Control
4876

GOVERNMENT OF THE DISTRICT OF COLUMBIA
DEPARTMENT OF ENVIRONMENTAL SERVICES
ENVIRONMENTAL HEALTH ADMINISTRATION
WASHINGTON, D. C. 20002

December 20, 1977

Nuclear Regulatory Commission
Radioisotope Licensing Branch
Division of Fuel Cycle & Material Safety
Washington, D. C. 20555

Attention: Mr. Paul Psomas

Dear Mr. Psomas:

This refers to your letter of August 12, 1977, (Control No.88585) in which you requested a detailed description of procedures and operations regarding use of Cesium-137.

The following information is submitted to amend the license "to store" to that of "use for calibration".

Sincerely,

ENVIRONMENTAL HEALTH ADMINISTRATION
BAILUS WALKER, JR., Ph.D., M.P.H.
Environmental Health Scientist
Administrator

Ralph W. Sanderson

Ralph W. Sanderson, Health Physicist
Radiological Health Division
724-4358

Enclosures

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RADIATION PROTECTION PROGRAM

Source security measures during use of Cesium^{137} at facility:

Cesium^{137} source will be stored in radiation restricted area with caution signs labels, signals and controls pursuant to NRC regulations, Title 10, Part 20.203 provided the radiation level twelve inches from the surface of the source container or housing exceeds five millirem per hour pursuant to NRC regulation Title 10, Part 20.204.

Record control system for personnel monitoring (NRC Title 10, Part 20.202) and survey (Title 10, Parts 20.201 & 20.401) shall be maintained.

Instruction of personnel; posting of notices to employees pursuant to NRC regulations Title 10, Part 20.206 will continue.

Restricted area will be under constant control and surveillance pursuant to NRC regulations Title 10, Part 20.207.

Should theft or loss of licensed material occur, reports shall be initiated pursuant to NRC regulation Title 10, Part 20.402.

Should over-exposure or excessive levels and concentrations occur, notification as required by NRC regulations Title 10, Parts 20.403, 20.404 and 20.405 shall be initiated.

Exposure of individuals to radiation in restricted area shall be controlled as required by NRC regulation Title 10, Part 20.101.

Upon termination of employment, each individual's exposure record shall be reported pursuant to NRC regulation Title 10, Part 20.408.

Individual users of Cs^{137} source will be restricted to those designated on application form AEC-313 - 10 CFR 30, item 4.

Additionally users of Cs^{137} will sign for and assume responsibility for restricting exposure to trainees pursuant to NRC regulations Title 10, Parts 20.104 and 20.105.

OPERATION OF THE CESIUM 137 CALIBRATOR ATOM CHEM MODEL 1005

GENERAL

1. Electrical Controls

a. Power to the unit (120 vAc) originates locally at the "Breaker Panel" on the outside wall of the calibration room. Breaker number 8 (a 20 amp unit) is the power control switch.

b. Power coming from the Breaker panel goes thru the "Relay Panel" beside the Breaker panel. The relay panel has three switches for machines and a reset button for the relay. Each of the three switches controls a radiation device and due to them being interlocked only one of the machines can be activated at any time. Switch number 2 operates the calibrator. When switch #2 is in the "on" position, switch #1 must be in the bypass position and switch #3 must be in the off position; otherwise pressing of the relay reset button will not power the calibrator control panel.

c. Interlocked with the relay panel is the electronic eye located at the edge of the operator's booth. This unit consists of an electronic eye unit and a light beam unit. If these units are not on and operating the relay will not function. Power to the elctronic eye and the light beam is controlled by Breaker #4 in the Breaker panel. There is also a switch on top of the light beam unit which must be pushed to "on" for operation. The swtiches on the eye unit <u>are not</u> in the circuit and are therefore not operational.

d. Interlocked with the relay panel and in circuit with the electronic eye is the "control room door interlock switch". This door leads to the Radiological Health office, and lead lined for protection of the office area. The interlock cuts the power to the three radiation units when the door is open. The door can be locked or unlocked from inside the calibration room or from the office side. Only four keys are available and the same key opens the "outside door" located in the control booth.

e. The calibrator console receives its power from the relay panel. Power is controlled by the key switch to turn on the console. Only two keys exist. Power is indicated by two lamps on the console (one white lamp with words "shutter panel" and one green lamp with words "Shutter Safe"). Also a green lamp located on top of the solinoid housing of the calibrator is on when the console is activated. This lamp is visible through the window of the booth. When the shutter is opened, both of the above green lamps go off and a red lamp (at the side of each of the green lamps) goes on. The red lamp on the console has the words "Shutter open".

