symbol and the words "Caution Radiation Area" will appear on labels affixed to equipment cabinets, work tables and walls of the facility where the calibrator is located. Warning signs will be visible from all doorways. This measure is to provide additional positive measure to prevent unauthorized personnel from being immediately upon the calibrator.

13. The cabinet of the calibrator is appropriately labeled to indicate it contains radioactive material. (An identification plate on the unit bears the radiation symbol and the words "Caution Radioactive Material" as well as type of radioisotope in the device (Cesium 137, quantity of Cesium 137 and the date of measurement.) A larger sign will remain posted on the wall behind the calibrator and bear the radiation symbol and the warning "Caution Radioactive Material, 130-Curies Cesium-137."

14. Radiation exposure of personnel will be limited to that specified in 10 CFR 20 Standards for Protection Against Radiation.

15. In the event the CDV-794 calibrator is enveloped in flame or exposed to fire causing extremely elevated temperatures, the calibration area may become contaminated, the amount of shielding around the source may have been degraded and external radiation hazards may be present. Circumstances of this nature require that the area be promptly evacuated and fire be extinguished as quickly as possible. Reentry into the area will be made only after an exposure rate and contamination check has been made.

16. In the event of any natural or man-made disasters or incidents; i.e., flood, explosion, theft, loss, etc., it is unlikely that the integrity of the source and shield of the CDV-794 would be affected. The unit might be lost or buried under mud, rubble or other debris and could be difficult to locate due to the low level of radiation escaping through the shield. During recovery operations, a sensitive low-range survey instrument will be used to pinpoint the location of the buried unit. The Radiological Safety Officer will make a preliminary evaluation of the situation and, if possible, determine the extent of damage or radiation hazard which exists without disassembly of the unit. The Radiological Safety Officer will notify the appropriate authorities according to procedures outlined in ITEM 10.3.

17. When it is necessary for personnel to enter the area prior to and during decontamination operations, protective clothing gloves and

footwear will be utilized. Respirators will be worn if airborne Cesium 137 contamination is detected to be above 1×10^{-8} microcurie per milliliter. Contamination control procedures to prevent the spread of contamination will be utilized including setting up of a contamination control line for removal of contaminated clothing and equipment. Ventilation of the contaminated area will not be performed without control of the effluent air to prevent spread of the contamination. All decontamination operations will be carried out under the supervision of the Radiological Safety Officer.

18. The user will comply with the step-by-step operator maintenance outlined in CDV-794 Model No. 2 Operations and Maintenance Manual. Adjustments and repairs not covered in the Operations and Maintenance Manual as well as equipment malfunctions will be reported to and serviced by the Radiological Protection Officer, FEMA Region IX, or, if necessary, by the manufacturer. The sealed source will not be tampered with or removed from the calibrator.

19. Leak Testing:

    a. The CDV-794 Model 2 calibrator is leak tested at intervals not to exceed six months.

    b. To accomplish this leak test, the following items are used:

    1 each CDV-700 monitoring survey meter, newly calibrated
    1 each 6" Forceps
    1 each 1-1/2 inch diameter Whatman No. 50 filter paper
    1 each Ludlum Scaler/Ratemeter, Model 2200
    1 each Film Badge, additional as required.
    1 each CDV-138 self-reading pocket dosimeter, additional as required

20. Radiation Exposure Rate Check: The contamination hazard from the CDV-794 calibrator is controlled by containing the cesium source within a system of shields and interlocks. However, prior to any leak test being performed, it will be standard procedure to conduct a radiation exposure rate check to ascertain shielding integrity as follows:

    a. Enter the calibrator area with a CDV-700 survey meter and approach the calibrator. If an exposure rate above 2 mr/hr is detected one foot or more at any point from the calibrator, take emergency actions as follows:

        (1) Clear the calibrator area of personnel.

        (2) Turn off the air conditioners.

        (3) Remove the power cord from wall outlet.

(4) Make a survey of the area to establish the 2 mr/hr isodose rate line.

(5) Isolate the area with barriers, ropes and lock doors of calibration facility.

(6) Post warning signs in accordance with Title 10, Part 20 of CFR.

(7) Notify appropriate authorities as required under ITEM: 10.3 Reporting Procedures.

(8) Implement other contamination control procedures as necessary.

(9) Document all applicable data on Calibrator Wipe Test and Radiation Survey Record.

b. If exposure rates are not greater than 2 mr/hr at a distance of one foot from any point of the calibrator, proceed with the check of the calibrator.

c. Place the detector of the CDV-700 on the external surface of the calibrator. The radiation exposure rate must not exceed 2 mr/hr at any point on the external surface for any position of the radiation level selector wheel. If surface exposure rates of 2 mr/hr or above are detected, implement emergency actions Number 1 through 9 above. If surface rates are less than 2 mr/hr, proceed with the wipe test.

21. Wipe Test Procedures: Wipe test smears are taken off the unsealed end of the source confinement cylinder (see Figures 1-2 and 1-5, attached) at intervals of not more than six months.

a. Lock radiation-level selector wheel in "Safe" position and observe "Safe" green indicator.

b. Remove extension power cord from power plus on left end of cabinet.

c. Remove cabinet access cover on the left side (see Figure 1-3, attached).

d. Place detector of CDV-700 near open access port. If reading at this point is 2 mr/hr or greater, take appropriate emergency actions prescribed under paragraph 20 above. If less than 2 mr/hr, proceed with wipe test.

e. Using forceps, grasp Whatman No. 50 or equivalent filter paper that has been moistened with isopropyl alcohol and smear the protruding portion of the source plug container (see Figure 1-2, attached).

f. Check filter paper with CDV-700M for gross contamination. This check should show little or no increase over background level and indicates no significant amount of leakage taking place.

g. Let filter paper dry and evaluate paper using an appropriate G-M counter or gas-flow proportional counter at a known counting efficiency, E cpm/dpm. Convert net count rate to units of microcuries using the appropriate E factor. Compare the results with the allowable limit of 0.005 microcurie activity.

h. If testing indicates less than 0.005 microcurie of activity present on the filter paper, the test is considered negative and has been satisfactorily passed. The leak test will be documented in units of microcuries in the permanent wipe test record of the calibrator. The calibrator will be secured by replacing access cover and tightening the four belts.

i. If testing indicates 0.005 or more microcuries of gross beta-gamma activity present on the filter paper, implement emergency actions described under paragraph 20 above, and carry out the following details:

(1) The calibrator area will be cleared of personnel and immediately checked for contamination.

(2) All contaminated areas will be restricted from use until cleaned under the supervision of a qualified health physicist and the Radiological Safety Officer and all requirements of Title 10, Part 20, of the Code of Federal Regulations satisfied.

(3) When it is necessary for personnel to enter the area prior to the institution of and during decontamination operations, protective clothing, gloves and footwear will be worn.

(4) If airborne and Cesium 137 contamination above 1×10^{-8} microcurie per milliliter is present, dust respirators and supplied air masks will be worn.

(5) Contamination control procedures will be utilized with established buffer zones for the changing of the contaminated, protective clothing.

(6) Ventilation of the radioactive contaminated area will not be performed without control of the affluent air to prevent spread of the contamination.

(7) Disposition of the calibrator with a leaking radioactive source must be handled directly by FEMA Region IX. No attempt to stop the leakage or dispose of the source will be made without written approval of the Radiological Protection Officer, FEMA Region IX.

(8) A report will be filed within five (5) days of the test with the U.S Nuclear Regulatory Commission, Region V, Office of Inspection and Enforcement, 1450 Maria Lane, Suite 210, Walnut Creek, California 94596, describing the equipment involved, the test results and corrective action taken.

22. Records:

a. Film badge results for the operator of the CDV-794 will be recorded on the Photodosimetry Report provided and processed by the U.S. Army Ionizing Radiation Dosimetry Center, ATTN: AMXTM-CE-DCR, Lexington, Kentucky 40511-5102.

b. Occupational radiation exposure records containing information called for in NRC Form 5 are provided by the U.S. Army Ionizing Radiation Dosimetry Center on a computer printout and filed.

c. Records of radiation surveys where the CDV-794 is used will be maintained and performed with the CDV-700 beta-gamma monitoring survey instrument. It will include the date, person performing the survey and the radiation intensity.

d. Records of wipe tests will be maintained and will indicate the type of instruments used to perform the analysis, the date, person performing the test and the test results, and the date the next wipe test should be performed.

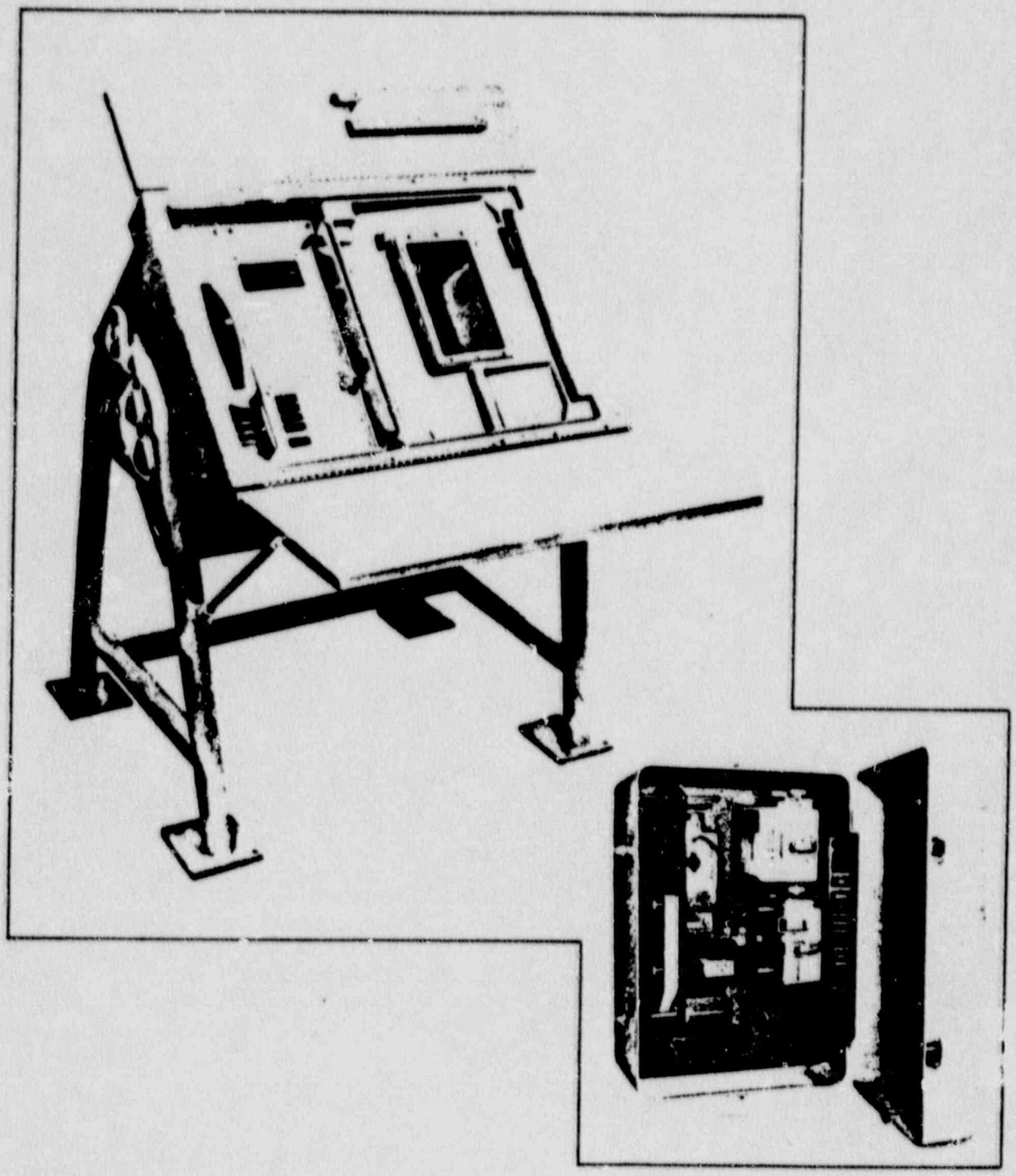
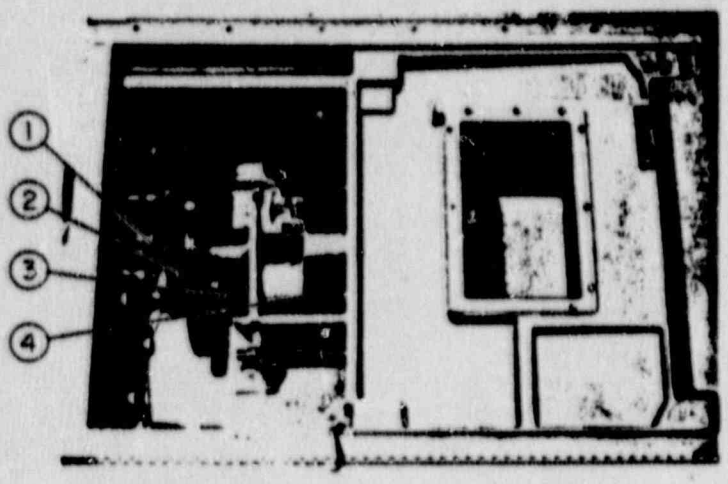
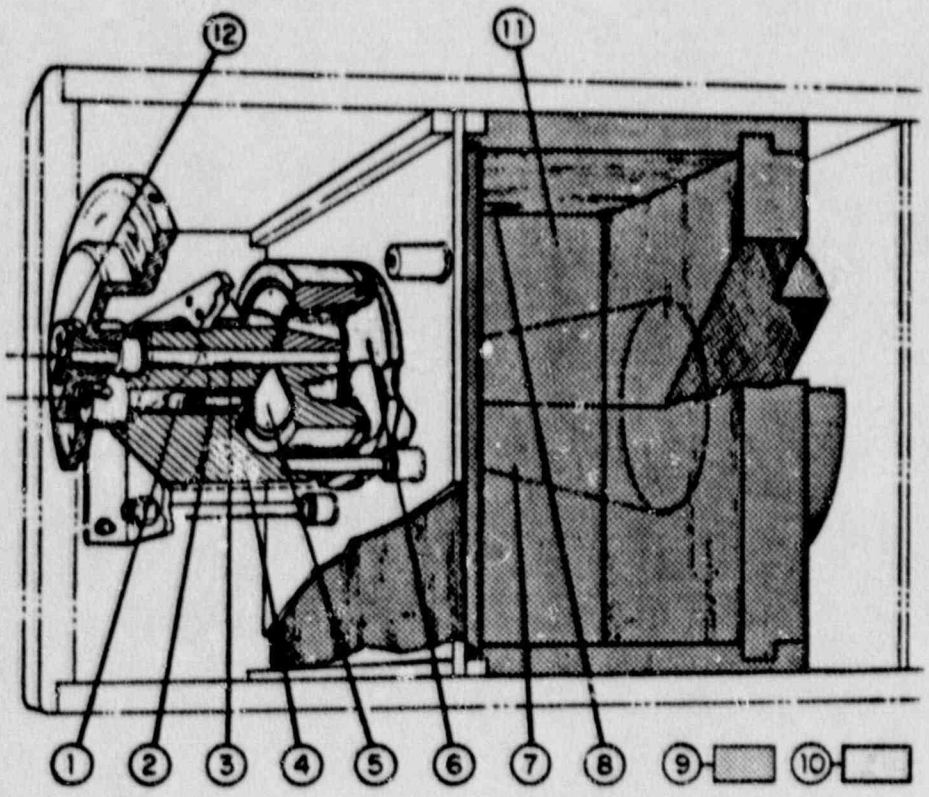


