MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 36, 39, 40, and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

301903

Licensee	
1. Keithley Instruments, Inc. Radiation Measurements Division 2. 28775 Aurora Road Cleveland, OH 44139	3. License Number 34-26760-01 4. Expiration Date January 30, 2002 5. Docket or Reference No. 030-34256

6. Byproduct, Source, and/or Special Nuclear Material	7. Chemical and/or Physical Form	8. Maximum Amount that Licensee May Possess at Any One Time Under This License
A. Cesium-137	A. Sealed source (J. L. Shepherd Model No. 6810)	A. 2 sources not to exceed 4 curies each
B. Cobalt-60	B. Sealed source (J. L. Shepherd Model No. 7810)	B. 2 sources not to exceed 1.2 curies each
C. Strontium 90/Yttrium-90	C. Sealed source (Amersham Model No. S1F.D1 (S1F-1177))	C. 200 millicuries

9. Authorized Use:

A. and B. One cesium-137 source and one cobalt-60 source to be used in a J. L. Shepherd Model 81-12D gamma irradiator/calibrator for irradiation of thermoluminescent personnel dosimeters to verify response and for research and development of the dosimeters.

One cesium-137 source and one cobalt-60 source to be stored in shipping containers for source replacement purposes.

C. To be used in a J. L. Shepherd Model 492 beta irradiator/calibrator for irradiation of thermoluminescent personnel dosimeters to verify response and for research and development of dosimeters.

9/

050054

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License Number
34-26760-01

Docket or Reference Number
030-34256

CONDITIONS

10. Licensed material shall be used only at the licensee's facilities located at Keithley Instruments, Inc., Radiation Measurements Division, 6045 Cochran Road, Cleveland, Ohio.

11. Radiation Safety Officer: Robert J. Kobistek

12. Licensed material shall only be used by, or under the supervision and in the physical presence of, individuals who have received the training described in application received dated September 30, 1996, letter dated November 27, 1996 and have been approved in writing by the Radiation Safety Officer.

13. A. Sealed sources and detector cells shall be tested for leakage and/or contamination at intervals not to exceed 6 months or at such other intervals as specified by the certificate of registration referred to in 10 CFR 32.210.

    B. In the absence of a certificate from a transferor indicating that a leak test has been made within 6 months prior to the transfer, a sealed source or detector cell received from another person shall not be put into use until tested.

    C. Sealed sources need not be leak tested if:

    (i) they contain only hydrogen-3; or

    (ii) they contain only a radioactive gas; or

    (iii) the half-life of the isotope is 30 days or less; or

    (iv) they contain not more than 100 microcuries of beta and/or gamma emitting material or not more than 10 microcuries of alpha emitting material; or

    (v) they are not designed to emit alpha particles, are in storage, and are not being used. However, when they are removed from storage for use or transferred to another person, and have not been tested within the required leak test interval, they shall be tested before use or transfer. No sealed source or detector cell shall be stored for a period of more than 10 years without being tested for leakage and/or contamination.

D. The leak test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. If the test reveals the presence of 0.005 microcurie or more of removable contamination, a report shall be filed with the U.S. Nuclear Regulatory Commission in accordance with 10 CFR 30.50(b)(2), and the source shall be removed immediately from service and decontaminated, repaired, or disposed of in accordance with Commission regulations. The report shall be filed within 5 days of the date the leak test result is known with the U.S. Nuclear Regulatory Commission, Region III, ATTN: Chief, Nuclear Materials Safety Branch, 801 Warrenville Road, Lisle, Illinois 60532-4351. The report shall specify the source involved, the test results, and corrective action taken.

E. Tests for leakage and/or contamination shall be performed by the licensee or by other persons specifically licensed by the Commission or an Agreement State to Perform such services.

14. The licensee shall not perform repairs or alterations of the irradiator involving removal of shielding or access to the licensed material. Removal, replacement, and disposal of sealed sources in the irradiator shall be performed by a person specifically licensed by the Commission or an Agreement State to perform such services.

15. The procedures contained in the manufacturers' instruction manuals for the Model 81-12 and Model 492 devices shall be followed and a copy of these manuals shall be made available to each person using or having responsibility for the use of these devices.

16. The licensee may not possess and use materials authorized in Items 6, 7, and 8 until:

    1. The licensee has constructed the facilities and obtained the equipment described in the application and supporting documentation; and

    2. The U. S. Nuclear Regulatory Commission, Region III, ATTN: Chief, Materials Licensing Branch, 801 Warrenville Road, Lisle, IL 60532-4351 has been notified that activities authorized by the license will be initiated.

17. Within 30 days of the date of a decision not to complete the facility, acquire equipment, or possess and use authorized material, the licensee must notify the Commission in writing, of the decision.

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License Number
34-26760-01

Docket or Reference Number
030-34256

18. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The U.S. Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.