f. Before the shutter can be raised, the button at the top center of the console must be pushed. This button is a reset relay which must always be reset whenever the shutter has lost power for any reason. Also the toggle switch located above the key slot and below the reset button on the console must be activated.

g. Occasionally in the process of opening the shutter, the shutter's solinoid will draw too much power and one of two beakers will break the circuit. One breaker is located in the Breaker panel as indicated in paragraph 1.a above. The second is located in the upper left rear of the console. Should either of these fail, they must be reset. If they fail immediately after being reset one of the authorized users should be notified to assist in lubrication or realignment of the shutter assembly.

h. On the wall of the booth over the console table is an electric clock. This clock operates when the shutter is open. The operation of the clock will record the accumulated time in seconds, minutes and hours that the shutter has been open. All three hands should be zeroed at 12 o'clock at the start of each day's operation. The product of the total "on time" in hours or hour decimals and the number of curies (the number of curies are equivalent to the rods pulled up, e.g., #2=2 curies, #7+4=11 curies, etc.) results in the total curie hours to be recorded on the use log (See Appendix IV).

i. In addition to the red light on the console, and over the calibrator, a red lamp outside of and above the calibration room door, to the office, is on when the shutter is open. Operation of this lamp should be checked periodically.

APPENDIX I

CESIUM CALIBRATOR - OPERATING SEQUENCE

1. Acquire console key from authorized user.

2. Close calibration room door (it may be locked to avoid interruptions).

3. Turn on electronic eye light.

4. Assure Breaker panel switch #8 is "in" circuit.

5. Assure Relay panel switches are set as follows:

   a. #1 is on "bypass"
   b. #2 is on "on"
   c. #3 is on "off"

6. Push relay reset button. It should be heard jumping into position and holding.

7. Walk over to electric eye and pass your hand through the light beam slowly. The relay in the relay panel should be heard to throw itself out of circuit.

8. Turn on radiation monitor to "x 1" setting. Assure operation by use of check source.

9. Pull up the desired rods from the calibrator top. Rotate each until the notch on the shaft is aligned with the catch then push the catch until it locks the rod in place.

10. Return to booth and repeat action as in #6 above.

11. Put key in console and turn to the right, two console lights should light and the green light atop the calibrator should light.

12. Push reset button on console.

13. Align the "on line" clock hands at 12 o'clock. The "on line" is located on the wall over the console.

14. Throw the toggle switch on the console to "on". Assure that "shutter open" red light comes on. Radiation monitor should indicate a rise in radiation level and a glance through the window should reveal that the red lamp on the top of solinoid housing is on.

15. Proceed with irradiation.

APPENDIX II

CESIUM CALIBRATOR - NORMAL SHUT DOWN SEQUENCE

1. Throw toggle switch on the console to "off". Console "shutter open" (red) light should go off and the "shutter closed" (green) light should come on. The lights on the top of the calibrator's solinoid should switch from red to green.

2. The radiation monitor should indicate a reduction in radiation level.

3. Turn the console key to the left. All console lights should go off. Remove the key.

4. Walk around the booth's end and turn the rods to release the catches and allow the rods to fall into the calibrator or push them gently into their recesses.

5. Turn off the electronic eye light unit.

6. Open the calibration room door.

7. Replace the console key in the key box.

8. On the "Cesium Calibrator Use Log" indicate the necessary information from the "on line" clock and the number of rods being used along with other required information.

APPENDIX III

EMERGENCY OPERATING INSTRUCTIONS
CESIUM CALIBRATOR

1. Turning the Calibrator off: (Below: For each component named below turn to "Off" to cut power to unit's shutter. The fail-safe shutter should then close).

   a. Control Console

      1. The off-on switch on console face, or
      2. The off-on key on console face

   b. Relay Panel (outside wall of operator's booth)

      1. Switch for unit #2 - on-off-bypass (off and bypass will cut power)

   c. Breaker Panel (outside of operator's booth)

      1. The off-on switch #8 for unit #2, or
      2. The off-on switch #4 for Electric Eye

   d. Electric Eye (operator booth-end of panel)

      1. Break light beam slowly, or
      2. Turn off switch on light source unit (Note: Switches on receiver unit are not in circuit)

2. If the shutter fails to close:

   a. Reactivate shutter again, and then cut the power as indiacted in Section I above.

   b. If shutter still fails to close:

      1. Manually push into safe position all five rods while standing at rear of calibrator.

      2. Using a screw driver and standing to the rear of the calibrator place screw driver between the solinoid bracket and the solinoid piston (either side) and twist the screw driver gently so that the piston moves and drops the shutter closed: or

      3. If above procedure fails to close the shutter, take a pair of vise grip pliers, and from the rear of the Calibrator, clamp on to the solinoid piston (shutter connecting shaft near the piston end). With both hands, apply down pressure to the pliers until shutter closes.