Figure 1-1. Radiological Instrument Calibrator, CD V-794, Model 2 and Accessories

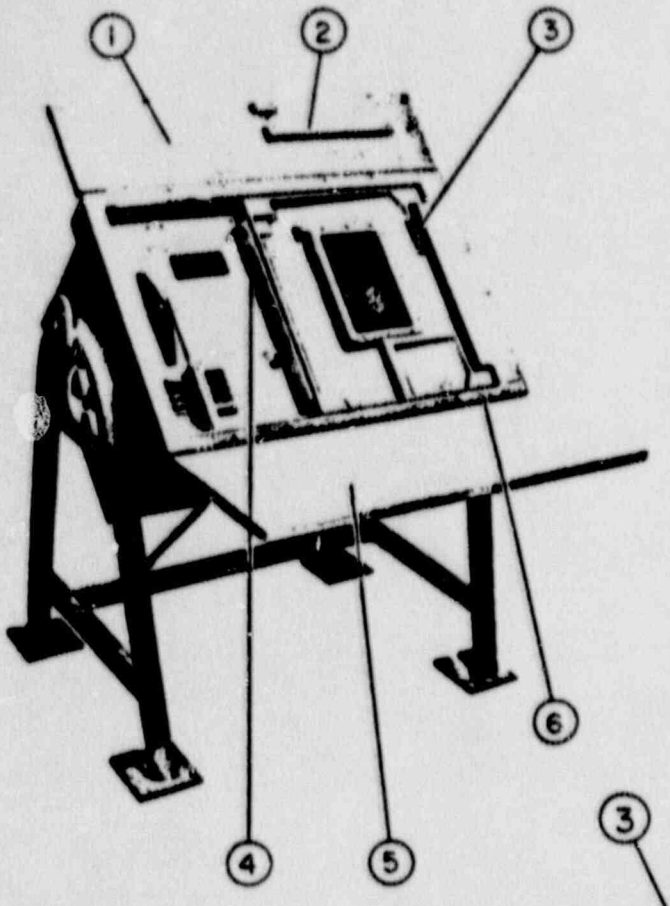


1. Wiper and Contacts
2. Radiation Level Selector Wheel
3. Primary Shield Assembly
4. Attenuator Disc

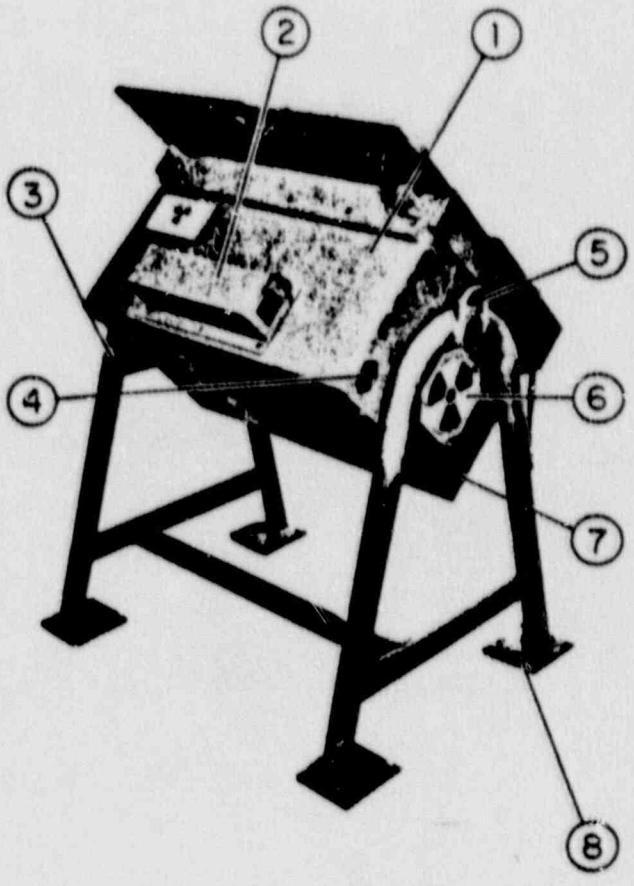


1. Container Plug
2. Source
3. Attenuator Disc Shaft
4. Main shield
5. Decay Compensator
6. Collimator
7. Conical Radiation Beam
8. Cable Port
9. Lead Shielding
10. Uranium Shielding
11. Exposure Chamber
12. Wiper

Figure 1-2. Main Components of Calibrator and Shielding Design

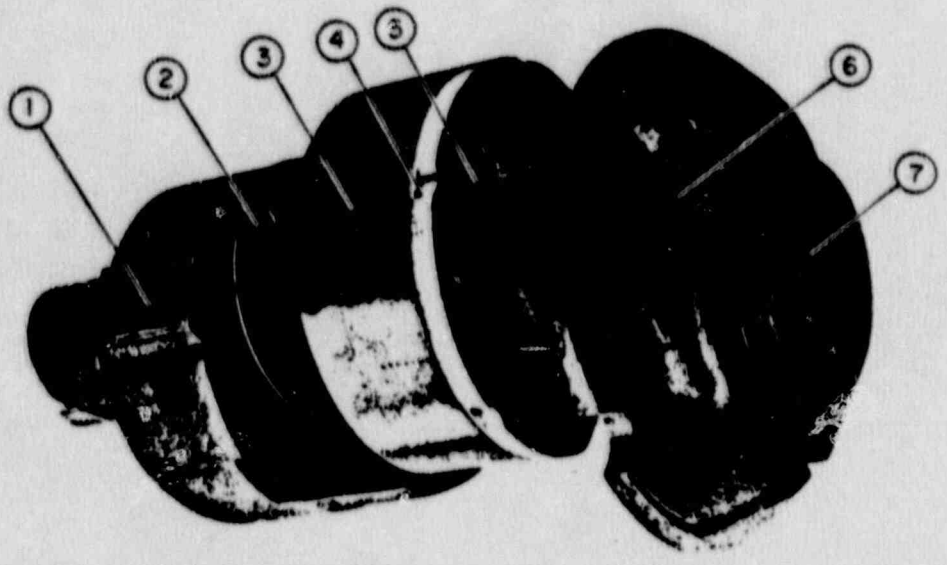


1. Upper Cover
2. Stay Bar
3. Lock Plate
4. Safe Secure Bolt Access
5. Lower Cover, Hinge, Writing Surface
6. Rail Assembly



1. Cabinet
2. Cable Port
3. Stand
4. Input Jack
5. Lifting Eye
6. Cabinet Access Cover
7. Main Switch
8. Leg Plate

Figure 1-3. Calibrator Parts



1. Main Shield
2. Decay Compensator Disc
3. Attenuator Disc
4. Detent
5. Absorption Area
6. Collimator
7. Beam Shaper

Figure 1-4. Shield Housing - Exploded View

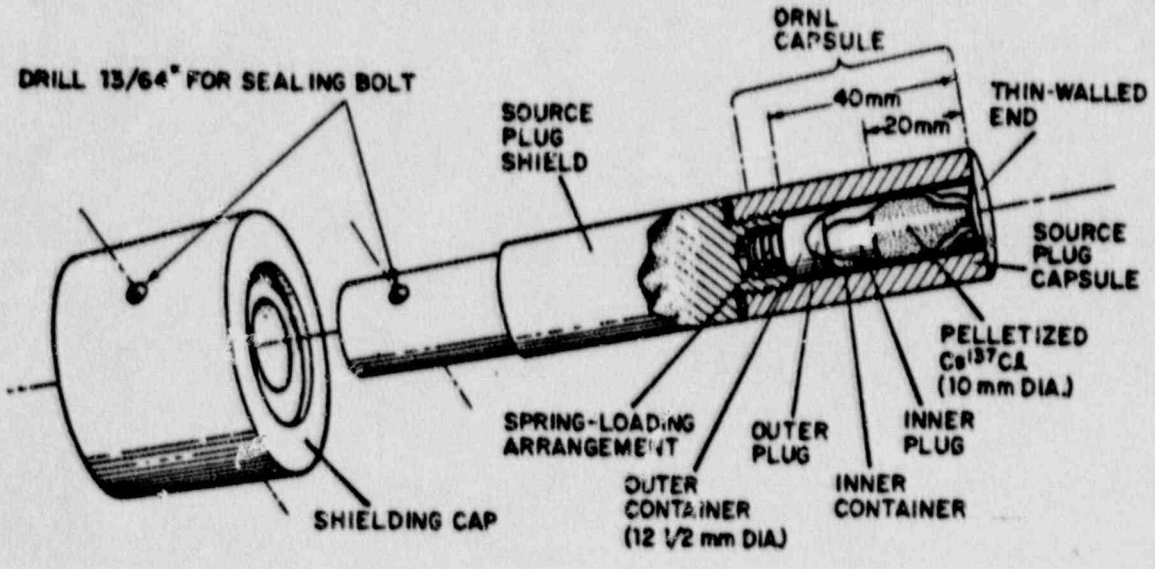


Figure 1-5. Pelletized Cs 137 Gamma Ray Source

ITEM 9: FACILITIES AND EQUIPMENT (continued)

PART III

EQUIPMENT: CDV-798 Model 1 Radiological Survey Meter Calibrator

1. The CDV-798 Radiological Survey Meter Calibrator, shown in Figure 2-1, is used to calibrate low-range radiological monitoring equipment such as the CDV-700 and E-520 Portable Beta-Gamma Geiger Counter. The two basic parts of the Radiation Unit of the CDV-798, which are assembled and shipped as a unit, are the source shield and the cabinet with its mechanisms.

2. Source Shield:

   a. The source shield is a steel-jacketed lead container which was designed for approval by the Bureau of Explosives of the American Trucking Association to comply with regulations of the Interstate Commerce Commission for shipment by common carriers in interstate transportation. The Bureau of Explosives Permit #1891 which has been assigned for this shield is specifically issued for the Cesium 137 source used in the CDV-798 calibrator; as such, the source shield is not approved for transportation of other sources.

   b. The cover of the shield is secured during shipment by three 1/4" diameter bolts and a padlock which extend through holes in the flanges on the cover and body of the shield.

   c. The axis of the shield is positioned on the vertical axis of the cabinet by being bolted to four braces which are secured to the bottom of the cabinet.

   d. The components inside the shield cavity are illustrated in Figure 2-2.

   e. The Cesium 137 source in the lower part of the shield cavity is positioned on the axis of the cavity by means of a toroidal sleeve with diameters just over the diameters of the source capsule and the inside diameter of the cavity. The vertical position of the source in the cavity is determined by one or more aluminum disc spacers which are inserted in the cavity prior to insertion of the sleeve and source during initial assembly at the factory. The vertical position of the source in the cavity determines the dimensions and to some extent the intensity of the cone of radiation above the shield; therefore, it is important that these spacers always be replaced before reinserting the source and sleeve in the unlikely event there is any necessity for removing the source from the shield.

f. On top of the source there are one or more thin copper attenuator discs which have been inserted to provide the proper exposure rates in the cabinet. The source and attenuator plates are secured in the cavity by a retainer ring which has two steel balls retained in diametrically opposite cavities along the periphery of the ring. These balls are pressed tightly against the wall of the cavity by pressure which is applied by the tapered point of a set screw behind the ball. The head of the set screw is accessible from the top surface of the ring, thereby permitting the screw to be tightened by use of the long-handled tool provided with the unit which can be inserted into the shield cavity when the instrument shelf is in its uppermost position.