A. Application received September 30, 1996; and

B. Letters dated November 27, 1996 and January 2, 1997.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Date Jan 13, 1997

By Evelyn R Matson
Nuclear Materials Licensing Branch, Region III

R&D $150

R9

14

BETWEEN:

License Fee Management Branch, ARM
and
Regional Licensing Sections

(FOR LFMS USE)
INFORMATION FROM LTS

Program Code:
Status Code: 3
Fee Category:
Exp. Date: 0
Fee Comments:
Decom Fin Assur Reqd:

LICENSE FEE TRANSMITTAL

A. REGION

1. APPLICATION ATTACHED
   Applicant/Licensee: KEITHLEY INSTRUMENTS INCORPORATED
   Received Date: 960930
   Docket No: 3034256
   Control No.: 301903
   License No.:
   Action Type: New Licensee

2. FEE ATTACHED
   Amount: 1200
   Check No.: 173569

3. COMMENTS

Signed D. Hersey
Date 10-3-96

96 OCT -7 PM 1:46

B. LICENSE FEE MANAGEMENT BRANCH (Check when milestone 03 is entered)

1. Fee Category and Amount: 3E $1200

2. Correct Fee Paid. Application may be processed for:
   Amendment
   Renewal
   License ✓

3. OTHER

Signed SC
Date 10/9/96

OCT 15 1996

Log Oct 4 III
Remitter
Check No. 173569
Amount $1200
Fee Category 3E
Type of Fee APP
Date Check Rec'd 10/7/96
Date Completed 10/9/96
By SC

NRC FORM 313
(1-84)
10 CFR 30, 32, 33, 34, 35 and 40

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED BY OMB
3150-0120
Expires: 8-31-87

APPLICATION FOR MATERIAL LICENSE

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.

FEDERAL AGENCIES FILE APPLICATIONS WITH:

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

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

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

U.S. NUCLEAR REGULATORY COMMISSION, REGION I
NUCLEAR MATERIAL SECTION B
631 PARK AVENUE
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
MATERIAL RADIATION PROTECTION 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, E. NO APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION V
MATERIAL RADIATION PROTECTION 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)*

- [XX] A. NEW LICENSE
- [ ] B. AMENDMENT TO LICENSE NUMBER _____
- [ ] C. RENEWAL OF LICENSE NUMBER _____

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

Keithley Instruments, Inc.
Radiation Measurements Division
28775 Aurora Road
Cleveland, Ohio 44139

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

Keithley Instruments, Inc.
Radiation Measurements Division
6045 Cochrad Road
Cleveland, Ohio 44139

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION | **TELEPHONE NUMBER**

Mr. Thomas K. Stefanakos, MSNE | 216-447-1045

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. LICENSEE FEES *(See 10 CFR 170 and Section 170.31)* FEE CATEGORY 170.31(3)(E) | AMOUNT ENCLOSED $ 1,200.00

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
Terrence E Sheridan	Mr. Terrence E. Sheridan	Vice-President & General Manager - Radiation Measurements Div.	

14. VOLUNTARY ECONOMIC DATA

a. ANNUAL RECEIPTS

- [ ] <$250K
- [ ] $250K–500K
- [ ] $500K–750K
- [ ] $750K–1M
- [ ] $1M–3.5M
- [ ] $3.5M–7M
- [ ] $7M–10M
- [ ] >$10M

b. NUMBER OF EMPLOYEES *(Total for entire facility excluding outside contractors)*

c. NUMBER OF BEDS

d. WOULD YOU BE WILLING TO FURNISH COST INFORMATION *(dollar and/or staff hours)* ON THE ECONOMIC IMPACT OF CURRENT NRC REGULATIONS OR ANY FUTURE PROPOSED NRC REGULATIONS THAT MAY AFFECT YOU? *(NRC regulations permit it to protect confidential commercial or financial–proprietary–information furnished to the agency in confidence)*

- [ ] YES
- [ ] NO

FOR NRC USE ONLY

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

RECEIVED
SEP 30 1996
REGION III

PM 9-27-96

PRIVACY ACT STATEMENT ON THE REVERSE

3F - less than 10,000 curies - underwater exposed
3G - 10,000 curies or more

30903

KEITHLEY RADIATION MEASUREMENTS

Radiation Measurements Division
Keithley Instruments, Inc.
28775 Aurora Road
Cleveland, Ohio 44139
(216) 248-0400 • Fax: (216) 349-2307

Sept 20, 1996

U.S. Nuclear Regulatory Commission, Region III
Materials Licensing Section
799Roosevelt Road
Glen Ellyn, Il 60137

Dear Sir,

It is requested that Keithley Instruments, Inc. be licensed under Fee Category 170.31(3)(E) for the irradiation of TLD's manufactured by this company, using a J.L. Shepherd Model 81-12 Dual Source Beam Irradiator and a J.L. Shepherd 492 Beta Calibrator/Irradiator.

Enclosed please find the license application, supporting documentation, and license application fee of $1,200.00. Any questions regarding this request should be addressed to Mr. Thomas K. Stefanakos MSNE at the above address or by phone at 216-447-1045.

Your prompt attention to this application is appreciated. Thank you.

Sincerely,

Terrence E Sheridan

Mr. Terrence E. Sheridan
Vice-President and General Manager
Keithley Instruments, Inc.
Radiation Measurements Division
28775 Aurora Road
Cleveland, Ohio 44139

SEP 30 1996

Keithley Instruments, Inc.
Radiation Measurements Division
By Product Material
Lic. App.