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4. If this fails, lock the door(s) and contact a health physicist from Radiological Health Division.

APPENDIX IV
CESIUM CALIBRATOR - USE LOG

(MAXIMUM USE PER WEEK = 960 CURIE-HOURS)

DATE	CURIES (ROD #S)	HOURS OF TIME ON	TOTAL CURIE HRS.	PURPOSE	INITIAL

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B. Relay Panel (outside wall of operator's booth)

1. Switch for unit #2 - on-off-bypass (off and bypass will cut power)

C. Breaker Panel (outside wall of operator's booth)

1. The off-on switch #8 for unit #2, or
2. The off-on switch #4 for Electric Eye

D. Electric Eye (operator booth-end of panel)

1. Break light beam slowly, or
2. Turn off switch on light source unit (Note: Switches on receiver unit are not in circuit).

II. If the shutter fails to close:

A. Reactivate shutter again, and then cut the power as indicated in Section I above.

B. If shutter still fails to close:

1. Manually push into safe position all five rods while standing at rear of calibrator.

2. Using a screw driver and standing to the rear of the calibrator, place screw driver between the solinoid bracket and the solinoid piston (either side) and twist the screw driver gently so that the piston moves and drops the shutter closed: or

3. If above procedure fails to close the shutter, take a pair of vise grip pliers, and from the rear of the Calibrator, clamp on to the solinoid piston (shutter connecting shaft near the piston end). With both hands, apply down pressure to the pliers until shutter closes.

4. If this fails, lock the door(s) and contact a health physicist from Radiological Health Division.

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SAFETY PRACTICES AND PROCEDURES
(Calibration Unit - Cesium 137)

Division of Radiological Health
D.C. General Hospital
PCRC Building - Room S-4
19th St. & Mass. Ave., S.E.
Washington, D.C.

I. General Information

A. Shielding barriers are as shown on the attached drawings.

B. There are no known penetrations or voids in the walls or ceilings of the calibration room other than the two doors as shown, ventilating ducts, and electrical conduits.

C. The readings of instruments during calibration or research studies are made through leaded glass with telescopic viewer from behind the protective control booth. Leaded glass has a minimum of 1.5mm lead equivalents. A photocell switch automatically terminates radiation beam from either calibrator or x-ray unit should aryone walk out of the protective booth into the unshielded area of the calibration room.

D. The room is located on the basement level with no excavated space below the room. It is bounded on three sides by uncontrolled area with 100% occupancy assumed. The fourth side (north wall) is below ground level and is the only side which will be struck by the primary beam of the calibrator. The primary beam will be restricted by mechanical stops. The east wall will be struck by the primary beam of a 150 kVp x-ray unit, however, the x-ray unit and the Cesium calibrator will be wired so that only one of the units can be <u>on</u> at any given time.

E. The height from floor to ceiling is 13 feet. The ceiling consists of 6" concrete. Occupied unrestricted area is on the floor above.

F. The radioisotope sources shall be tested for leakage at intervals not to exceed six months. Records of test results shall be kept in units of microcuries and maintained for inspection by the Commission. The test shall be sufficiently sensitive to detect

0.005 microcuries of contamination on the test sample. The test sample shall be taken by wiping the source rod actuators at the top of the Unit, with the source in the "off" position. If the test reveals the presence of 0.005 microcuries or more of removable contamination, prompt action will be taken to prevent spread of contamination by the named users, and a report will be filed within five days of the test to the Radioisotope Licensing Branch, Division of Fuel Cycle and Material Safety, Nuclear Regulatory Commission, Washington, D.C. 20555, describing the results and action taken.

G. Written instruction shall be posted at the control panel of the unit. This instruction shall inform the operator of the procedure to be followed should he be unable to turn the machine's primary beam of radiation "off", using the controls at the control panel. These instructions shall caution individuals to avoid exposure to the primary beam of radiation when in the calibration area and shall include specific instructions for:

1. Locating and manually turning off the unit.

2. Securing the room against unauthorized entry.

3. Notifying the responsible radiation protection officer.

H. The Calibration Facility will be kept locked at all times except when in use by the named users. A sign will be posted at each doorway with the following instructions:

> CAUTION - RADIATION AREA
> When entrance is required, contact office of the Radiological Health Division, 724-4358.

I. The Calibrator, Model 1005, will also be kept locked when not in use. Only the authorized users will have access to a key to the unit.