3. Cabinet:

a. The cabinet, which is approximately 2' x 2' x 3', houses the source shield (1) and contains all the mechanisms for removing the cover (2) from the shield and other functions required for positioning the instrument to be calibrated in the resulting radiation field. The cabinet serves as a physical barrier preventing the operator from exposing his body or hands to unnecessarily high exposure rates.

b. The base of the cabinet is a 3/16" steel plate. Four brackets (3) mounted on this plate serve the purpose of positioning the source shield on the central axis of the cabinet when the flange of the shield is bolted to the holes provided in the brackets.

c. Instruments to be calibrated are positioned on a shelf (4) in the cabinet which is mounted on a screw rod (5). The shelf is moved up and down by turning a hand-wheel (6) outside the cabinet which is connected by a shaft to a 90° angle gear box which turns the screw rod. The ratio of the gear box is such that one turn of the hand-wheel provides two turns of the screw rod.

d. A steel rod (7) which is a body extension of the shelf protrudes into an open slot (8) on the front panel of the cabinet and prevents the shelf from rotating when the screw rod is rotated. This rod also serves as the pointer to the scale (9) mounted adjacent to the slot for indicating the vertical position of the shelf in the cabinet.

e. A four-inch diameter hole on the shelf defines the axis of the cone of radiation. Stops (10) mounted on the shelf can be adjusted so that the axis of the ion chamber of the survey meters will be directly over the center of the four-inch diameter hole.

f. The access door is on the left-hand side of the cabinet, as viewed by an operator. The handle on the door has a lock for which two keys are provided. The door serves as part of the interlock system and when the door is closed it releases the interlock (11), permitting the lever (12) to be moved for removing the cover from

the source shield. The interlock mechanism is described more fully in the following section.

g. Instruments being calibrated or tested are viewed through a safety glass window (13) on the front panel of the cabinet with the aid of a mirror which is mounted on the rear side of the instrument shelf. The safety glass is held in the front panel by a rubber molding. In the event it would ever be necessary to replace the glass, the rubber molding can be removed by removal of the round rubber stripping (14) which is retained in a groove in the molding.

h. A fluorescent light inside the cabinet, with a switch directly above the window, provides illumination in the interior of the cabinet.

i. The purpose of the interlock mechanism is not to provide a situation which is completely tamper-proof; rather it is to serve as a reminder so that an operator will not inadvertently expose his hands to the cone of radiation during routine operations.

j. The interlock mechanisms utilize no springs; the positions of the interlock components are determined by positive displacement by the door or the lever to the shield cover and by gravity working on the components which are pivoted off their center of gravity. The lever, which is attached to the shield cover, cannot be moved until after small interlock lever is rotated by closing the door of the cabinet. When the lever to the shield cover is moved, another small interlock lever engages a tab on the door panel, preventing its opening. This latch is released when the shield cover lever is moved back to the position of the cover being on the shield.

k. As mentioned previously, interlocks for the device are not intended to be a tamper-proof mechanism. The operator is warned against unnecessary bypassing of the interlock to gain access to the cabinet. The maximum radiation exposure rate immediately above the shield is approximately 1 R/hr when the shield is open. Although the dimensions of the radiation field at this point are such to preclude exposure of the major portion of the body to the high rate, operations bypassing the interlock system and exposing the hands to the main gamma beam are forbidden unless proper health physics support and special monitoring devices (such as wrist film badges) are available. Under routine operations, adjustments of instruments to be calibrated must be performed with the cover over the source shield so that the door can be opened in its normal manner.

l. The exposure rate on the top surface of the Radiation Unit cabinet being approximately 10 mr/hr when the cover is off the shield constitutes a radiation area. As such, it is required that

radiation signs be posted identifying the radiation area and procedures be used to restrict access to that area.

m. When the Radiation Unit is in use, the operator will prevent unauthorized personnel from being immediately above the cabinet. He will place a sign(s) on top of the cabinet which bears the conventional propeller-type radiation symbol and the words "Caution Radiation Area." This sign(s) shall be visible from all doors providing access into the room. Additional wording on the sign shall include the exposure rates on top of the cabinet and other areas accessible to personnel when the cover is off the shield.

n. When the radiation unit is not in use, these "Caution Radiation Area" signs shall not be displayed and the access door and the source shield must be locked.

o. The door(s) providing access to the room where the Radiation Unit is located shall be posted with a sign bearing the radiation symbol and the words "Caution Radioactive Material."

p. The operator will not leave the Radiation Unit unattended with the cover off the shield unless he takes additional measures to keep unauthorized personnel out of the radiation area. These measures shall include erecting a barrier (such as rope between movable stands) and posting "Caution Radiation Area" signs on the barrier so that personnel entering the room will be aware of the existence of the radiation area and will be alerted to stay out. The access door to the unit should also be locked. Another procedure, where possible, will be to lock the doors to the room where the unit is located and post the doors as a radiation area.

q. The cabinet of the Radiation Unit is appropriately labeled indicating that it contains radioactive material. The label on the cabinet door bears the radiation symbol and the words "Caution Radioactive Material" as well as (1) the exposure rates on the cabinet with the cover on the shield; (2) the radioisotope (Cesium 137) in the device; (3) the quantity of Cesium 137; and (4) the date of measurement. The larger sign on the opposite side of the cabinet bears the radiation symbol and the words "Caution Radioactive Material."

4. The location of the Radiation Unit is in the general location where similar types of operation are being performed or where radiological survey meters are being repaired and inspected. Sufficient work space is available for handling the supply of instruments before and after they are calibrated. The unit is located on a work bench, suitable for a 220-pound load, and is approximately 30" to 36" high for convenience of viewing the instruments being calibrated. With the unit on a surface of this height, the top of the cabinet is approximately six feet above floor level.

5. A radiation survey will be made using an instrument such as the CDV-700 which has been calibrated on all ranges.

6. Operations involved in removing the copper attenuator discs to correct for decay of the source is accomplished with adherence to the procedures described in the Corrective Maintenance section of the CDV-798 Model 1 Instruction and Maintenance manual and will be done by or under the surveillance of a qualified health physicist.

7. Leak Testing:

   a. The source of the Radiation Unit of the CDV-798 Model 1 Calibrator is tested for leakage of radioactivity at intervals not to exceed six months.

   b. To accomplish this leak test, a CDV-788 handling tongs and a rod about six inches long are required. A common lead pencil with a rubber eraser can be used for the rod if it is destroyed after the test. A filter paper or other porous paper about 1-1/2" in diameter is then folded over the rounded end of the rod and secured to the rod with pressure-sensitive tape. A few drops of a diluted solution of detergent in water should be put on the paper. The rod is then grasped firmly with the CDV-788 tongs at a 90° angle, and with the instrument shelf in a raised position, the interlock is bypassed and the cover removed from the source shield, thereby making it possible to wipe the paper on the walls of the cavity of the source shield, the inner surface of the source retainer ring, and the center top of the copper attenuator discs. Moderate pressure can be used in this swabbing, but care should be exercised to avoid tearing the paper.

   c. After removing the tongs and rod from the cabinet, the paper will first be checked for activity with a thin-end-window geiger tube of a radiation survey meter such as the CDV-700M. If no activity is detected, the paper will be removed from the rod and allowed to dry prior to being counted with the Ludlum Scaler/Ratemeter, Model 2200, that is capable of measuring 0.005 microcurie of Cesium 137. If the Ludlum Scaler/Ratemeter indicates there is less than 0.005 microcurie of activity present on the paper, the leakage test has been satisfactorily passed and a record of the test will be written and retained in appropriate files.

   d. In the unlikely event the Radiation Unit is ever flooded and the cavity of the shield filled with water, the water in the cavity could become contaminated with Cesium 137 if the welded seals on the source capsule fail. The water in the cavity of the source shield will be tested for presence of radioactivity, and the results of the test will be recorded as a leak test of the source. Such operations will be done by or under the supervision of a qualified health physicist.

e. If, at any time, there is any evidence of source leakage, no attempt will be made to clean the source shield. The appropriate authority in ITEM: 10.3 will be notified immediately and the area closed off until corrective action can be accomplished to render the unit safe for use or disposal.

8. Operating Instructions:

a. Prior to use, the door to the cabinet will be unlocked with the key provided. The padlock on the source shield will be unlocked and will be placed at a convenient place inside the cabinet.

b. The guides or stops on the instrument shelf should be adjusted so that the axis of the ion chamber of the instruments is positioned directly over the center of the four-inch diameter hole in the instrument shelf. The axis is defined by the intersection of the lines on the front and sides of the instrument cases. For instruments in the 0-2000 mr/hr range, the distance between the front of the cases and the axis are the same; therefore, the rear stop on the shelf was appropriately set at the factory. When the side stops are adjusted so the distance between them is equal to the width of the instrument case and so that they are perpendicular to the rear stop, the side stops should be equal distances from the edges of the four-inch hole.

c. Prior to placing the instrument in the calibrator, the operator will be sure that the instrument operates properly as indicated by satisfactory results from the battery-condition test and capability of the instrument to be "zeroed." The instrument should warm up for approximately five minutes or that time specified in the operating manual of the instrument prior to being rezeroed just before inserting in the instrument.

d. The door to the cabinet is then closed, the door handle latched, and the instrument shelf moved to the position corresponding to the 100 mr/hr point as indicated on the calibration table. The lever to the shield cover is then moved down, to the right, and up (thereby removing the shield cover from the source shield). The response of the instrument should be allowed to stabilize (approximately 15 seconds). Then the reading can be noted. If the reading is significantly different from 100 mr/hr, the shield cover will be replaced and the instrument removed from the cabinet. The instrument case is then opened and adjustment made on the calibration pot corresponding to the 0 to 500 mr/hr scale. The case is then placed back on the instrument and the instrument replaced on the instrument shelf. The door should be closed and the shield cover again removed. If the reading is then within 85 mr/hr to 115 mr/hr, the instrument is lowered to the position corresponding to 400 mr/hr as indicated on the calibration table and the response observed. At this point, the instrument should read within the range of 340 mr/hr to 460 mr/hr. If the reading is out of this range, the instrument should be removed (after

raising the shelf) and additional adjustment made on the pot in the instrument. The instrument readings at both the 400 mr/hr (or 350 mr/hr) and the 100 mr/hr positions of the shelf should be recorded for each instrument.

e. This calibration procedure would be for 15 percent accuracy. If greater or less accuracy in calibration is desired, the acceptable ranges for each dose rate position should be correspondingly changed as indicated by calibration tables.

f. Prior to removing the instrument from the cabinet, the instrument shelf will be removed up to a position (above 28.5) which permits the shield cover to clear the shelf when it is placed back on the source shield.

9. Outline of Procedure:

a. Unlock cabinet and source shield.

b. Adjust side stops on instrument shelf.

c. Check battery condition of survey meter.

d. Check "zero" capability of survey meter.

e. Warm up survey meter specified time.

f. "Zero" survey meter.

g. Insert survey meter into calibration unit.

h. Check mirror adjustment.

i. Close and latch door to cabinet.

j. Move shelf to position corresponding to 100 mr/hr (see calibration table in appendix).

k. Move lever to shield cover down, to the right, and then up.

l. Allow survey meter response to stabilize (approximately 15 seconds).

m. Note reading. If response is within acceptable range shown in the calibration table in appendix, proceed to Step o.

n. If reading is out of acceptable range, remove survey meter from unit and make adjustment on pot in survey meter corresponding to 0-500 mr/hr range. Repeat Steps f through n until response is within acceptable range.

o. Lower shelf to point corresponding to 400 (or 350) mr/hr, as indicated in calibration table.

p. Allow response to stabilize (approximately 15 seconds).

q. Note response. If response is within acceptable range, record the reading.

r. Raise shelf and turn survey meter off after it is removed from the Radiation Unit.

s. If response in Step q is not within acceptable range, raise shelf, remove survey meter, and make adjustment on pot in survey meter corresponding to 0-500 mr/hr range. Repeat Steps f, c, e, g, k, l, m and n until response falls within acceptable range.

10. After use, the operator shall secure the padlock in the source and cover to prevent unauthorized use in his absence, and the door to the cabinet closed and locked.

11. Records:

a. Film badge results for the operator of the CDV-798 will be recorded on the Photodosimetry Report provided and processed by the U.S. Army Ionizing Radiation Dosimetry Center, ATTN: AMXTM-CD-DCR, Lexington, Kentucky 90511-5102.

b. Record of radiation surveys will be maintained including the date, person performing the survey and radiation intensity.

c. Record of wipe tests will be maintained and will indicate the type of instrument used to perform the analysis, the date, person performing the test and test results, and the date the next wipe test should be performed.