ITEM 5 - MATERIAL TO BE POSSESSED

A Radioactive Material	B Chemical and/or Physical Form	C Maximum Quantity License May possess at any one time.
Cobalt-60 Cesium-137	Sealed Source (J.L. Shepherd Model No. 81-12 dual source irradiator ^{137}Cs J. L. Shepherd & Assoc. type 6810 Capsule per State of CA. SS&D Sheet No. CA598S119S, & ^{60}Co source J.L. & Assoc. type 7810 Capsule per State of CA SS&D Sheet No. CA598S122S) See Enclosure 1	2.4 Ci.* 8.0 Ci.*
Strontium-90	Sealed Source (J.L. Shepard Model No. 492, ^{90}Sr/^{90}Y Beta Calibrator per State of California SS&D Sheet No. CA598D123S) See Enclosure 2	200mCi.*

*Quantity is double that to be used to allow for source change.

Keithley Instruments, Inc.
Radiation Measurements Division
By Product Material
Lic. App.

ITEM 6 - PURPOSE FOR WHICH LICENCENSED MATERIAL WILL BE USED

AUTHORIZED USE:

To be used only in a J.L. Shepherd Model 81-12 dual source beam irradiator and Model 492 ^{90}Sr irradiator, See Enclosures 1 and 2. For the purpose of irradiating thermoluminescent personnel dosimeters to verify response of the dosimeters and dosimeter readers, which licensee manufactures. This is a part of the manufacturing/QA process to verify that the dosimeters and readers operate properly. In addition, the unit will be used for research and development.

Keithley Instruments, Inc.
Radiation Measurements Division
By Product Material
Lic. App.

ITEM 7 - INDIVIDUALS RESPONSIBLE FOR RADIATION SAFETY - THEIR TRAINING AND EXPERIENCE

1. **Responsible Individual**
   - **A.** Robert J. Kobistek, RSO
     See enclosure 3 for letter of authorization.

2. **Training of each responsible individual**
   - **A.** Robert J. Kobistek - Has completed a RSO training course provided by Radiation Service Organization Inc. From June 10 through June 14, 1996 see enclosure 4 for course description, enclosure 5 for certificate of completion, and enclosure 6 for his CV.

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

1. Course will cover the following topics:

   A. Atomic structure and radioactivity.
   B. Natural and man made radiation.
   C. Biological effects of radiation.
   D. Radiation risks.
   E. Radiation protection standards.
   F. Radiation detection instruments.
   G. Exposure contamination control.
   H. Laboratory safety.
   I. Emergency response/procedures.
   J. Exam.

2. Course duration will be 4 hours.

3. The training will be conducted by any of the following individuals or someone with the appropriate qualifications:
   A. Robert J. Kobistek, MS
   B. Thomas K. Stefanakos, MSNE (see enclosure 7)

4. Training will be documented by attendee signing attendance roster. Roster will be maintained in RSO's training file.

ITEM 9 - FACILITIES AND EQUIPMENT

1. The irradiators are self contained/shielded sources. Exposure levels in the off mode are well below allowable limits.

2. The units will be housed in the RMD radiation calibration lab which is located at the southeast corner of the building (see enclosures 8, 9, 10).

3. Since the sources are self contained, they are stored in the shielded irradiator thus there is no need for source storage facilities, source handling equipment, or special/added shielding or area monitoring.

4. The source mechanisms are key controlled,. The units cannot be operated without the key. When not in use the keys will be removed from the units.

Keithley Instruments, Inc.
Radiation Measurements Division
By Product Material
Lic. App.

ITEM 10 - RADIATION SAFETY PROGRAM

1. Personnel Monitoring Equipment

   A. Type - Film or TLD.
   B. Exchange interval - monthly.
   C. Supplier - ICN or similar company.

2. Radiation Detection Instruments and Instrument Calibration

Instrument	Model	Number Available	Type	Radiation Detected	Sensitivity Range	Use	Calibration Facility
Victoreen	450P	1	Ionization Chamber	Beta>1MeV Gamma, X-ray>25keV	0-5 R/h	Survey and Monitoring	University of Wisconsin ADCL *
Ludlum	3	1	GM Pancake Probe, Model 44-9	Alpha, Beta, Gamma, X-ray	0 - 6×10^5 CPM	Survey and Monitoring	University of Wisconsin ADCL*

*or an equivalent type facility.

3. Operating & Emergency Procedures

   A. Operating procedures: See Enclosure 11.
   B. Emergency procedures: See Enclosures 11.
   C. Leak testing:
      1. Semi-annually
      2. Procedure: See Enclosures 1 & 2

4. The manufacturer will decontaminate/dispose of source/unit as appropriate.

5. The TLD's are not calibrated, therefore no calibration procedures or certificates are required.

Keithley Instruments, Inc.
Radiation Measurements Division
By Product Material
Lic. App.

ITEM 11 - WASTE MANAGEMENT:

No waste is generated. When the source becomes depleted, it will be replaced and disposed of by manufacturer or an authorized individual. Only a licensed source handler who is authorized to remove and dispose of the source will be permitted to work on the source mechanism.