J. The maximum work load of the calibrator will be 20 hours "on" time per week.

K. Radiation levels in all accessible areas outside the calibration room will be sufficiently attenuated such that no individual in these areas could receive a dose in excess of 5 millirems in any one hour, or 100 millirems in any 7 consecutive days, not to exceed 0.5 rems within a period of 1 year.

M. An operational and leak check will be made by named users. Prior to initiating routine operation with the unit, a comprehensive radiation protection survey will be made of the entire installation. This will include the following.:

1. The source housing, with the source in the "off" position. The maximum and average radiation levels at one meter from the source in the "off" position shall not exceed 10 Milliroentgens per hour and 2 milliroentgens per hour, respectively.

2. All areas adjacent to the calibration area, with the source in the "on" position. The survey, except Item (c) below, shall be performed with a phantom in the primary beam of radiation and shall clearly establish:

(a) That radiation levels in restricted areas are not likely to cause personnel exposures in excess of the limits specified in Section 20.101 of Title 10, Code of Federal Regulations.

(b) That quantities of radiation in unrestricted areas do not exceed the limits specified in Section 20.105 (a & b) of 10 CFR 20.

(c) The intensity of the primary beam of radiation at a specified distance from the source.

3. Tests shall be made to determine proper operation of:

(a) Electrical interlocks on the entrance doors of the south wall, and the photocell interlock at the passageway into the radiation area from the control booth.

(b) The source "on-off" indicators, both at the source housing and on the calibration unit control panel.

(c) Mechanical stops installed for the purpose of limiting use of the primary beam of radiation.

4. A report of the results of the above surveys and tests will be sent in duplicate to the Radioisotopes Licensing Branch, Division of Fuel Cycle and Material Safety, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555 within thirty days.

5. Personnel monitoring equipment will be worn by the individual when he enters the "Radiation Area".

The monitoring device (film badge) will be checked monthly and a permanent record will be maintained of the individual's radiation history.

6. Records of surveys, tests, operation and maintenance of the source shall be maintained and will include but not be limited to data generated under 1.F,J,K,M, & 2.a,b & 3.a,b,c.

SURVEY DATA

Source: Cesium 137 approximately 19 curies (calibrated 10/2/77) Calibrator Atom Chemical Model 1005 at Room S-4, PCRC Building, Division of Radiological Health

Date: November 10, 1977

Detectors: G.M. tube: Victoreen Model #6A checked 11/10/77.
G.M. Victoreen Model #1A checked 11/10/77

Conditions: Shutter open and all sources exposed.

All ground floor readings taken at floor contact

Monitoring Results: (Cesium beam is toward the East Wall)
(See Attached Plan)

I. Basement Area:

A. Operator's Booth

	Milliroentgens/hour
1. North-East Corner	∠ 1.0
2. South-East Corner	∠ 1.0
3. Center South Window	∠ 1.0
4. End of Booth Panel	∠ 1.0

B. Radiological Health Office
Calibration room's West Wall

1. Behind door	∠ 0.1
2. South Door-Wall	∠ 0.1
3. North of Door-Wall	∠ 0.1

C. Calibration Room's South Wall
(unoccupied)

1. West Corner - North Wall	∠ 0.1
2. 1st third of wall from West corner	0.2
3. 2nd third of wall	0.6
4. East corner	1.0

D. Outside (Calibration Room's East Wall)

1. Closest to Beam Center	0.4
2. Halfway between Building corner and point	0.3

Survey Data-contd

E. Basement Level Patio:
Calibration Room's North Wall

	Milliroentgens/hour
1. East corner	∠ 0.1
2. Old window area	∠ 0.1
3. Edge near door	∠ 0.1
4. Door to calibration room	0.9