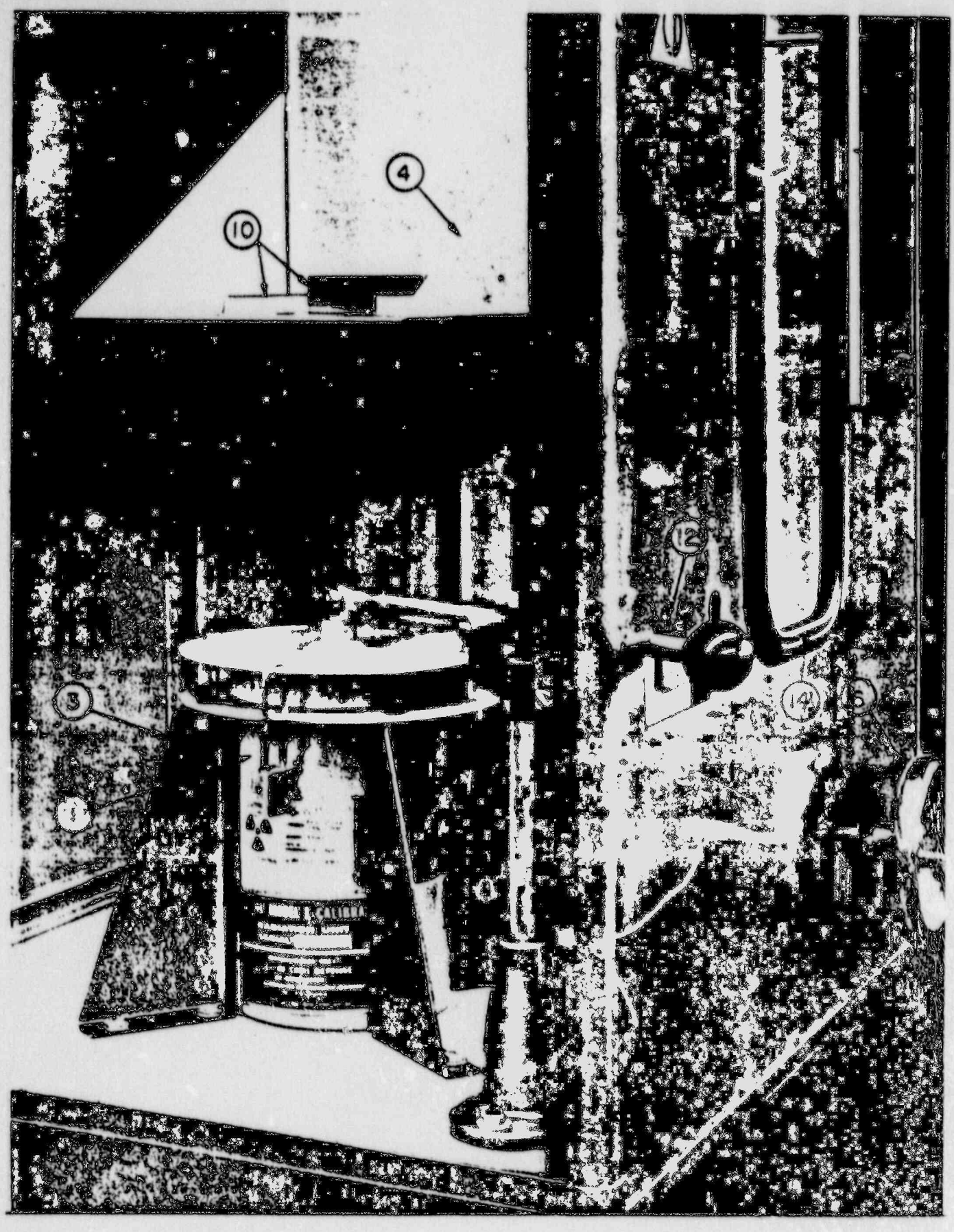


FIGURE 2-1 View of Inside of Radiation Unit

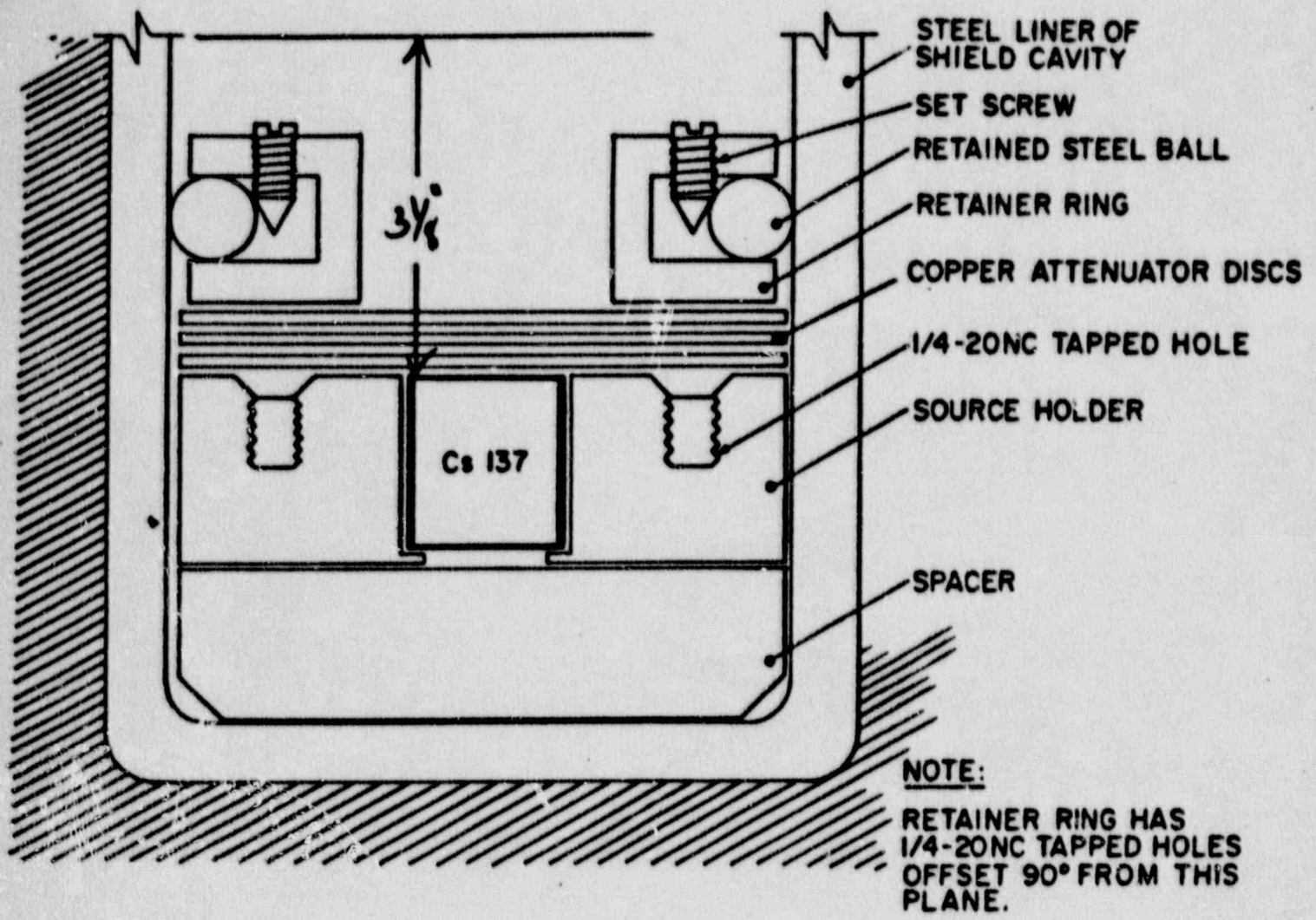


FIGURE 2-2 Components in Source Shield

PART IV

EQUIPMENT: CDV-757 Model 1 Barrier Shielding Demonstrator Set

1. The CDV-757 Model 1 Barrier Shielding Demonstrator Set, shown at Figure 3-1, is designed to provide the materials and equipment required to present a short lecture and demonstration on the use of common materials as barrier shielding against fallout radiation. The set provides a gamma radiation source with holding fixture, a radiation detector with a conventional output meter plus an auditorium-size indicator, samples of barrier shielding materials, a complete public address system, and a prepared text for the lecture-demonstration. All component parts are stored for transportation in two shipping containers, each of which can be easily handled by one person.

2. The Demonstrator Set is used throughout the State and intra-island barge service is used for transporting the set to the islands of Kauai, Maui and Hawaii. Storage facilities at these areas are:

Kauai Civil Defense Agency
4444 Rice Street, Room 230
Lihue, Kauai, Hawaii 96766

Hawaii Civil Defense Agency
34-A Rainbow Drive
Hilo, Hawaii 96720

Maui Civil Defense Agency
200 South High Street
Wailuku, Maui, Hawaii 96793

3. Storage area rooms at the above locations are equipped with key-type locks on all entrances/exits. The Radiological Safety Officer, at the conclusion of each demonstration and lecture, shall immediately make the necessary arrangements for return transportation of the Demonstrator Set to its permanent storage location at Building 90, Fort Ruger, Honolulu, Hawaii. Maximum security will always be provided when used and stored at the temporary storage location to include securing locks on both the set and doors in the room area used for storage and posting of "Caution Radioactive Materials" signs.

4. The gamma ray source furnished as part of the CDV-757 Model 1 is a one millicurie Cesium 137 sealed source supplied by the Nuclear Products Department of the Minnesota Mining and Manufacturing Company. The source material consists of 3M brand radiating microspheres incorporating Cesium 137 oxide as the radioactive material. The radiating microspheres are tiny spheres of insoluble high temperature ceramic, which are also shock and abrasion resistant and which has a softening point over 1500° C. These radioactive particles are sealed into the bore of a threaded, stainless steel capsule with a press fitted stainless steel plug. The plug is then silver brazed in place to hermetically seal the source. The combination of the 3M radiating

microsphere plus the hermetic encapsulation produces a compact source with an excellent seal.

5. The hermetic source capsule is threaded into the end of a lead-filled steel-walled sphere. The sphere is mounted beneath the deck of the base unit by means of a steel plate welded to the equator of the sphere. The spherical shield is constructed with a gamma beam exit port positioned opposite the end of the source holder. A removable brass and tungsten plug, which also passes through the deck of the base unit, gives the operator effective "on-off" control of a narrow conical beam of gamma rays from the beam port. With the exit port plug in place, the radiation level around the shield housing is only slightly greater than natural background radiation.

6. With the gamma exit port plug removed, the exposure rates in the vicinity of the source housing are as indicated in Figure 3-2. A cutaway drawing of the source capsule, shield and base unit with all important parts labeled is shown in Figure 3-3.

7. The base unit is a heavy gauge aluminum 12" x 12" x 5-1/2" high with the bottom open. The 12" x 12" closed side forms the work deck of the demonstrator and is covered with heavy ribbed vinyl rubber mat to protect the metal surface. The underside of the deck is heavily reinforced for rigidity and also serves as a mounting support for the heavy support shield. One corner of the deck has a grommeted indexed hole which receives the pointed end of the geiger tube support arm and correctly orients the detector with respect to the radiation beam exit port located in the center of the deck. A second grommet on a bracket below the deck prevents the deck arm from wobbling.

8. The radiation detection system uses a geiger tube detector feeding into a pulse amplifier and shaper and finally to a three decade log count rate meter output circuit. This permits operation over a 1000:1 intensity ratio without having to resort to range switching on the instrument. A mounting arm supports the geiger tube radiation detector in a fixed horizontal position centered over the radiation beam exit port. The upper end carries the geiger tube, tube socket and protective housing, including a beta shutter which may be opened if desired. The beta shutter should be kept in the closed position, except for certain special tests.

9. In use, the barrier shielding demonstrator set shows directly the relative stopping power of the shielding materials furnished. It includes two concrete, two earth and two water specimens contained in clear plastic containers with thin metal screw tops. Also furnished are four wood samples cut to size, such that the stack of four pieces is the same height as two of the other specimens when stacked.

10. In use, one opens the radiation beam exit port and then places the samples in the beam of gamma rays singly or in combination. The geiger tube radiation detector senses the change in the amount of radiation reaching it, and this is indicated on the panel meter and

remote readout. Magnetic button markers are provided to enable the lecturer to mark the intensity level for any given absorber and so be able to compare the effect of one absorber relative to another with ease and accuracy.

11. An extension tube is provided for use with the detector mounting arm when it is desired to show the effect of increasing the source distance upon the indicated dose rate. The extension tube effectively doubles the source-detector distance, facilitating illustration of the inverse square law. The extension tube has a guide pin near the lower end oriented with a slot at the upper end to maintain the detector position over the beam exit port.

12. The demonstrator set comes packed in two laminated fiber shipping/storage containers, Figure 3-4, each of which is "one-man portable."

13. The instrument console, base unit, microphone, detector arm and cable and the remote indicator cable are housed in the cubical box. Also included are the maintenance and instructional manual, a copy of the text for the lecture-demonstration and a 25-foot extension power cord. The second case contains the remote indicator, remote speakers, barrier shielding material samples, indicator-base strut and detector arm extension tube, plus a set of magnetic marker buttons for use with the remote indicator.

14. Each case is fitted with a padlock hasp to permit locking to prevent tampering. Since the base unit contains a radioactive isotope, it is made inaccessible to unauthorized personnel. The case is locked as soon as the base unit is returned to it. Each case is provided with its own padlock.

15. When the demonstrator set is in use and the gamma beam exit port closed with the plug provided, radiation levels at the surfaces of the base unit are negligible for all practical purposes. However, with the gamma port beam exit port open, the dose rate one-half inch above the open port is approximately 35 mr/hr, decreasing to approximately 1.5 mr/hr at a height of one foot. This is a collimated conical beam with fairly sharp limits, and outside of this cone the dose rate remains low except for a slight increase due to air scattering. The user will avoid exposing his hands or head to this cone of radiation; he will wear a film badge and CDV-138 dosimeter in his shirt or coat pocket and refrain from leaning over the gamma port of the base to protect his head. The hand most often used to place the materials in the gamma beam will be monitored by strapping a wrist-type film badge or CDV-138 dosimeter to the back of the hand with tape or by clipping on to his shirt or coat cuff. The "Caution Radiation Area" sign will be posted and participants in the demonstration and lecture will not be allowed access to the demonstrator set.

16. When the demonstrator set is in use, the user does not leave the set unattended. In the event the user must leave the area, the beam exit port will be closed and secured by inserting the plated brass tungsten

plug from the top of the deck, and the lock will be engaged in the spring-loaded slide locking hasp that retains the plug for storage or shipment (see Figure 3-2). The base unit will be placed in its shipping case and padlocked (see Figure 3-4) and the set placed in a room with its door locked and secured.

17. The outside of the base unit is labeled to show that it contains radioactive material. The label displays the magenta and yellow radiation symbol with the legend "Caution Radioactive Material" followed by the isotope (Cesium 137), the activity (1 mc), the date measurement, chemical form and radiation level outside the container (§ 0.1 mr/hr at one foot). The same information is also marked on the outer surface of the source shield mounted inside the base unit. When the source is in use, the area immediately above the source is posted with a "Caution Radiation Area," sign.

18. Radiation exposure of personnel is limited to that specified in 10 CFR 20 standards for protection against radiation.

19. In the event of any natural or man-made accidents or catastrophes (fire, flood, explosion, theft, loss, etc.) that the base unit of the CDV-757 is involved in, it is unlikely that the integrity of the source and shield would be affected. The unit might be lost or buried under mud, rubble or other debris and could be difficult to locate due to the low level of radiation escaping through the shield. A sensitive low-range survey instrument will be used to pinpoint the location of the buried unit. The Radiological Safety Officer will make a preliminary evaluation of the situation and, if possible, determine the extent of damage or radiation hazard which exists without disassembly of the unit. Appropriate authorities will be notified in accordance with instructions outlined in ITEM: 10.3.

20. Records:

    a. The exposure readings from pocket dosimeters (CDV-138) issued to the user of the demonstrator set are recorded and maintained in the computer at the RIM&C Facility.

    b. Film badge results for each user are recorded on the Photodosimetry Report provided and processed by the U.S. Army Ionizing Radiation Dosimetry Center, ATTN: AMXTM-CE-DCR, Lexington, Kentucky 40511-5102.

    c. Occupational radiation exposure records containing information called for in NRC Form 5 are provided by the U.S. Army Ionizing Radiation Dosimetery Center on a computer printout.

    d. Radiation survey records on file at the Maintenance and Calibration Facility include the date, person performing the survey, and the radiation intensity.

e. Records of wipe tests are and will be maintained and will indicate the date, person performing the test, and the test results. Also included is the date the next wipe test should be performed.

f. Records of individual exposures for the past sixteen (16) years for both user radiological safety officers and other authorized personnel indicate compliance with 10 CFR 20, 20.101 and 20.105.

21. A radiation survey will be made on the CDV-757 shipping/storage container (top and four sides) and recorded using a calibrated CDV-700 instrument. Each survey will be performed prior to each wipe test.

22. The set will always be secured when not in use or when left unattended. Upon conclusion of a demonstration and lecture, the base unit with exit port plug secured will be padlocked, placed in its shipping container and padlocked, returned to its permanent storage area with doors of the building key locked and mobile security police physically checking all doors and windows for securement.

23. Leak Testing:

a. The CDV-757 Model 1 Barrier Shielding Demonstrator Set is leak tested at intervals not exceeding six months by a radiological safety officer as indicated in ITEM: 6.

b. To accomplish this leak test, the following items are used:

1 each CDV-700 Monitoring Survey Meter, newly calibrated.
1 each CDV-788 18-inch long Handle Tong.
1 each 1-1/2 inch diameter Whatman No. 50 Filter Paper.
1 each Ludlum Scaler/Ratemeter, Model 2200.
1 each Film Badge.
1 each CDV-138 self-Reading Pocket Dosimeter.