J L SHEPHERD & ASSOCIATES
1010 ARROYO AVE., SAN FERNANDO, CALIFORNIA 91340-1822
818-898-2361 FAX 818-361-8095

INSTALLATION & OPERATION MANUAL FOR MODEL 81 DUAL SOURCE GAMMA CALIBRATOR

ENCLOSURE 1

INSTALLATION & OPERATION MANUAL
FOR MODEL 81 DUAL SOURCE GAMMA CALIBRATOR

TABLE OF CONTENTS

INSTALLATION & OPERATION MANUAL
FOR MODEL 81 DUAL SOURCE GAMMA CALIBRATOR

Model _____
S.N. _____

NOTICE: IF AT ANY TIME THIS DEVICE MALFUNCTIONS, REMOVE THE SYSTEM FROM OPERATION IMMEDIATELY AND CALL J.L. SHEPHERD & ASSOCIATES FOR INSTRUCTIONS ON CORRECTIVE PROCEDURES.

I. MODEL 81 RADIATION SAFETY

The Model 81 Calibrator emits an intense beam of radiation through the area subtended by the beamport whenever either source is in the "EXPOSED" position. A much lower level of scattered radiation extends in a penumbra surrounding the primary beam. The user should set up exclusion lines for personnel using this calibrator, as well as limit room access. Ordinarily, this information is included as part of the facility operation rules and is required as part of the user's license to possess this calibrator.

A. Leak Test Procedure

1. Locate sources in "OFF" position.

2. Wipe the upper end of the source rod(s) where it exits from the top of the shielded container with a piece of absorbent material. Wiping the areas where the operating tower meets the top of the shield is acceptable.

3. These wipes should be measured on an instrument capable of detecting 0.005 μCi of Cs-137, Co-60 or Sr-90, depending upon isotope loading of your device.

4. If contamination above this level is detected, remove the device from service immediately and notify the manufacturer.

NOTE: The 0.005 μCi level is that generally prescribed by Regulatory Authorities; individual institutions may require more stringent standards.

II. INSTALLATION

The Model 81 is shipped completely assembled in wood shipping crate. The control panel and the base for the unit are shipped in separate boxes. Installation procedures are as follows:

1. Remove the based from the shipping box and place into position. The base has 4 each angle floor mounting brackets welded in place. After the base has been located, transfer hold pattern from mounting holes in brackets to floor and install floor anchors. Bolt base to anchors.

2. Remove the Model 81 from the shipping box. It may be lifted by eyebolts on sides, but extreme care must be taken not to damage tower assembly during lifting and transport. Place Model 81 on stand and bolt in place using bolts provided. NOTE: The Model 81 is shipped with a solid beam port plug in place.

3. Attach an air supply rated 60 psig or greater (bottled air or N2 is suggested) to the inlet port of the oiler-filter-regulator mounted on the side of the tower which has 1/4 NPT female fitting. The regulator on the unit is factory set to the proper operating pressure, but may require slight adjustment in the field. See adjustment section of manual. Next, fill the oiler section of the oiler-filter-regulator with SAE 10 weight non-detergent oil as indicated in the instructions for this unit in the manual. Adjust the bleed screw on the oiler ca. 1/2 turn from full closed. During operation a slight mist should appear in the sight glass. The oiler should be replenished one time per year. Adjust as required.

4. Attach th. ables with amphenol connectors from the control panel to the mating connectors on the tower. Attach interlock systems to the 2 each 2 pin interlock connectors on the back of the control panel (mating connectors supplied). NOTE: Both interlock circuits must have continuity or the source will not raise. Attach external warning light (such as JLS&A Model WL-2) to the external warning light amphenol on the rear of the panel. This circuit is rated 50 watts

maximum. NOTE: The warning light circuit does not affect operation of the unit and may be used at the discretion of the user. Plug the cable from the control panel to a 115V 60 Hz circuited rated 10 amp. NOTE: This circuit must not be connected to other equipment such a fluorescent lights or refrigerators/freezers which will introduce capacitive or inductive pulses into the Model 81 circuit. Such pulses will cause the electronic timer in the Model 81 control panel to malfunction.

5. Remove the rear cover from the tower of the unit. Unlock and remove the locking bar which holds the source rod assembly in the fully shielded position during shipment. This bar with lock may be replaced at any time to prevent the unit from being operated. Replace cover after testing has been completed.

INSTALLATION IS NOW COMPLETE.

III. OPERATION PROCEDURES FOR MODEL 81 DUAL SOURCE CALIBRATOR

A. TEST PROCEDURES:

All systems must be plugged in and connected per installation procedures. Turn the key switch to the "ON" position. The power lights should be illuminated. The beamport plug should be installed during device check out.

CHECK OUT PROCEDURES:

1. Interlock system - With the interlock circuit closed, the interlock light in the control panel should be illuminated.

2. Adjustable Time Delay system - press the "Irradiate" switch on the control panel. The sonalert should be activated for the preset time.

3. Model 81 - Unscrew and remove the rear half of the tower cover, next remove the air pressure. With the door open, raise the source rod to sufficient height to release "OFF" position microswitches. The "OFF" lights on control panel and tower should turn off.

NOTE: All units (Model 81) are designed so that the sources may be raised sufficiently to test without increased personnel exposure, provided that the source rod is raised from behind the unit.

4. Lights on operating tower - Press each light sequentially for illumination. All lights are press-to-test type. If all sources are in the "OFF" position, all "OFF" lights should be illuminated without pressing.