F. Outside: Ground Level

13' to ground level	∠ 0.1

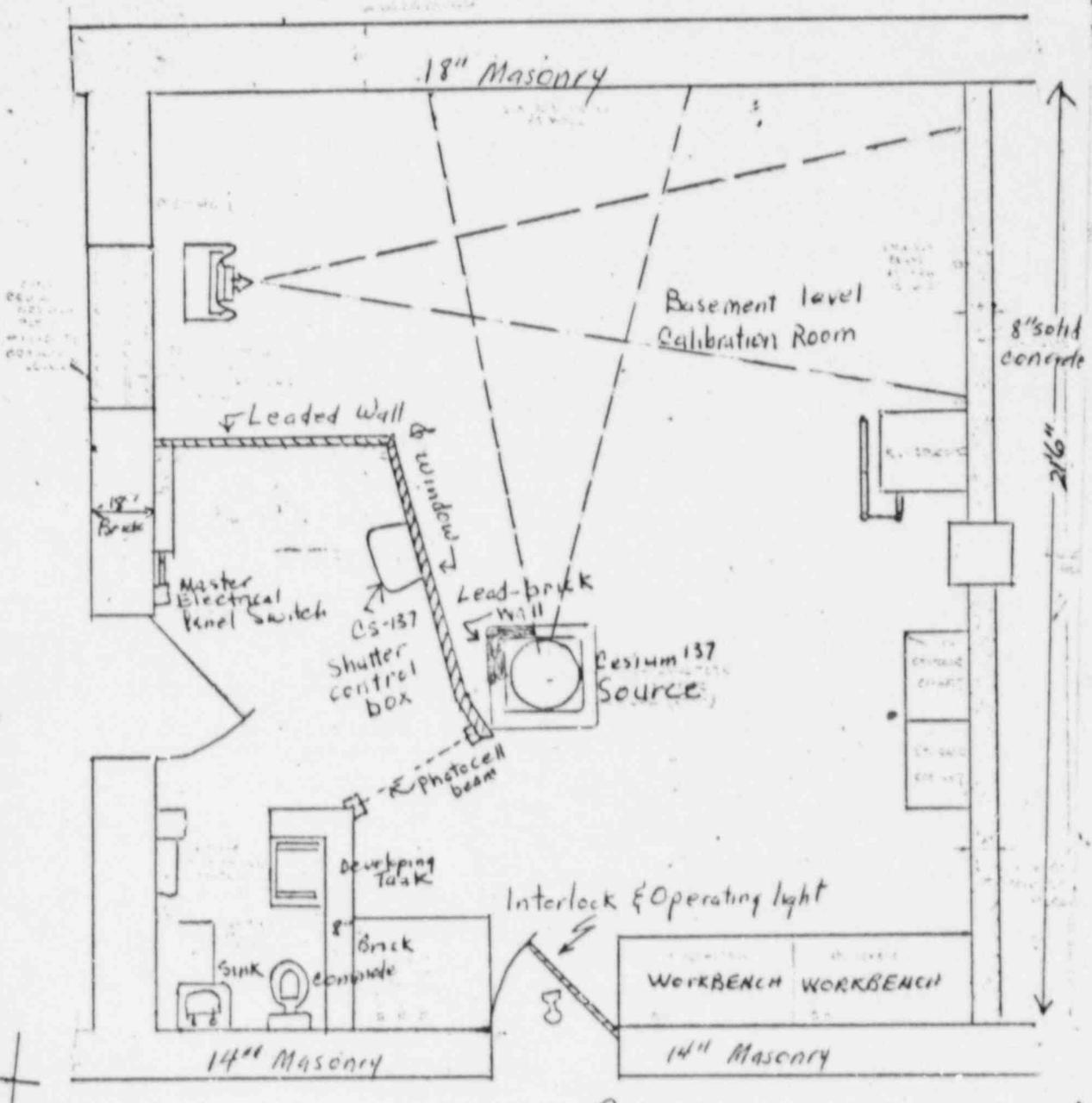
G. Main Floor: Above and around calibration room at floor surfaces

East Wall

1. North corner	∠ 1.0
2. Middle left	∠ 1.0
3. Middle right	∠ 1.0
4. South corner	
5. Middle or room, 5 feet from East wall	∠ 1.0
6. Middle of room, 10 feet from East wall	∠ 1.0
7. Middle of room, 2 feet from West wall	∠ 1.0

H. Entrance Foyer: Above East Wall of Calibration Room

1. West wall - north corner	∠ 0.1
2. West wall - center by doors	∠ 0.1
3. North wall - center	∠ 0.1
4. East (by doors) wall	∠ 0.1



ADJACENT ROOM
FORMERLY DIVISION RADIOLOGICAL
HEALTH

CALIBRATION PROCEDURE A_1

PURPOSE: For determination of the self reading dosimeter of the pocket chamber to reproduce gamma radiation dose results to within a given tolerance. (As of March 1969 the Radiological Health Division has established, for economical reasons that the tolerance for these devices will be plus or minus 25%)

PROCEDURE: Check-Calibration of Dosimeter(s) and Pocket Chamber(s)

1. Using the appropriate charger-reader, zero all chambers to be checked. The best procedure is to use the 10 mR line as the zero point; thus the "charged circuit break" which occurs when with-drawing the chamber from the charger will be indicated as a number rather than "less than zero". (Note: the pocket chambers can only be charged or read with the Landsverk L-60 unit. The dosimeters can be charged with either the CDV 750 charger or the Victoreen model charger)

2. Select the following requirements for use with the Cesium 137 Calibrator:

   a. Source to chamber distance (For 100 mR dose use 100 cm.)

   b. Source rod(s) sequence versus desired exposure rate. (All rods exposed, for one minute, at the 100 cm distance will give 101.6 mR dose.)