24. Leak Test Procedure:

a. Moisten filter paper with several drops of diluted detergent solution.

b. Hold the protective source cover slide open.

c. With filter paper secured in jaw of handling tongs, insert into bore of gamma beam port, thrusting it all the way to the bottom of the hole.

d. Using moderate pressure, swab the bottom of the bore with wiping or twirling movements. Use a second dry filter paper swab to remove any excess moisture left in the bore.

e. With the CDV-700M, evaluate the filter paper for obvious activity; if test shows little or no increase over background level, there is no great amount of leakage.

f. Let filter paper dry and evaluate with Ludlum Scaler/Ratemeter, Model 2200, which is capable of measuring 0.005 microcurie of Cesium 137.

g. If the more sensitive detection Ludlum Scaler/Ratemeter, Model 2200, indicates there is less than 0.005 microcurie of activity present on the paper, the test is considered negative and has been satisfactorily passed.

h. Secure barrier shielding demonstrator set and record test results and retain on permanent file from the set.

i. If 0.005 microcurie or more of gross beta gamma activity is detected, lock the source, wrap it in heavy plastic or paper, seal with tape and store in location away from personnel access. Appropriate authorities will be notified in accordance with instructions outlined in ITEM: 10.3.

j. As a minimum, the report will describe the equipment involved, the test results and the corrective action taken.

25. Contamination Control:

a. The barrier shielding demonstrator set area will be cleared of personnel and immediately checked for contamination.

b. Contaminated area will be restricted from use until cleaned under the supervision of a qualified health physicist and radiological safety officer, and all requirements of Title 10, Part 20, of the Code of Federal Regulations will be satisfied.

c. When it is necessary for personnel to enter the area prior to the institution of or during decontamination operations, protective clothing, gloves and footwear will be worn.

d. If airborne and Cesium 137 contamination above $1x10^{-8}$ microcurie per milliliter is present, dust respirators and supplied air masks will be worn.

e. Contamination control procedures will be utilized with established buffer zones for the changing of the contaminated protective clothing.

f. Ventilation of the radioactive contaminated area will not be performed without control of the affluent air to prevent spread of the contamination.

g. Disposition of the barrier shielding demonstrator set with a leaking radioactive source must be handled directly by the Federal Emergency Management Agency, Region IX. No attempt to stop the

leakage or disposal of the source will be made without written approval of the Radiological Defense Officer, FEMA Region IX.

26. Upon termination of the Radiological Maintenance and Calibration Program contract or when otherwise necessary, the CDV-757 Model 1 Barrier Shielding Demonstrator Set, with its radioactive source, will be returned to the Federal Emergency Management Agency, Region IX, as directed by instructions.

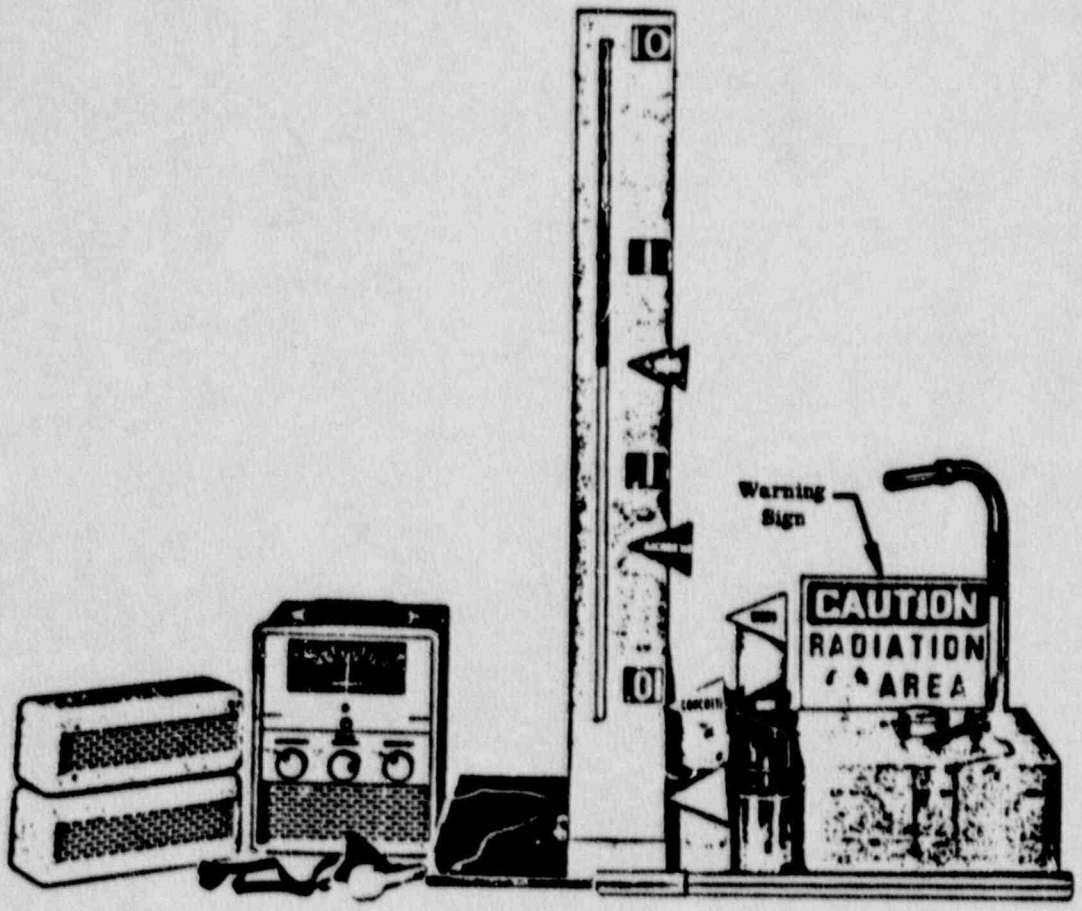
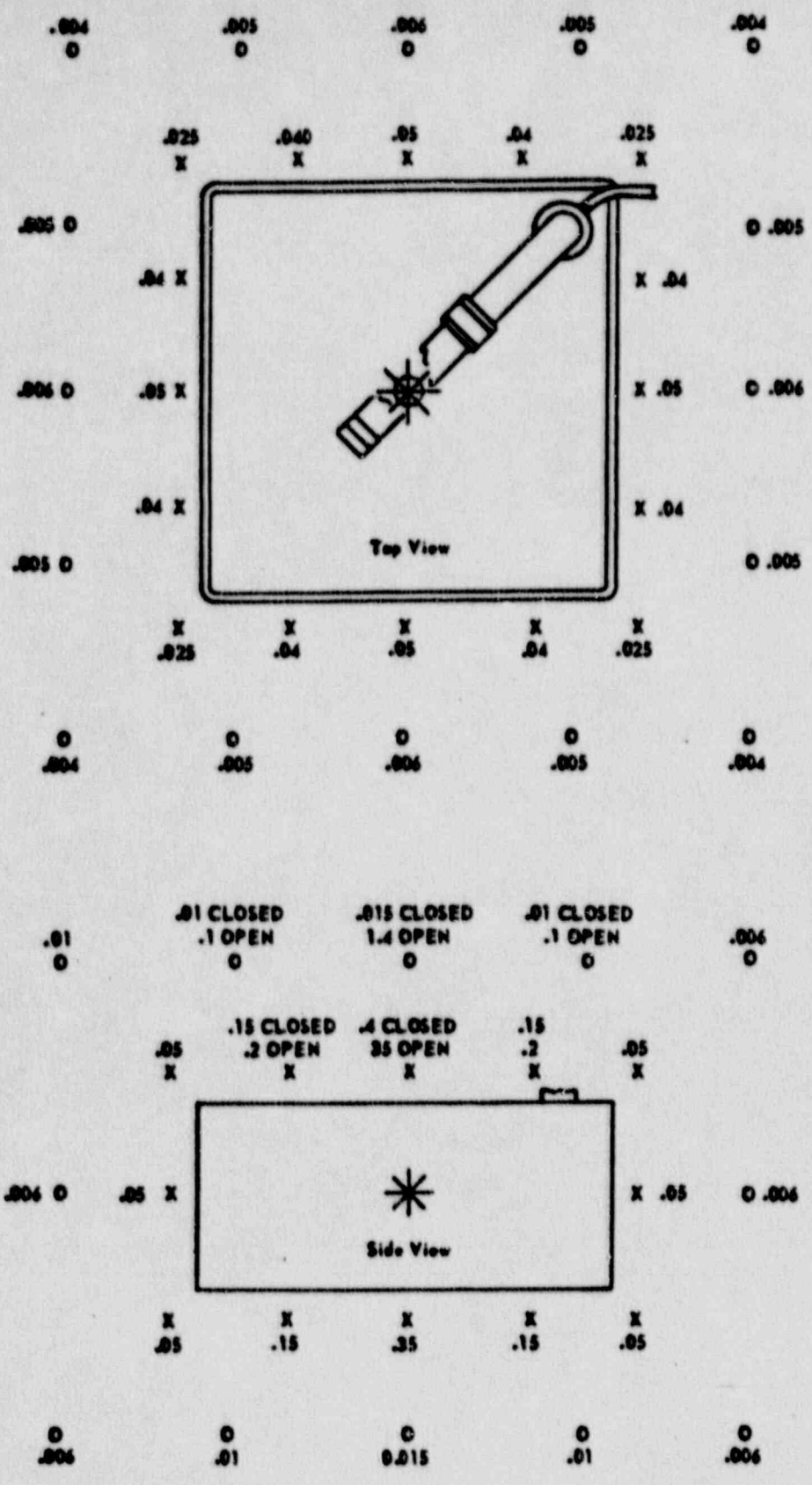


Figure 3-1 Barrier Shielding Demonstrator In Operational Form Showing Use Of Radiation Warning Sign.