B. OPERATION OF DIGITAL PRESET TIMER

1. Place the mode selector switch to "MANUAL" or "PRESET" time.

2. To preset time, press the buttons above and below the digits on the right side of the timer.

3. With selector switch in the "MANUAL" position, the timer will show elapsed time, but will not control exposure. With the selector switch in the "PRESET" position, the timer will control the exposure. The timer counts up from "0" to the preset time.

NOTE: AFTER THE COMPLETION OF ANY EXPOSURE, IT IS NECESSARY TO PRESS THE "RESET" BUTTON BEFORE ANOTHER EXPOSURE IS INITIATED. If this is not done, the source cannot be raised. Pressing the "RESET" button will automatically reset the time previously selected. In operation, the timer starts at 0000.00 and counts up to the preset time, after the exposure is completed, showing at all times the time expired on the preset exposure.

4. The electric timer is activated whenever any source is in the fully exposed position.

C. UNIT OPERATION

Activate the "SET-UP" switch on the operating tower, exit the room and close the door. All interlock lights on the control panel should be illuminated. Select source to be exposed by operating the rotary switch on

the control panel. Press "IRRADIATE" button, the alarm will sound in the room for 0-30 seconds (whatever is selected) prior to source exposure. At the end of the alarm interval the source selected will be raised to the "EXPOSED" position. All sources may be returned to the fully shielded position by:

a) Opening/Interrupting any interlock circuit.
b) End of the preset time selected on the timer.
c) Pushing the "OFF" button on the control panel.
d) Deactivating any interlock switch in the radiation room, or by turning interlock switch on tower into "OFF" position.
e) Power failure.
f) Loss of air pressure.

NOTE: Provided that the door is not open, additional exposures may be made. Operation of the rotary switch when any source is exposed will cause the new source selected to be exposed.

D. POSITION INDICATING LIGHTS

1. The two small irradiation lights on the control panel are illuminated only when the respective source in the fully exposed position.

2. The "OFF" lights on the control panel are illuminated only when the sources are in the fully shielded position.

E. SAFETY SYSTEM

1. The interlock light is illuminated only when all interlocks are closed.

2. Low pressure light is illuminated when pressure falls below levels set on pressure switch. This is NOT a source interlock modality.

3. All sources are returned to the fully shielded position by air pressure whenever:

   a) Any interlock switch is open (including pressing mushroom or panic button switches).
   b) "OFF" switch is operated.
   c) Timer times out.
   d) Power failure.

Sources are mechanically returned (by twin constant force springs) to the fully shielded position in the event of loss of air pressure.

4. The shield design provides for full shielding in ALL directions, at all times, except out the beamport when the source is in the "ON" position.

5. The spring return assembly on the pneumatic source operating cylinders provides fail-safe operation in that the source automatically returns to the "OFF" position in case of air or power failure. In addition, the normally closed solenoid valve provides pressure to hold the sources in the "OFF" position whenever air pressure is supplied to the system and the "ON" switch is not activated.

6. The source rod never touches the bottom on the tube in which it travels (clearance is approx. 1/2"), eliminating the possibility of damage to the source by striking the end of the source tube.

F. ADJUSTMENTS

Source/shutter travel should be smooth and rapid, and should not slam in either direction.

1. To adjust the source/shutter in the Model 81, the travel speed may be changed by adjusting the pressure delivered to the cylinder, or by adjusting the flow control valves provided.

2. If the source rod/shutter travel is jerky or hesitant, the pneumatic assembly is misaligned and should be readjusted. Take care that the bottom of the pneumatic assembly is clean, and that all bolts are evenly adjusted. If action is not smooth and regular after this adjustment, the manufacturer should be contacted for further instructions.

3. An assembly drawing, a pneumatic schematic and an electrical schematic drawing are included as part of this manual.

G. GENERAL INFORMATION

The Model 81 Calibrator incorporates two Cesium-137 sources mounted on one operating rod assembly. Operation is by pneumatic cylinder controlled by a solenoid valve. This valve in turn is activated by the control panel. All lines between solenoid valves and cylinders are equipped with flow control valves. Automatic spring return assemblies are mounted on each cylinder.

CAUTION: AT NO TIME IS ANY LUBRICATION TO BE APPLIED TO THIS DEVICE, PARTICULARLY THE SOURCE ROD AND DRIVE MECHANISM. THE USE OF ANY LUBRICANT IMMEDIATELY VOIDS ALL WARRANTIES.

H. EMERGENCY PROCEDURES

1. If at any time, the source fails to return to the "OFF" position, (as shown by the source position indicating lights on the control panel) at the end of the preset or manual exposure, or after operation of an interlock, the following procedures are to be followed:

   a) Enter the irradiation room, approaching the calibrator from the rear (opposite beamport). Unlatch the cylinder cover, and move the source rod downward until the source is in the "OFF" position. A high-range survey meter should be carried during this procedure.

   b) Take the calibrator out of operation immediately and contact the manufacturer for an authorized representative to effect repairs.

JL SHEPHERD and Associates, Inc.