3. Set up recording log sheet. List serial numbers of chambers and other pertinent data.

4. Place the chambers, clip toward the source, on the chamber-dosimeter calibration holder. This is two wires stretched between two metal bars which are in turn on the mobile stand. Place the stand beam line in the appropriate distance from the source and on line with the beam height center line (54 inches)

5. Charge, using the Victoreen model 570, then place a model 130 R-chamber in line with the chambers to be irradiated for a reference point-dose register. (Serial #1317 or #1341 are usually used).

6. Follow the calibrator operating instructions and irradiate the chambers as selected in paragraph 2 above.

CALIBRATION PROCEDURE-contd

7. Use the same charger-reader as used for zeroing; read and record results of each chamber beside the appropriate serial number. Repeat paragraph 4 through 7 at least three times.

8. Average the results. Correlate the results with the selected dose. If the chamber is within plus or minus 25% accuracy continue to paragraph 9, below. If the chamber is greater than plus of minus 25% then use a rubber band and a tag so indicating and place these chambers in the box marked "DEFECTIVE".

9. For those chambers which fall within the plus or minus 25%, rezero each; record the time and date; charge to about 10 mR, record initial reading and place in an area free from radiation for 6 to 7 days. Then reread and record the results. This "leak test" should fall within plus or minus 5% of the total chamber capability (200 mR). If satisfactory place the chamber in the box labeled "Calibrated $\angle$25%". Those that fall outside the $\angle$5% place in the box marked "DEFECTIVE".

CALIBRATION PROCEDURE B

PURPOSE: . To calibrate R-Meter chambers against NBS chambers Model 621, serial #1317 R-Meter chamber and Cs^{137}.

PROCEDURE: For R-Meter chambers calibration

1. Select chamber set serial numbered 1317.

2. Using the Cesium 137 calibrator place at 100 centimeters (source to chamber distance).

3. Fix the tripod feet with string and masking tape assuring that the exact center of the tripod is at the 100 cm line and on the beam center line. Also assure that the tripod shelf is capable of being cranked up to 70 inches and down to 40 inches from the floor.

4. Screw on to the tripod shelf an aluminum chamber holder and align this with the beam center line.

5. The set of chambers consists of the following models:

MODEL	MAX. RANGE	ENERGY	MODEL	MAX. RANGE	ENERGY
188	0.25R	med.	70-5	25R	med.
130	.25R	med.	552	2.5R	hi
633	2.5R	med.	621	100R	hi

6. Use a thermometer and take a room temperature reading. Call 936-1212 for barometer reading. Take thermometer reading every two hours during the calibration procedure.

7. Using a Model 570 charger reader, zero a chamber and place in the chamber holder. Adjust the tripod crank mechanism so that the active area of the chamber is 54 inches off the floor.

8. Calculate the calibrator "on time" using all source rods exposed (about 6.1 R/hour) so that the resultant reading is greater than 10% of full scale and less than 90% full scale.

CALIBRATION PROCEDURE B-contd

9. Activate the calibrator using all rods exposed, for the calculated time. Shut off calibrator, lower the rods, remove the chamber and read it. Record the results of the reading and the "on time". Repeat paragraph 9 at least twice and perferably three times for each chamber (Chamber #188 would require at least six readings due to a short "time on". While chamber #621 would only need two readings due to length of "time on").

10. Average the readings for each chamber and calculate the standard deviation. Using the data from paragraph 6, calculate the correction for the average reading so that each will be a standardized result.

11. Using the model #621 and the NBS standardized correction factor for this chamber of 0.91 for Cesium 137, determine a correction factor for the other chambers. Record these correction factors as "Cs^{137}-Cf---".

CALIBRATION PROCEUDRES C

PURPOSE: To calibrate nuclear detector rate-meters

PROCEDURE FOR:
1. Geiger-Mueller Tube Rate-Meters
2. Ion Chamber
   a. Rate-meter
   b. Integrating meters

A. Determine Cesium 137 calibrator range at 50 cm through 400 cm (source to chamber distance).

B. Use of Instrument Calibration Form

1. In line G. select two points (mR/hr) for each range to yield a curve

2. Lines H & I: Indicate the source to be used on line H. On line I list applicable items such as settings which are required for the instruments' calibration pot(s): setting requirements for special switches.

3. Lines J & K used only for R chambers.

4. Line ∠ :

Column 1: Used for indicating the source (Cs^{137} - also list rods) required to reach the desired exposure rate.

Column 2: Indicate the calculated exposure rate from the source at the given distance (Note: It may be necessary to perform an R-chamber verification at this point if such is not available in the files).