MAX. INTENSITY AT SURFACE:
.4 MR/HR AT MIDDLE OF PLATFORM
.35 MR/HR AT BOTTOM OF PLATFORM

X = 1/2" FROM SURFACE
O = 1FT. FROM SURFACE
ALL FIGURES IN MR/HR

FIGURE 3-2

Maximum Radiation Levels Around Base Unit As Of 5/19/67

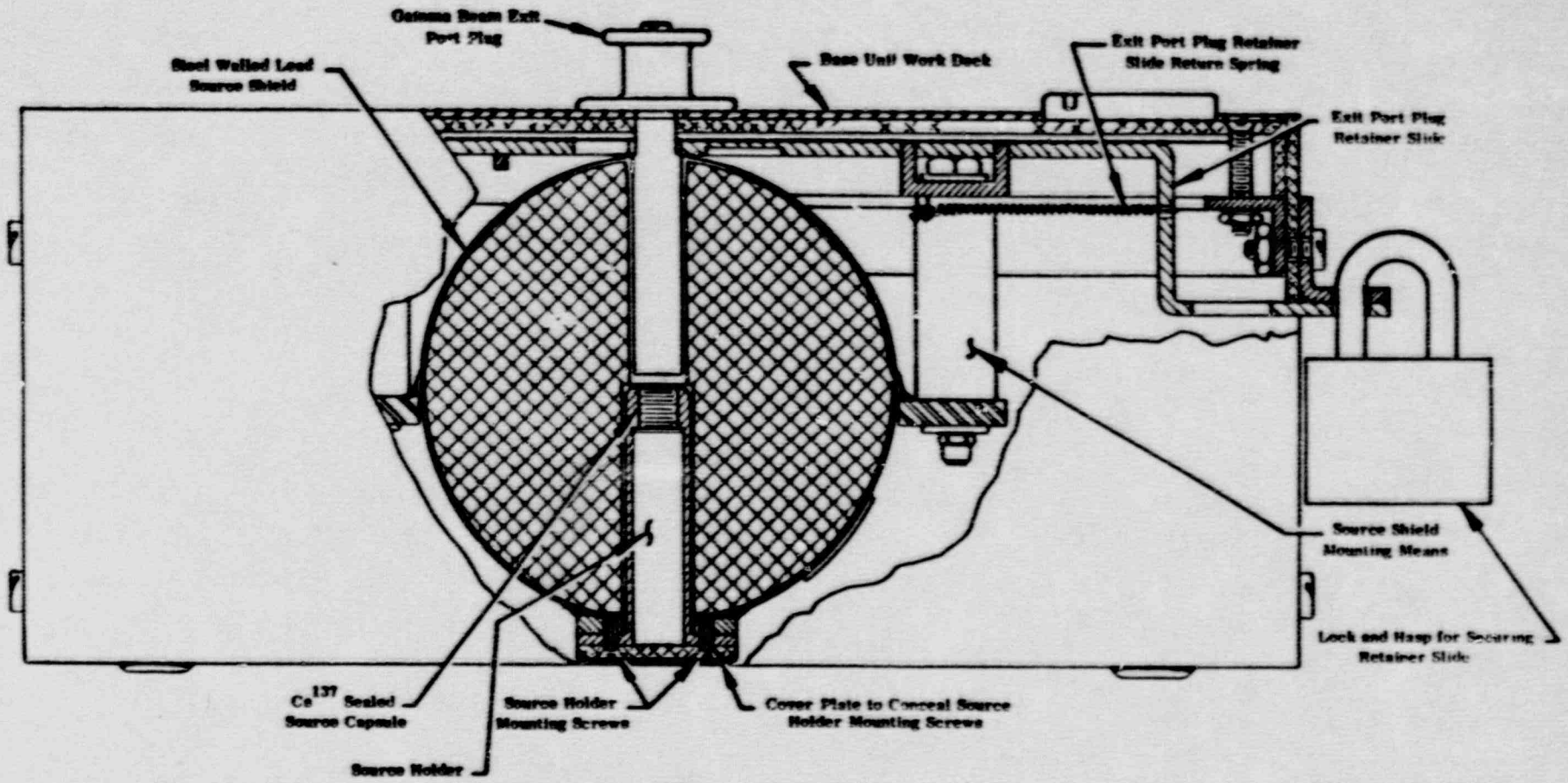


Figure 3-3 Base Unit Source and Shield

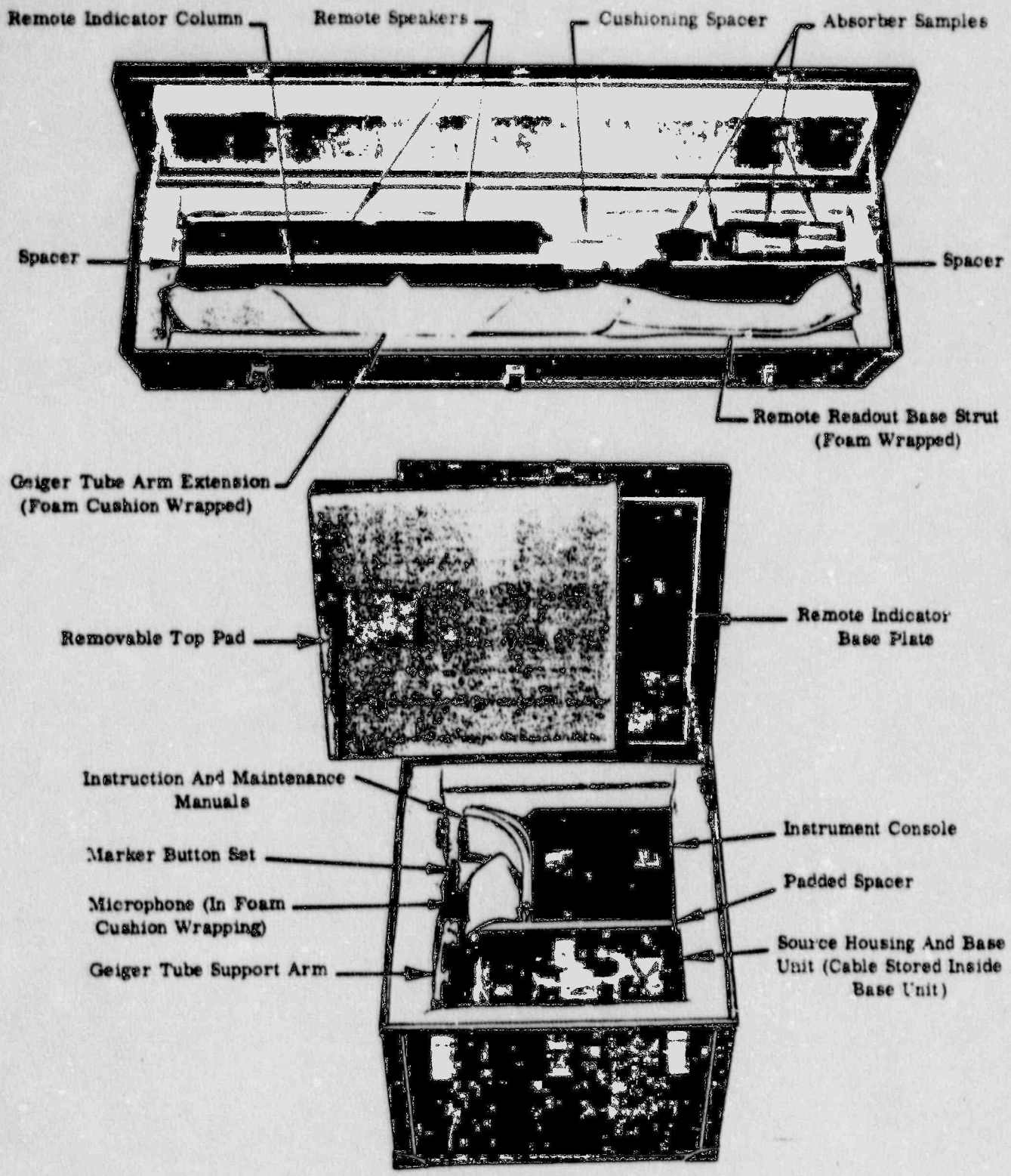


Figure 3-4 Shipping Cases Opened Showing Placement Of Barrier Shielding Demonstrator Components.

ITEM 9: FACILITIES AND EQUIPMENT (continued)

PART V

EQUIPMENT: CDV-784 Cobalt 60 Training Source Set

1. State Civil Defense has five CDV-784, 30 millicurie, radiation training source sets. Each set consists of six (6) Baird-Atomic, Inc., cobalt 60 sealed sources. The training source set has been specifically designed for use in training exercises for the training of radiological monitors. The set provides a gamma radiation source with most of the beta radiation being absorbed in the wall of the capsule and source needle itself. Accessory equipment consist of the following items:

   6 each 5.0 mc cobalt 60 sealed sources totaling 30 mc
   1 each lead container, small CDV-791
   1 each lead container, medium CDV-792
   2 each locks for lead container, large CDV-792
   1 each long-handle tongs for handling sources, CDV-788
   8 each radiation area signs
   2 each 0-200 mr Dosimeters, CDV-138
   1 each Dosimeter Chargers, CDV-750
   1 each Geiger Counter, CDV-700

2. The Bureau of Explosives has approved the CDV-791 and CDV-792 lead containers, when used together and locked, as a shipping container for six sealed source capsules totaling 30 millicuries of cobalt 60. The permanent storage facility for the five (5) FEMA CDV-784 training source sets is in the State Radiological Instrument Maintenance and Calibration Facility, Building 90, 3949 Diamond Head Road, Honolulu, Hawaii 96816. This facility has an area of 1,272 sq. ft. The area is patrolled by mobile security guards who physically check the building for securement. Doors are posted with signs bearing the standard three-blade propeller design with the words: "Caution Radioactive Material," "Contents" (type of radioactive materials to include amounts), "Emergency Notification" (includes name and home telephone number of radiological safety officer), and "only authorized persons are allowed in this room area."

3. The five (5) FEMA CDV-784 cobalt 60 training source sets will be used throughout the State for the training of radiological monitoring personnel and instrument calibration exercises to satisfy the State's network of monitoring stations and mobile teams in preparation for a nuclear emergency. Intra-island barge service shall be used for transporting the set to and from the islands of Kauai, Maui and Hawaii, from the Radiological Instrument Maintenance and Calibration Facility. Normally all five (5) training source sets are stored at its permanent storage facility, however, training activities throughout the State of Hawaii make it impractical to return the sets to

Building 90 after each use. As a result, three (3) source sets are stored on the islands of Kauai, Maui and Hawaii on a semipermanent basis. Addresses of the semipermanent storage locations are as follows:

a. Kauai Civil Defense Agency
4444 Rice Street, Room 230
Lihue, Kauai, Hawaii 96766

b. Maui Civil Defense Agency
200 South High Street
Wailuku, Maui, Hawaii 96793

c. Hawaii Civil Defense Agency
34-A Rainbow Drive
Hilo, Hawaii 96720

4. Storage area rooms for the safekeeping of the training source set at each location are equipped with key-type locks on all entrances/exits. County Civil Defense Administrators holding a custodian certificate are officially designated as temporary source set custodians by the State Civil Defense Director. Radiological safety officers and custodians responsible for the safe storage of the source set must keep a record of dates the source set was used. Such records are maintained on file at the State Radiological Instrument Maintenance and Calibration Facility. When the source set is returned to the permanent storage area at the conclusion of a training course, the radiological safety officer or custodian monitors each capsule (six each) with a CDV-700 to ensure that the cobalt 60 source material is contained inside each capsule. This monitoring is performed at a distance from the other sources where the gamma radiation levels are not significantly above natural background. Each source capsule is inspected and monitored before and after each time the source set is used. This action provides immediate detection for capsule or source material losses during or at the conclusion of each training session. Capsules are then placed in the CDV-792 lead container and cover padlocked with two padlocks. Source set is then placed in the authorized storage room.

5. Description of sealed sources is described in Figure 4-1.

6. Activity of the CDV-784 cobalt 60 training source set is described in Figure 4-2 and a Table of Decay Correction Factors for Cobalt 60 is at Figure 4-3.

7. Surveys:

a. Two (2) CDV-784 cobalt 60 radiation training source sets are stored at the State Radiological Instrument Maintenance and Calibration Facility where surveys indicate the exposure rates within the building are less than .07 mr/hr. Radiation surveys

are taken by the radiological safety officer using a calibrated CDV-700.

b. Present control measures and barriers surrounding equipment containing radioactive materials restrict access to each radiation unit during the normal workday.

c. Two (2) CDV-457 audible and visual monitoring instruments located in the building provide constant information as to the radiation intensity within the building.

d. A new survey is required whenever there is a change at the storage site which could change exposure rates to which personnel would be exposed.

e. Storage of one CDV-784 cobalt 60 radiation training source set in building and room provided by the custodians (civil defense administrators) for the Counties of Kauai, Maui and Hawaii indicates exposure rates of less than .03 mr/hr which is no increase above background radiation levels.

f. The storage room is not frequented by individuals during the normal workday and the training source set is removed and issued to a certified user only when training is conducted which requires the use of the source set.

g. The set is always secured when not in use and is never left unattended. Always upon conclusion of a training course the set, to include source capsules, is checked, container padlocked and returned to its authorized storage location with doors to room and building key locked.

8. Records of individual exposure for the past sixteen (16) years for both user, radiological safety officer and other authorized personnel indicate compliance with 10 CFR 20, 20.101 and 20.105.

9. Leak Testing:

a. Leak testing of CDV-784 cobalt 60 training source sets is accomplished in accordance with the State of Hawaii, Manual of Procedures, Use and Control of Radiation Training Source Sets, dated July 1983, at Attachment 1.

b. Confirmation measurements are made with the Ludlum Scaler/Ratemeter, Model 2200, capable of measuring 0.05 microcuries of cobalt 60.

c. If the Ludlum Scaler/Ratemeter, Model 2200, indicates there is less than 0.05 microcuries of activity present on the "wipe," the test is considered negative and has been satisfactorily passed.

d. If the 0.05 microcurie of gross beta gamma activity is detected, lock and secure the source set and store in location away from personnel access. The appropriate authorities will be notified by telephone or telegraph and a written report filed according to procedures outlined in ITEM: 10.3. As a minimum, the report will describe the equipment involved, the test results, and the corrective action taken.

e. Disposition of the CDV-784 cobalt 60 radiological training source set with a leaking source must be handled directly by FEMA Region IX. No attempt to stop leakage or disposal of the source will be made without written approval of the Radiological Defense Officer, FEMA Region IX.

10. In the event of any natural or man-made accidents or catastrophes (fire, flood, explosion, theft, loss, etc.) that the CDV-784 cobalt 60 radiation training source set is involved in, it is unlikely that the integrity of the source and shield would be affected. The unit might be lost or buried under mud, rubble or other debris and could be difficult to locate due to the low level of radiation escaping through the shield. A sensitive low-range survey instrument will be used to pinpoint the location of the buried unit. The radiological safety officer will make a preliminary evaluation of the situation and, if possible, determine preliminary evaluation of the situation and, if possible, determine the extent of damage or radiation hazard which exists. The appropriate authorities will be notified according to procedures outlined in ITEM: 10.3.

11. Additional guidelines describing procedures for the care, use, storage, transport and supervision of CDV-784 cobalt 60 training source sets are outlined in State of Hawaii, Manual of Procedures, Use and Control of Radiation Training Source Sets, at Attachment 1.

12. The following equipment is made available and issued to each county civil defense administrator for use by qualified instructors in the training of radiological monitors:

	Quantity
CDV-138 0-200 mr dosimeters	30
CDV-700 geiger counter (1-50 mr/hr)	15
CDV-715 survey meter (0-500 r/hr)	15
CDV-717 survey meter (0-500 r/hr)	2
CDV-742 0-200 r dosimeter	2
CDV-750 dosimeter charger	15
Ludlum Scaler/Ratemeter, Model 2200	1*
2" lead shielded GM counting chamber	1*
Film badges	3*
Wrist film badge	1*

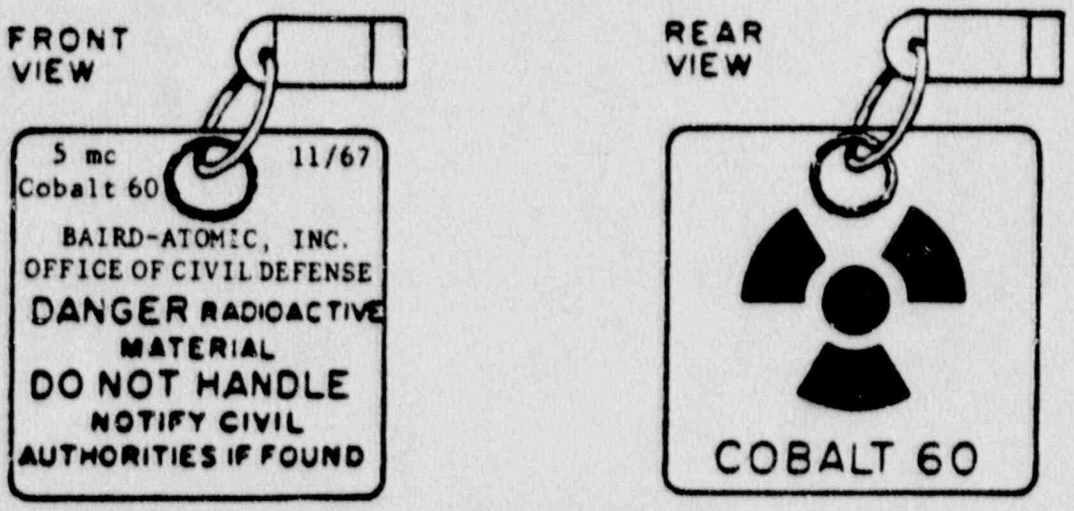
* Available only at the State Radiological Equipment Maintenance and Calibration Facility.

PREPARATION OF THE SEALED SOURCES

Model CDV-784

Any radioactive material that is encased in, and is to be used in, a container in a manner intended to prevent leakage of the radioactive material, or any of its daughter products, is referred to as a sealed source. The sources in the training source set are of such a nature. The radioactive material is Cobalt 60, which was prepared by the neutron irradiation of Cobalt 59, in a nuclear reactor.

$$^{59}_{27}Co + ^{1}_{0}n \text{ --------- } ^{60}_{27}Co$$



CDV-784 Sealed Source
Figure 4-1

Nickel 60 is in the excited state and emits 2 gamma rays of 1.17 and 1.33 million electron volts (mev). These sources are primarily gamma radiation sources. Most of the beta radiation will be absorbed in the wall of the capsule and source needle itself.

The Cobalt 60 decays with a 5.3 year half-life by beta and gamma emission to Nickel 60.

$$^{60}_{27}Co \xrightarrow{(5.3\ yrs)} ^{0}_{-1}B\ (.32\ Mev) + ^{60}_{28}Ni + 2^{\gamma} \times (1.17 + 1.33\ Mev)$$

The cobalt pellet is nickel plated to prevent oxidization and erosion or flaking off from the radioactive pellet.

The cobalt pellet is enclosed in a standard Oak Ridge, screw-type capsule.

The capsule is then silver soldered to prevent possible escape of any radioactive material.

ACTIVITY OF TRAINING SOURCE SET CDV-784 CO 60

Each of the CDV-784 sealed source capsules was 5 millicuries plus 20% or minus 10% on the date of encapsulation, October 1967. Date and activity are marked on the tag attached to each source capsule.

The table below can be used to compute the total or individual activity of the set or capsules.

Example: Find the present activity of one (1) of the 5 millicurie sealed source capsules and the total activity of the set 132 months after date of encapsulation.