1010 Arroyo, San Fernando, California 91340 • (818) 898-2361

Irradiation & Calibration Equipment • Lead Shielding • Nuclear Applications

OPERATING MANUAL FOR

MODEL 492M CALIBRATOR

Model 492

S.N. 15009

ENCLOSURE 2

J L SHEPHERD and Associates

1010 Arroyo St., San Fernando, CA 91340
(818) 898-2361

Irradiation & Calibration Equipment • Lead Shielding • Nuclear Applications

OPERATING MANUAL FOR MODEL 492M CALIBRATOR

Model 492

S.N. 15009

NOTICE: IF ANY ANY TIME THIS CALIBRATOR MALFUNCTIONS, REMOVE THE UNIT FROM OPERATION IMMEDIATELY AND CALL J.L. SHEPHERD AND ASSOCIATES FOR INSTRUCTIONS ON CORRECTIVE PROCEDURES.

RADIATION SAFETY

1. The calibrator emits an intense beam of radiation in the area in front of the calibrator when the shutter is in the "OPEN" position. A much lower level of scattered radiation extends in a penumbra surrounding the primary beam. THE OPERATOR SHOULD NEVER STAND IN THE DIRECT BEAM WHILE OPERATING THE UNIT. The operator should also avoid standing in the penumbra adjacent to the primary beam. The unit must be operated at all times from a position behind the calibrator on the side opposite the beam. The user should set up exclusion lines for personnel using this calibrator as well as limited room access. This information is ordinarily included as part of the facility operation regulations and is required as part of the user's license to possess the calibrator.

   CAUTION: The window of the Sr-90 source faces the direction of the beam as in-set approximately .06" from the face of the primary shield. The source window is .003" stainless steel covered by an aluminum filter for a total of 100mg/cm filtration. Extreme care should be taken not to puncture the filter/window. If the window/filter is punctured, the source will probably leak. THE MANUFACTURER IS NOT RESPONSIBLE FOR DAMAGE TO THE SOURCES OCCASIONED BY PUNCTURING THE WINDOW. IF THE WINDOW IS PUNCTURED (BY THE USER), ALL WARRANTIES ARE VOID. THE SOURCE WINDOW/FILTER SHOULD NEVER BY TOUCHED BY ANY OBJECT EXCEPT A SOFT Q-TIP WHEN PERFORMING A LEAK TEST.

RADIATION SAFETY CONTINUED

2. At intervals not exceeding six (6) months, leak test should be made on the calibrator by taking wipes on the face of the source with the shutter open using a "U" shaped rod with wipe (typically a Q-tip) attached to the end of the rod. The operator should stand behind the calibrator. These wipes should be measured on an instrument capable of measuring 0.005 uCi of Sr-90. Use of the calibrator should be stopped immediately if contamination is detected and the manufacturer should be notified. NOTE: The 0.005 uc level is that generally prescribed by regulatory authorities: individual institutions may require more stringent standards.

INSTALLATION

Model 492 Calibrators are normally shipped in two parts: (a) The source shield and (b) the stand. To install: Bolt the source shield to stand in the location where calibrator is to be used. Plug cord into a 115 volt (single phase) socket. Remove the shipping fixture - 2/each 7" x 7-1/2" steel plates fastened around the shield and shutter mechanism with 4/each 1/2" bolts.

OPERATION

1. Remove the padlock which locks the shutter in the "OFF" position during shipment using the key provided. NOTE: This padlock may be used to lock the shutter in the "OFF" position at any time that the calibrator is not being used.

2. To expose the source, grasp the black operating knob (while standing behind calibrator, opposite beam) and move the shutter until it touches the end of the frame (Stop). The source is now exposed.

3. To return the shutter to the "OFF" position, push the operating knob and shutter, in front of the shield, until it strikes the end of the shutter frame. The source is now fully shielded.

SAFETY FEATURES

The Sr-90 source is fixed in the primary shield of the calibrator. It is exposed by moving the shutter by means of an operating rod with knob. The shutter is contained in a heavy steel framework.

SAFETY FEATURES CONTINUED

Position indicating lights (green = OFF, red = ON) at the top of the calibrator, show source position at all times. The "ON" light is activated whenever the source is not fully "OFF".

EMERGENCY PROCEDURES

If at any time the shutter sticks in the "OPEN" position and cannot be moved to the "CLOSED" position, radiation from the source maybe effectively shielded by placing a 1" thick piece of lead or equivalent, in front of the source. Dimensions should be greater than 4" x 4". If this should occur, take calibrator out of service immediately and inform the manufacturer.

TECHNICAL DATA

The Model 492 is equipped with a low "Z" (27) filter built in front of the source so that the total filtration for the Sr-90 is 100mg/cm .

MAINTENANCE

1. DO NOT lubricate the shutter at any time in any way. LUBRICATION OF ANY KIND WILL VOID ALL WARRANTIES.

2. Operate the unit in a clean atmosphere. Do not permit dirt or other particles to fall in hole at top of unit. When not in operation, it is recommended that the unit be covered, i.e., by a plastic bag, etc.

3. The slots in the bottom of the shutter frame through which the shutter wheels travel as well as the slots in the upper section of the shutter frame, should be maintained free of dirt and debris. These should be cleaned on a regular basis. The bearings on which the shutter rolls as well as the shutter guides may be lubricated with light oil at intervals NOT MORE FREQUENT THAN SIX (6) MONTHS to maintain smooth and easy shutter operation.

J L SHEPHERD and Associates, Inc.