Column 4: To be used when calibrating an R-chamber or similar devices having correction factors.

C. Use of Cesium 137 Calibrator

1. Select the exposure rate desired. On the back of the calibration room door is the calculated and verified point on the curve for each calibrator rod and rod combinations. Identify the rod (or combination of rods) which will give the exposure rate desired. A verification should be made before calibration, using a condenser chamber "See Cesium Calibrator Operating Procedures". If the point has been verified note the distance needed and the rod(s) to be used as listed on the chart.

2. The fixed tripod is to be used with the Cesium calibrator. This tripod has a slip-on wooden platform which goes over the metal platform plate of the tripod. Place the tripod at the distance required (see C1 above). Put the unit to be calibrated on the platform and adjust the detector portion so that the calibrator beam will be in line with the center of the chamber. It may be desired to use a utility three-prong clamp to fix the detector.

   a. Ion chamber meter: The chamber should be placed so that the primary beam enters the end furthest from the electronic housing. This is usually the end of the cylinder. A line should be marked on the side of the cylinder corresponding to one half the length of the active volume of the chamber to be used for the source to detector distance.

   b. G.M. Tube Meter: The end window tube should be placed in the beam and parallel to the path of the beam so that the beam enters the window. The center of active volume of the tube would be the point which bisects the tube. This center plane should be marked on the exterior of the tube's side. The center plane (or line) for a side window tube would be with the tube perpendicular to the axis of the beam. This center plane should be marked on the exterior of the tube.

   c. Orient the center plane of the detector either at the edge or at the center of the platform. Use one of the plum bobs and align the tripod so that the proper plum bob is directly over the distance marker on the floor tape which gives source-distance to detector. Using the elevating crank of the tripod raise or lower the now horizontal center of the detector so that it is 54 inches from the floor.

   d. Stand in the calibration booth and look out the window closest to the meter. If the face of the meter cannot readily be seen, orient it so that it can be seen from inside the booth;

the adjustable mirror can be used to assist in the visual alignment. Once proper adjustment of the meter and the mirror has taken place, try the telescope from inside the booth to assure that all the meter's field can be seen and read.

e. Follow the operating sequence for the Cesium calibrator (see Appendix I of Cesium Calibration Operation) and proceed with calibration.

D. Detector Operational Graph

1. Using the actual exposure rate data and the observed exposure rate data from the Instrument Calibration sheet, plot a graph as shown in Attachment 2.

2. This graph when completed, is to be taped to the detector, preferably on the left side.

3. The instrument calibration sheet, when completed should be placed in the appropriate folder of file #253.

4. Make a record of the calibrations on the monthly maintenance log - file #250.

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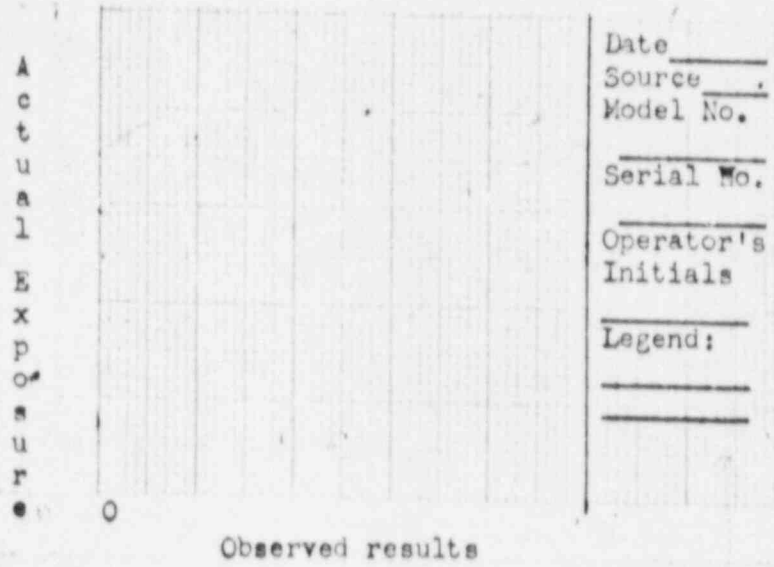
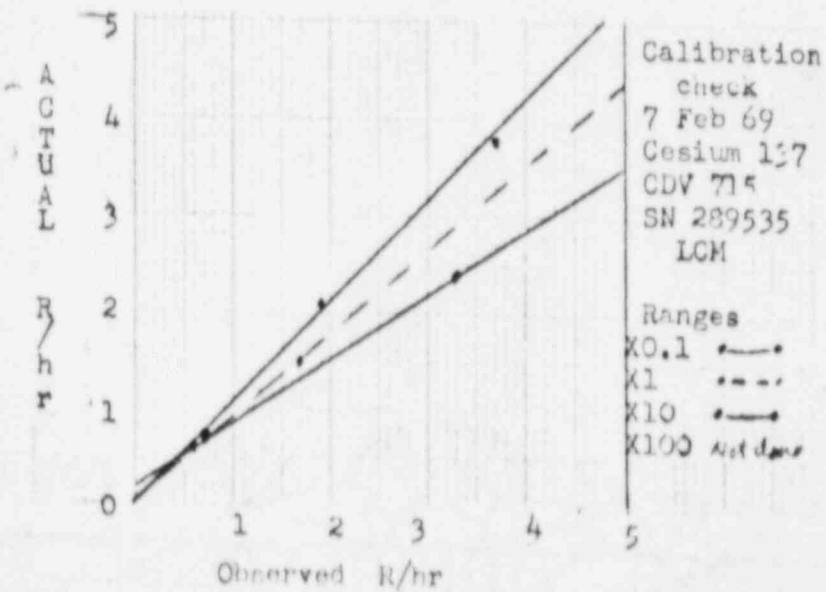
PLACARD GRAPH TO BE PLACED ON CALIBRATED INSTRUMENT WHEN SUCH IS COMPLETED.