Source activity on date of encapsulation = 5 millicuries
Elapsed time = 132 months.
Decay correction factor from table below = .23

Source activity 132 months after encapsulation
= .23 x 5 = 1.15 mc
= 1.2 mc + 20% - 10%

Total activity of the set
= 6 capsules x 1.2 mc/capsule
= 7.2 mc + 20% - 10%

Figure 4-?

TABLE OF DECAY CORRECTION FACTORS FOR COBALT 60

Factor (1 month) = 0.01 Half Life = 5.3 years

Months	0	1	2	3	4	5	6	7	8	9
0	1.00	.99	.98	.97	.96	.95	.94	.93	.92	.91
10	.90	.89	.88	.87	.86	.85	.84	.83	.82	.81
20	.80	.79	.79	.78	.77	.76	.75	.74	.74	.73
30	.72	.71	.70	.70	.69	.68	.67	.67	.66	.65
40	.65	.64	.63	.62	.62	.61	.60	.60	.59	.58
50	.58	.57	.57	.56	.55	.55	.54	.54	.53	.52
60	.52	.51	.51	.50	.50	.49	.49	.48	.48	.47
70	.46	.46	.45.	.45	.44	.44	.43	.43	.42	.42
80	.41	.41	.41	.40	.40	.39	.39	.38	.38	.38
90	.37	.37	.36	.36	.35	.35	.35	.34	.34	.34
100	.33	.33	.33	.32	.32	.31	.31	.31	.30	.30
110	.30	.29	.29	.29	.28	.28	.28	.28	.27	.27
120	.27	.26	.26	.26	.26	.25	.25	.25	.24	.24
130	.24	.24	.23	.23	.23	.23	.22	.22	.22	.22
140	.21	.21	.21	.21	.20	.20	.20	.20	.20	.19

Figure 4-3

PART VI

EQUIPMENT: CDV-790 Model 1 Calibrator

1. The CDV-790 Model 1 Calibrator, identified in the draft Operation and Maintenance Manual, Attachment 2, will be permanently positioned on a work bench in the Radiological Instrument Maintenance and Calibration Facility, Building 90, 3949 Diamond Head Road, Honolulu, Hawaii. The calibrator contains a 16 millicurie Cesium 137 source manufactured by Nuclear-Chicago to provide a gamma radiation field for calibrating the low-range CDV-700 GM instruments.

2. The CDV-790 calibrator consists of a CDV-792 shipping container into which a collimated Nuclear-Chicago 16 mCi Cesium 137 source is placed. During transportation, the lid on the CDV-792 is locked to prevent unauthorized access. In the calibration laboratory, the lid is removed from the shipping container and the calibration jig (as shown in the diagram) is then mounted onto the container and a lead storage plug is used to prevent unnecessary exposure to personnel while the unit is not in use. When in use, the probe is placed on two V-blocks at a predetermined height. The lead storage plug is unlocked and removed. The radiation beam can then be attenuated by sliding one or any combination of the three tungsten attenuators in the beam path to approximate gamma exposure rates of 45, 30, 22.5, 15, 4.5, 3, 2.25 and 1.5 mrem/hr $\pm$ 5%.

3. The CDV-790 Model 1 calibrator shall be operated only by or under the supervision of individuals listed in ITEM: 7. These personnel will be familiar with the operating instructions, radiological hazards, leak testing, radiation safety, controls and emergency notification procedures outlined in the draft Operation and Maintenance Manual, prior to use of the calibrator.

4. Leak testing of the CDV-790 Model 1 calibrator will be accomplished at intervals of not more than six months using techniques capable of detecting 0.005 microcuries of removable contamination and in accordance with the following procedures:

   a. Fasten a filter paper (Whatman No. 50 or equivalent) to the end of a two (2) foot long 1/4 inch dowel rod and moisten the filter paper with alcohol. A cotton swab may be substituted for filter paper.

   b. Remove the storage plug and with all the slides open, insert the prepared end of the rod down through the tabletop past the collimators of the calibrator, and wipe the end of the 16 mCi source.

c. Withdraw the dowel rod and replace the storage plug.

d. Carefully remove the filter paper or cotton swab from the end of the rod with tweezers.

e. Check the smear with the CDV-700M for gross contamination. Let smear air-dry and evaluate the smear with the Ludlum Scaler/ Ratemeter, Model 2200. Convert net count rate to units of microcuries. Compare the results with the allowable limit of 0.005 microcurie activity. If 0.005 microcuries or more of gross beta-gamma activity is detected, the logistics support branch of FEMA and the activity radiation safety officer of the appropriate FEMA regional office will be immediately notified by telephone and telegraph. See paragraphs 5.c. and 5.d., below, for reporting details. The calibrator area must be cleared of personnel and immediately checked for contamination. All contaminated areas must be restricted from use until cleaned under the supervision of a qualified health physicist and all requirements of Title 10, Part 20, of the Code of Federal Regulations are satisfied.

f. When it is necessary for personnel to enter the area prior to the institution of, and during, decontamination operations, protective clothing, gloves, and footwear should be worn. If airborne Cesium-137 contamination above 1×10^{-8} microcurie per milliliter is present, dust respirators or air masks should also be worn. Contamination control procedures to prevent the spread of radioactive contamination should be utilized. Buffer zones should be established for the changing of contaminated protective clothing. To prevent spread of the contamination, the radioactive contaminated area should not be ventilated without control of the effluent air. All operations must be carried out under the direct supervision of an authorized health physicist or the radiological safety officer.

g. All wipe test results will be recorded in units of microcuries in the permanent Calibrator Wipe Test and Radiation Survey Record of the calibrator. Replace the access cover and tighten the four bolts. The wire seal need not be replaced.

5. Records:

a. The operator of the CDV-790 Model 1 calibrator will always wear a film badge when engaged in calibration activities, securing the calibrator or working in the general area of the calibrator. Film badge results will be recorded on Photodosimetry Report provided and processed by the U.S. Army Ionizing Radiation Dosimetry Center, ATTN: AMXTM-CE-DCR, Lexington, Kentucky 40511-5102.

b. Records will be maintained as prescribed by paragraph 20-401, CFR 20, and retained on file at the Radiological Instrument Maintenance and Calibration Facility, Building 90.

c. Records of periodic radiation surveys performed using a CDV-700 beta-gamma monitoring survey instrument will include the date, person performing the survey, and the radiation intensity in the general working area of the CDV-790 calibrator.

d. Records of leak testing will be maintained and will indicate the type of instruments used to perform the analysis, the date, person performing the test and the test results, and the date the next wipe test is due.

6. Radiation Protection:

a. The area where the CDV-790 Model 1 calibrator is located will be marked at all times by signs bearing the words "Caution Radioactive Material, 16 millicuries, Cesium 137," and displaying the purple or magenta standard radiation symbol on a yellow background. Signs of this type are also affixed to the calibrator.

b. Should a radiation survey at time of receipt of the calibrator identify that a radiation leakage has occurred, results of a wipe test determine that 0.005 microcuries or more of gross beta-gamma activity is present, or the CDV-790 Model 1 calibrator was affected by fire, authorities identified under paragraph 5.c., below, will be notified promptly after contamination controls are implemented.

c. In the event of any natural or man-made accidents or catastrophes (fire, flood, explosion, theft, loss, etc.) that the CDV-790 Cesium 137 source is involved in, it is unlikely that the integrity of the source and shield would be affected. The unit might be lost or buried under mud, rubble or other debris and could be difficult to locate due to the low level of radiation escaping through the shield. A sensitive low range survey instrument will be used to pinpoint the location of the buried unit. The radiological safety officer will make a preliminary evaluation of the situation and, if possible, determine the extent of damage or radiation hazard which exists. The following will be immediately notified by telephone and telegraph in accordance with 10 CFR 20, paragraphs 20.402, 20.403 and 20.405:

(1) U.S. Nuclear Regulatory Commission, Region V
Office of Inspection and Enforcement
1450 Maria Lane, Suite 210
Walnut Creek, CA 94596-5368
Telephone: (415)

(2) Federal Emergency Management Agency, Region IX
Radiation Protection Officer
Building 105
Presidio of San Francisco, CA 94129

Telephone: Commercial (415) 556-9412
Autovon 586-9412
FTS 556-9412

(3) Federal Emergency Management Agency
Logistics Support Branch
Washington, D.C. 20472

Telephone: (202) 287-0061
(After hours, EICC, (202) 634-7800)

d. Within 30 days of the incident, a written report will be submitted to each of the above and to the following agency:

Director
Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

e. The disposition of the calibrator with a leaking radioactive source will be handled directly by FEMA. No attempt to stop the leakage or to dispose of the source shall be made without the written approval of an authorized FEMA Radiation Protection Officer.

ITEM 10: RADIATION SAFETY PROGRAM

10.1 Personnel Monitoring Equipment:

Type	Service Company	Exchange Frequency
Film Badge CDV-138 Dosimeter (0-200 mr)	Film Badge serviced by: U.S. Army Ionizing Radiation Dosimetry Center, ATTN: AMXTM-CF-DCR, Lexington, Kentucky 40511-5102	Monthly

10.2 Radiation Detection Instruments and Instrument Calibration

10.2a Radiation Detection Instruments

Type	Number Available	Radiation Detected	Sensitivity Range	Use
CDV-717	2	Gamma	0-500 r/hr	Monitoring/ Surveying
CDV-457	2	Beta-Gamma	0-15,000 cpm (Audio)	Area Monitoring
CDV-700	1	Beta-Gamma	0-500 mr/hr	Monitoring/ Surveying
CDV-700	2	Beta-Gamma	0-50 mr/hr	Monitoring/ Surveying
Ludlum Model 2200 Scaler/Ratemeter	1	Beta-Gamma	6 decade Readout	Quantitative Measurement
Eberline E-520	2	Beta-Gamma	0-2 r/hr	Monitoring/ Surveying
Eberline PAC-1 SAGA			0-2 r/hr	Monitoring/ Surveying
GM/Scintillation Detector		Alpha	0-2x10^6 cpm	

All instruments used in evaluating the radiation hazards in terms of exposure will be calibrated on a routine basis once every year by the applicant. (See Data Sheets 1 and 2.) Instruments will be calibrated at one or two points on the scale on each range. One point calibration should be at least 2/3 or more of the full scale, and on two points it should be at least 1/3 and 2/3 of the full scale.

A Baird-Atomic Cesium 137 standard source (Serial No. CD-55), certified at 3.2640×10^4 dpm by Baird-Atomic on October 20, 1966, is used to determine the efficiency of the Ludlum Scaler/Ratemeter, Model 2200. To determine the current disintegration/minute of the standard source, the decay equation is used.

The exposure rates of the CDV-794/2 (high range) calibration unit is standardized annually by the use of the Federal Emergency Management Agency's (FEMA) CDV-765 Gamma Radiation Transfer Standard. The exposure rate for the CDV-790 (low range) calibration unit was originally obtained from the FEMA Radiological Instrument Test Facility. The exposure rates are currently updated using the decay equation annually.

10.3 Operating and Emergency Procedures:

The operating, instrument calibration and emergency procedures for each of the devices using sealed sources listed in ITEM 5: RADIOACTIVE MATERIAL, are found in their respective operating and maintenance manuals located in the Radiological Instrument Maintenance and Calibration Facility. The emergency procedures are described in ITEM 9: EQUIPMENT, PARTS II through VI, and in the following Radiation Safety Procedure:

1. Security and Safety Measures:

   a. Radioactive material for calibration and training is located in the State Radiological Equipment Maintenance and Calibration Facility. Entrance to this facility will be by a single standard door with lock. Double metal doors with a lock at the back of this facility remain locked and used only for loading and off-loading packaged instruments and equipment and emergency entrance/exit purposes.

   b. Doors will be locked when operators are not in the facility.

   c. During nonworking hours or days, a security patrol officer is to check the facility for security and provide surveillance.

   d. Doors providing access to the area where radiation material is located will be posted with signs bearing the standard trefoil symbol and the words "Caution Radioactive Material," "Contents" (type of radioactive material to include amount), and "In Case of Emergency Notify" (includes phone numbers for Radiological Safety Officers).

   e. The inside walls of the building will be posted with "Caution Radioactive Material" signs.

f. Form NRC-3 will be posted in areas frequented by and/or where individuals work. A copy of the Byproduct Material License and 10 CFR, Parts 19 and 20, and these instructions will be posted on a bulletin board accessible and observable to individuals on their way to and from the licensed activity.

g. The room area enclosing the calibrators and the CDV-784 sealed sources will be classified as a restricted area and only authorized personnel will be admitted within this area. One CDV-138 self-reading 0-200 milliroentgen pocket dosimeter will be assigned by serial number to each person authorized in the restricted area. Operational CDV-138 dosimeters will be readily available for issue to authorized visitors. The Radiological Instrument Maintenance and Calibration Facility staff are assigned film badges which are changed each calendar month and sent to:

U.S. Army Ionizing Radiation Dosimeter Center
ATTN: AMXTM-CE-DCR
Lexington, Kentucky 40511-5102

h. When a calibrator is in use, the operator will not leave the unit unattended. Upon completion of tests and calibration or if the operator intends to leave the facility, the calibrator will be closed and locked.

i. The conventional trefoil radiation symbol and the words "Caution Radiation Area" will appear on labels affixed to equipment cabinets, work tables and walls of the facility where the calibrators and other sealed sources are located. Warning signs will be visible from all doorways. This measure is to provide additional positive measures to prevent unauthorized personnel from being in the immediate area of the calibrators.

j. Each calibrator is appropriately labeled to indicate it contains radioactive material. (An identification plate on each unit bears the radiation symbol and the words "Caution Radioactive Material" as well as type of radioisotope in the device; e.g., Cesium 137, quantity of Cesium 137 and the date of measurement.) A larger sign will remain posted on the wall adjacent to or behind each calibrator and bear the radiation symbol, the warning "Caution Radioactive Material" and quantity and type of radioisotope; e.g., 130-Curies Cesium 137.

k. Radiation exposure of personnel will be limited to that specified in 10 CFR 20 Standards for Protection Against Radiation.

l. In the event the radioactive material in calibration and training equipment is enveloped in flame or exposed to fire causing extremely elevated temperatures, the calibration area may become contaminated, the amount of shielding around the sources may have been degraded and external radiation hazards may be present. Circumstances of this nature require that the area be promptly evacuated and the fire be extinguished as quickly as possible. Reentry into the area will be made only after an exposure rate and contamination check has been made.

m. In the event of any natural or man-made disasters or incidents; i.e., flood, explosion, theft, loss, etc., procedures in Item 9 will be followed for recovery of the radioactive material. The Radiological Safety Officer will make a preliminary evaluation of the situation and, if possible, determine the extent of the damage or radiation hazard which exists without disassembly of the unit.

n. When it is necessary for personnel to enter the area prior to and during decontamination operations, protective clothing, gloves and footwear will be utilized. Respirators will be worn if airborne Cesium 137 contamination is detected to be above 1×10^{-8} microcurie per milliliter. Contamination control procedures to prevent the spread of contamination will be utilized including setting up of a contamination control line for removal of contaminated clothing and equipment. Ventilation of the contaminated area will not be performed without control of the effluent air to prevent spreading the contamination. All decontamination operations will be carried out under the supervision of the State Radiological Safety Officer.