1010 Arroyo St., San Fernando, CA 91340
(818) 898-2361

Irradiation & Calibration Equipment • Lead Shielding • Nuclear Applications

SHIPPING DOCUMENT

DATE: October 30, 1987

CUSTOMER: ATLANTIC NUCLEAR/COMBUSTION ENGINEERING, INC.

LICENSE: 06-00217-06, Amend. # 34 Issued by U.S.N.R.C.

SOURCE: 10mCi Sr 90 Amersham Beta Source, Type X.117 Capsule, S.N. 1875BC

SHIPPING CONTAINER: DOT 7A (J.L. Shepherd & Associates Model 492 Beta Calibrator, S.N. 15009)

(SPECIAL FORM)

ON ARRIVAL
_____
_____

RADIATION LEVEL AT SURFACE:

$\leq$0.2 mR/hr

RADIATION LEVEL AT ONE METER FROM SURFACE:

N/A

SURFACE CONTAMINATION:

$\leq 10 dpm/100cm^2$

INSTRUMENT:

Eberline RO-2, S.N. 3786

LEAK TEST:

$\leq 5 \times 10^{-5}$ microcuries

DOT CLASS I LABEL REQUIRED

TRANSPORT INDEX N/A

TRUCK PLACARDS REQUIRED _____ YES XXX NO

SHIPPING WEIGHT 40 lbs.

FREIGHT CLASSIFICATION:
Empty containers: NMFC 100D, Item 41070
Radioactive: 40 cents per pound valuation:
NMFC 100D, Item 164900, Sub 1, Class 70

J. L. SHEPHERD

JL SHEPHERD and Associates

1010 Arroyo, San Fernando, California 91340 • (818) 898-2361

Irradiation & Calibration Equipment • Lead Shielding • Nuclear Applications

EXTERNAL RADIATION LEVELS

TO: ATLANTIC NUCLEAR/COMBUSTION ENGINEERING, INC.

SOURCE: 10mCi Sr 90 Amersham Beta Source, Type X.117 Capsule, S.N. 1875BC

MOUNTING: J.L. Shepherd & Associates Model 492 Beta Calibrator, S.N. 15009

SOURCE IN "OFF" POSITION:

≤0.3 mR/hr at surface

≤0.1 mR/hr at 30cm from surface

SOURCE IN "ON" POSITION:

≤3.5 mR/hr at 30 cm 120° behind Beam Port

DATE: October 24, 1987

J.S. Shepherd

J.L. SHEPHERD

JL SHEPHERD and Associates

1010 Arroyo, San Fernando, California 91340 • (818) 898-2361

Irradiation & Calibration Equipment • Lead Shielding • Nuclear Applications

LEAK TEST CERTIFICATION

TO: ATLANTIC NUCLEAR/COMBUSTION ENGINEERING, INC.

SOURCE: 10mCi Sr 90 Amersham Beta Source, Type X.117 Capsule, S.N. 1875BC

MOUNTING: J.L. Shepherd & Associates Model 492 Beta Calibrator, S.N. 15009

LEAK TEST:

$\leq 5 \times 10^{-5}$ microcuries

DATE: October 24, 1987

J.L. SHEPHERD

J.L. SHEPHERD and Associates, Inc.

1010 Arroyo, San Fernando, California 91340 • (818) 898-2361

Irradiation & Calibration Equipment • Lead Shielding • Nuclear Applications

CALIBRATION CERTIFICATE

TO: ATLANTIC NUCLEAR/COMBUSTION ENGINEERING, INC. P.O. # 9774770-D9403/AN2842

SOURCE: 10mCi Sr 90 Amersham Beta Source, Type X.117 Capsule, S.N. 1875BC

MOUNTING: J.L. Shepherd & Associates Model 492 Beta Calibrator, S.N. 15009

INSTRUMENT: This unit is calibrated by direct comparison to J.L. Shepherd & Associates Model 492M Calibrator, S.N. 15005, loaded with 100mCi Sr-90/90Y, which has been calibrated at National Bureau of Standards. Comparison is made using a transfer chamber. Calibration data in a range of 20 to 200 cm is generated by direct comparison to NBS data in this range.

POSITION: Transfer chamber is mounted directly in line with source mounted in calibrator.

DISTANCE: All distances are measured from the face of the fixed block in which the source is mounted in the calibrator. The face of the moving shutter is 1.5" from the face of this fixed section in which the source is mounted.

FILTER: The 492 has built-in 100mg/cm^2. Total filter (atomic # $\leq$27) between the Sr-90 and the face of the calibrator.

DOSE RATE DATA: Sr-90/90Y sources are calibrated by NBS in terms of the absorbed dose rate in water (rads-water). NBS calibration is in SI Units, for convenience J.L. Shepherd & Associates calibration curves are in rads (water) per hour.

CALIBRATION: See Attached Curve

DATE: October 24, 1987

J.L. SHEPHERD

J L SHEPHERD and Associates, Inc.

1010 Arroyo, San Fernando, California 91340 • (818) 898-2361

Irradiation & Calibration Equipment • Lead Shielding • Nuclear Applications

DEVICE CERTIFICATION

J.L. SHEPHERD & ASSOCIATES CERTIFIES THAT THE UNIT MEETS ALL APPLICABLE D.O.T. SHIPPING REGULATIONS RELATED TO EXTERNAL RADIATION LEVELS FOR CONTAINERS FOR RADIOACTIVE MATERIALS.