EXAMPLE



ATTACHMENT #2

Ralph W. Sanderson
2205 Arcola Avenue
Wheaton, Maryland 20902

Cirriculum Vitae

B.A. - English - Ohio State University

Other Courses - Undergraduate

Biological Science	24 hours	Lincoln University Jefferson City, Mo. 1946-1949
Electronics	30 hours	8 hours per day for 13 weeks - Kessoler AFB Mississippi Summer 1950
Nuclear Physics	4 hours	Sandia Base, New Mexico September-December 1950
Radiation Physics	3 hours	NIH - March-June 1961
Radiological Health	2 weeks	Taff Center - Cincinnati, Ohio - January 1961
Medical Aspects	2 weeks	Taff Center - Cincinnati, Ohio - February 1961
Medical X-ray Protection	2 weeks	Bureau of Radiological Health - Rockville, Md. 1963

Graduate

Botany - 8 hours - Howard University - Washington, D. C. Spring 1970

Chemistry - 6 hours - Autumn-Winter - American University
Washington, D. C. 1971-1972

Geology - 6 hours - Autumn-Winter - American University
Washington, D.C. 1971-1972

Health Physics - 24 hours - 10 weeks - February - April 1974
Oak Ridge Associated Univ.
Oak Ridge, Tennessee

Education	51 hours	Ohio State University 1956 - 1957

The following individual will supervise maintenance or repair operations and certify that the calibrator is acceptable for routine use.

Name: Satish Bhatia

Qualification: M.S. - Electrical Engineering
B.S. - Chemistry and Physics

Professional Engineer's Registration

Relevant Experience: Design of electronic instrumentation for laboratory equipment, medical electronic and industrial application.

Design of instrumentations and control systems for Radiological Health Physics including airborne radioactivity solid liquid and gaseous radioactivity waste monitoring and processing.

Writing reports for NRC to conform to regulatory requirements.

RADIOLOGICAL HEALTH DIVISION

INSTRUMENT CALIBRATION

A. DATE: _____ OPERATOR: _____

B. TYPE OF INSTRUMENT: _____

C. MFG & MODEL NUMBER: _____ SERIAL NUMBER: _____

D. LAST BATTERY CHANGE: _____

E. TOTAL RANGE: _____ NUMBER OF RANGES: _____

F. NUMBER OF CALIBRATION POTS: _____

G. SELECTED CALIBRATION POINTS ON THE METER'S RANGES:

1. _____ 5. _____

2. _____ 6. _____

3. _____ 7. _____

4. _____ 8. _____

H. CALIBRATION SOURCE: _____

I. CONDITIONS AFFECTING CALIBRATION: _____

_____

J. BAROMETER & TEMPERATURE: _____ Cf_{BT}: _____

K. ENERGY CORRECTION FACTOR($Cf_{Cs\ 137}$, Co 60, Ra 226 or XR): _____

L. CALIBRATION RESULTS:

(1) SOURCE(S)	(2) Exposure rate	(3) Observed Exp. rate	(4) Corrected to	(5) Other perimeters	(6)	(7)

ATTACHMENT #1

April 1969

SURVEY INSTRUMENT LISTING

Radiological Health Program

Washington, D.C. 20004

Item No.	Item & Manufacturer	Quantity	Model #
1	Meter Radiation Survey Victoreen	1	6A
2	Meter Radiation Survey Victoreen	3	1A