2. Reporting Procedures:

a. In the event of a fire, disaster, personnel overexposure, release of the radioactive material or other accidents/incidents described in 10 CFR 20, paragraphs 20.402 and 20.405, the following will be immediately notified by telephone and Teletype message. Also see Item 9, Part VI, for addition reporting instructions.

U.S. Nuclear Regulatory Commission
Region V
Office of Inspection and Enforcement
1450 Maria Lane, Suite 210
Walnut Creek, CA 94596-5368

Telephone: (415) 943-3700
(FTS) 463-3700

Federal Emergency Management Agency
Region IX
Radiological Protection Officer
Presidio of San Francisco, CA 94129

Telephone: (415) 556-9412
(FTS) 556-9412

b. In addition to the telephone and telegraph notifications above, and within 30 days, a written report describing the equipment involved, the test results and corrective action will be sent to:

U.S. Nuclear Regulatory Commission
Region V
Office of Inspection and Enforcement
1450 Maria Lane, Suite 210
Walnut Creek, CA 94596-5368

Director
Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

3. Contamination Control:

a. All contaminated areas will be restricted from use until cleaned under the supervision of a qualified health physicist and the Radiological Safety Officer and all requirements of Title 10, Part 20, of the Code of Federal Regulations satisfied.

b. When it is necessary for personnel to enter the area prior to the institution of and during decontamination operations, protective clothing, gloves and footwear will be worn.

c. If airborne and Cesium 137 contamination above 1×10^{-8} microcurie per milliliter is present, dust respirators and supplied air masks will be worn.

d. Contamination control procedures will be utilized with established buffer zones for the changing of the contaminated, protective clothing.

e. Ventilation of the radioactive contaminated area will not be performed without control of the affluent air to prevent spread of the contamination.

f. Disposition of a calibrator with a leaking radioactive source must be handled directly by FEMA Region IX. No attempt to stop the leakage or disposition of a source will be made without written approval of the Radiological Protection Officer, FEMA Region IX.

g. File a report within five (5) days of the test with the U.S. Nuclear Regulatory Commission, Region V, Office of Inspection and Enforcement, 1990 N. California Boulevard, Suite 202, Walnut Creek, California 94596, describing the equipment involved, the test results and corrective action taken.

4. Records:

a. Readings taken from the self-reading pocket dosimeter issued to each individual (student, instructor and user) will be recorded on a radiation exposure record sheet. Records of each individual exposure will be recorded and maintained in a computer at the Radiological Instrument Maintenance and Calibration Facility.

b. Film badge results for each individual will be recorded on a Photodosimetry Report provided and processed by the U.S. Army Ionizing Radiation Dosimetry Center, ATTN: AMXTM-CE-DCR, Lexington, Kentucky 40511-5102.

c. Occupational radiation exposure records containing information called for in NRC Form 5 are provided by the U.S. Army Ionizing Radiation Dosimetry Center on a computer printout.

d. Records of radiation surveys performed with the CDV-700 beta-gamma monitoring survey instrument will be maintained at the Radiological Equipment and Maintenance Facility. The records will include the date, person performing the survey and the radiation intensity.

e. Records of wipe tests will be maintained and will indicate the type of instruments used to perform the analysis, the date, person performing the test and

the test results, and the date the next wipe test should be performed.

5. Surveys:

   a. Radiation survey results taken by the Radiological Safety Officer using a calibrated CDV-700 indicates the exposure rates in three areas (see floor plan, ITEM 9: PART I, FACILITY) within the maintenance and calibration facility to be less than .07 mr/hr.

   b. Periodic radiation surveys may be performed at the direction of a Radiological Safety Officer prior to operational activities within the building for any changes and update of the recorded surveys. In addition, two (2) CDV-457 audible and visual monitoring instruments provide constant information as to the radiation intensity within the building.

   c. A survey will be conducted every six (6) months and whenever there is a change in the facility area which could change exposure rates to which personnel would be exposed.

6. Preventive Maintenance:

   The user will comply with the step-by-step operator maintenance outlined in the applicable Operations and Maintenance Manuals. Adjustments and repairs not covered in the Operations and Maintenance Manuals as well as equipment malfunctions will be reported to and serviced by the Radiological Protection Officer, FEMA Region IX, of if necessary, by the manufacturer. Sealed sources will not be tampered with or removed from the calibrator or a training source set.

7. Other:

   a. Records of individual exposures for the past sixteen (16) years for both user and Radiological Safety Officers and other authorized personnel indicate compliance with 10 CFR 20, 20.101 and 20.105.

   b. The maintenance facility is equipped with two sets of CDV-788 eighteen-inch long handling tongs and personnel protective equipment items including coveralls, hoods, respirators and plastic footwear. Plastic receptacles in assorted sizes are available to collect and hold contaminated material. A latrine, located adjacent to the maintenance facility, is designated for use as the protective clothing exchange area.

c. The State Radiological Defense Officer will assure that a minimum of two (2) CDV-777-1 sets and protective equipment are readily available for emergency purposes when access to instruments, coveralls, boots and protective masks maintained in the maintenance and calibration facility is restricted due to fire or other uncontrolled circumstances.

d. State of Hawaii Manual of Procedures, Use and Control of Radiation Training Source Sets, dated July 1983, at Attachment 1, provides detailed guidance for the safe use, control, storage, transport and emergency measures required for CDV-784 Cobalt 60 sealed source sets. This Manual of Procedures establishes responsibilities and designates current members of the Radiation Safety Committee.

8. Leak Testing:

a. Leak testing procedures to be followed are found as outlined in their applicable operating and maintenance manuals and ITEM 9: PART II - VI. Leak testing of sealed sources listed in ITEM 5 will be accomplished at intervals not to exceed six months.

9. Preparation of Test Apparatus for Wipe Sample Analysis:

a. Decay Correction of ^{137}Cs Check Source:

(1) The radioactive decay equation is used for calculating the present activity of the ^{137}Cs check source to determine efficiency ($A = A_0 e^{\frac{-0.693t}{T_{1/2}}}$).

(2) The decay equation is used since the decay table uses t values in whole or half years.

(3) See Data Sheet 3.

b. Preparation of the CDV-700M (modified with an end-window GM tube):

(1) The CDV-700M is used to scan the wipes for gross contamination before they are taken into the counting area.

(2) Determine the efficiency of CDV-700M using the ^{137}Cs check source.

c. Preparation of the Ludlum 2200 Scaler/Ratemeter:

(1) Determine the work voltage (see Data Sheet 4). Plot cpm versus voltage on graph paper.

(2) Determine the counting system efficiency (see Data Sheet 5).

(3) Determine the statistical counting sensitivity at 99.9% confidence level (see Data Sheet 6).

d. Preparation of Leak Test Data:

(1) Fill in Data Sheet 7 using information from Data Sheets 3-6.

(2) Count wipe samples.

NOTE: All Data Sheets 3-7 have been compiled and formatted into the IBM PC computer. (See attached Laboratory Counting Statistics.)

LABORATORY COUNTING STATISTICS

REFERENCE SOURCE CALIBRATION

REFERENCE SOURCE: CS137 DATE: AUGUST 16, 1988
SERIAL NO : CD-55
ORIG. ACTV. DATE: OCTOBER 20, 1966 NAME: R. SAKUMA
REF. SOURCE CAL. DATE: AUGUST 16, 1988
MONTH NO. 8
CUR. YR: 1988
TIME DIFFERENCE IN YEARS: 21.83
ORIGINAL ACTIVITY (DPM): 32640.00

DPM AS OF REF. SOURCE CAL. DATE: 19711.23

****

COUNTER SYSTEM EFFICIENCY

INSTRUMENTATION: LUDLUM SCALER
SERIAL NO: 9737
OPERATING VOLTAGE: 905

100 MINUTE COUNT(CD-55)	100 MINUTE COUNT(BKGD)	CD-55 CPM	BACKGROUND CPM	NET COUNT CPM
496083	1623	4961	16.23	4945

EFFICIENCY (%) = 25.1

EFF. FACTOR = 4.0

SENSITIVITY = 9.9 (pico-CURIES)

****

LEAK TEST DATA

RAM ID NO: 1003 SOURCE: COBALT 60
CDV TYPE: 784 TIME DIFF. IN YRS: 20.83
SERIAL NO: 314 CUR. ACT. (MCI): 0.29
LOCATION: KAUAI

WIPE NO.	WIPE TESTED	TOTAL COUNT (5 MIN)	GROSS COUNT CPM	NET COUNT CPM	DPM	PICO-CURIES
1.	OUTER	75	15.00	0.00	0.00	0.00
2.	CAP 1 SN B00509	81	16.20	0.00	0.00	0.00
3.	CAP 2 SN B00507	87	17.40	1.17	4.66	2.10
4.	CAP 3 SN B00504	77	15.40	0.00	0.00	0.00
5.	CAP 4 SN B00506	80	16.00	0.00	0.00	0.00
6.	CAP 5 SN B00508	77	15.40	0.00	0.00	0.00
7.	CAP 6 SN B00505	74	14.80	0.00	0.00	0.00
8.	INNER	80	16.00	0.00	0.00	0.00

DATA SHEET 1

INSTRUMENT CALIBRATION DATA

CDV-790 Calibration Unit, Model 1

Cesium 137, 16 mCi
Encapsulation Date: March 1977
Date of Calibration: _____
Current Activity: _____

Issued To: _____
Address: _____
_____
Phone No: _____

(1) Attenuator Combinations	(2) Range Selector Switch Setting	(3) Meter Reading (mR/hr)	(4) TRUE mR/hr
None	X-100		
#1	X-100		
#2	X-100		
#2 + #1	X-100		
#3	X-100		
#3	X-10		
#3 + #1	X-10		
#3 + #2	X-10		
#3 + #2 + #1	X-10		

Instrument Type: _____ Date of Last Calibration: _____

Model Number: _____ Calibrated by: _____

Serial Number: _____ Date: _____

DATA SHEET 2

INSTRUMENT CALIBRATION DATA

CDV-794 Calibration Unit, Model 2

Cesium 137, 130 curies
Encapsulation Date: September 1982
Date of Calibration: _____
Current Activity: _____

Issued To: _____
Address: _____
_____
Phone No: _____

Range	R/hr Applied	Meter Reading (R/hr) Before Cal.	After Cal.
X-100			
X-10			
X-1			
X-0.1			

Instrument Type: _____ Date of Last Calibration: _____

Model Number: _____ Calibrated by: _____

Serial Number: _____ Date: _____

DATA SHEET 3

REGION: DATE:
STATE: NAME:

Decay of Cs-137 Check Source

Check source serial number: _____

Date of calibration: _____

Beta activity at calibration: _____ dpm

Date of calculation: _____

Difference in time between original calibration date and present date (Time t) _____

Decay equation ($A = A_0 e^{\frac{-0.693t}{T_{1/2}}}$): _____

Activity at calibration (dpm) x decay factor = present activity (dpm)

(_____ dpm) x (_____) = _____ dpm

DATA SHEET 4

REGION: DATE:
STATE: NAME:

Working Voltage

Check source serial number: CD-_____

Instrumentation: Name: _____

Serial Number: _____

High Voltage	Control Knob	Counts	Count/10 minutes - CPM
850			
860			
870			
880			
890			
900			
910			
920			
930			
940			
950			

Plot: High voltage (X-axis) vs. cpm (Y-axis) on linear graph paper and a copy.

From the graph, the WORKING VOLTAGE = _____.

DATA SHEET 5

REGION: DATE:
STATE: NAME:

COUNTER SYSTEM EFFICIENCY

Check Source: Serial Number: _____

Instrumentation: _____ Serial Number: _____

Operating Voltage: _____

100 minute count of Check Source = _____/100 = _____ cpm

100 minute count of background = _____/100 = _____ cpm

Gross Counts (_____ cpm) - Background (_____ cpm) = Net Counts _____ cpm

$$\text{Efficiency} = \frac{\text{Net counts}}{\text{Check source present activity}} = \frac{(\text{\_\_\_\_\_ cpm})}{(\text{\_\_\_\_\_ dpm})}$$

Efficiency = _____

$$\text{Eff Factor} = \frac{1}{\text{Efficiency}} = \frac{1}{(\text{\_\_\_\_\_})} = \text{\_\_\_\_\_}$$

DATA SHEET 6

REGION: DATE:
STATE: NAME:

STATISTICAL COUNTING SENSITIVITY

Check Source: Serial Number: _____

Instrumentation: _____ Serial Number: _____

Operating Voltage: _____

Background: _____ cpm

Sample Counting Time: 5 minutes

$$\text{Sensitivity} = 3 \times \left(\frac{\text{background cpm}}{100} + \frac{\text{background cpm}}{5} \right) \times \frac{(\text{eff factor})}{2.22}$$

$$= 3 \times \left(\frac{\quad\text{cpm}}{100} + \frac{\quad\text{cpm}}{5} \right) \times \frac{(\quad)}{2.22}$$

$$= 3 \times (\quad + \quad) \times (\quad)$$

$$= 3 \times (\quad) \times (\quad)$$

$$= 3 \times (\quad) \times (\quad)$$

Sensitivity = _____ picoCuries

DATA SHEET 7

RAM ID # _____

CDV-_____ MODEL NO._____ SERIAL NO._____

- -

SCALER TYPE _____

SERIAL NO. _____

OPERATING VOLTAGE: _____ BACKGROUND: _____ CPM

COUNTING TIME: 5 MINUTES EFFICIENCY: _____ (EFF. FACTOR) _____

SENSITIVITY: _____

TOTAL COUNT (5 MIN)	GROSS CPM	NET CPM	DPM	UCI

NAME _____

DATE _____

ITEM 11: WASTE MANAGEMENT

All sealed sources and devices that are no longer needed or obsolete will be returned to the Federal Emergency Management Agency (FEMA) Radiological Instrument Test Facility or to other facilities instructed by FEMA.