WARRANTY: FREE PARTS AND SERVICE WILL BE ALLOWED FOR THREE MONTHS FOLLOWING INSTALLATION, WITH AN ADDITIONAL NINE MONTHS FOR PARTS.

JL SHEPHERD and Associates

1010 Arroyo, San Fernando, California 91340 • (818) 898-2361

Irradiation & Calibration Equipment • Lead Shielding • Nuclear Applications

J.L. SHEPHERD & ASSOCIATES, INC.

PRODUCT WARRANTY

MODEL 492M

BETA CALIBRATOR

A. THIS WARRANTY CONSTITUTES THE ENTIRE UNDERSTANDING BETWEEN ATLANTIC NUCLEAR/COMBUSTION ENGINEERING, INC. HEREINAFTER REFERRED TO AS BUYER, AND J. L. SHEPHERD & ASSOCIATES, INC., HEREINAFTER REFERRED TO AS SELLER RELATING TO WARRANTIES, GUARANTEES, OR PROVISIONS IN BUYER'S TERMS AND CONDITIONS OF PURCHASE.

B. SELLER WARRANTS THAT ALL PRODUCTS DELIVERED UNDER PURCHASE ORDERS ISSUED BY BUYER, OR UNDER PURCHASE ORDERS ISSUED DIRECTLY BY BUYER'S CUSTOMERS WILL CONFORM TO APPLICABLE SPECIFICATIONS AND DRAWINGS; WILL BE FREE FROM DEFECTS IN MATERIAL AND WORKMANSHIP: WILL BE FREE FROM DEFECTS ARISING FROM THE PROCESS OF MANUFACTURE, WHICH PROCESS IS DICTATED BY THE REQUIREMENTS OF THE BUYER'S DESIGN; AND WILL BE FREE FROM DEFECTS ARISING FROM SELLER'S ROUTINE SELECTION OF MATERIALS. BUYERS AND SELLER RECOGNIZE THAT CERTAIN METHODS AND MATERIALS USED IN THE MANUFACTURE OF THE PRODUCTS ARE PROPRIETARY TO OR THE SOLE RESPONSIBILITY OF SELLER. SELLER THEREFORE WARRANTS THAT DEFECTS OR FAILURES ARISING FROM THE PROPRIETARY PROCESSES OF MANUFACTURE AND THE SELECTION OF MATERIAL NOT CALLED OUT IN THE SPECIFICATIONS OR DRAWINGS OR WHERE OPTIONAL MATERIAL REQUIREMENTS ARE ALLOWED WILL BE THE RESPONSIBILITY OF SELLER.

THE WARRANTIES OF THIS SECTION SHALL BE APPLICABLE AS FOLLOWS:

1. FREE PARTS AND SERVICE WILL BE ALLOWED FOR THREE MONTHS.

2. FREE PARTS FOR AN ADDITIONAL NINE MONTHS.

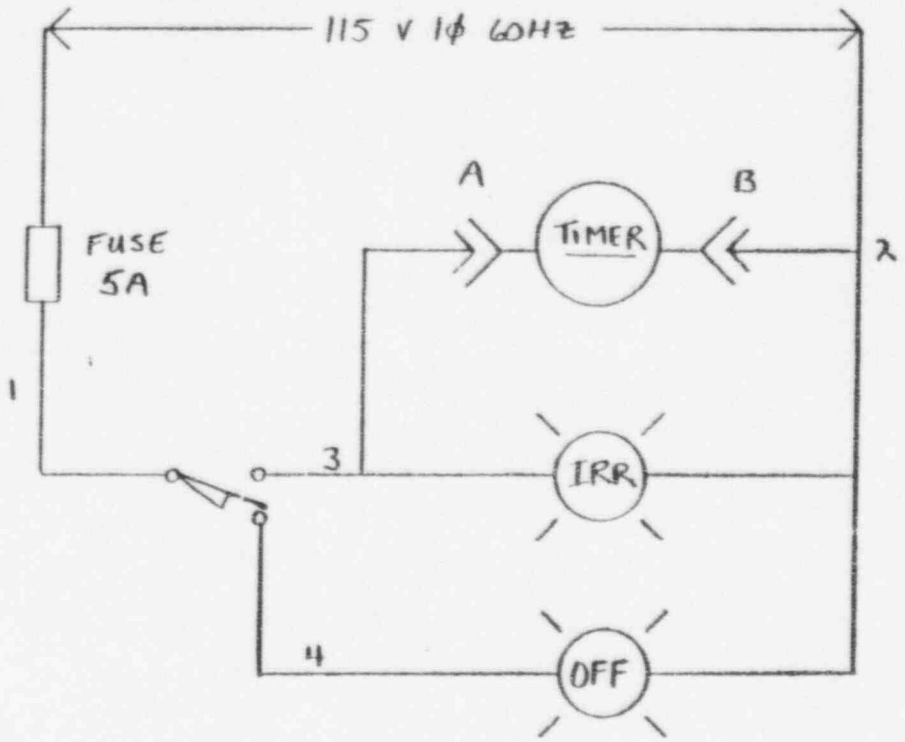
C. THERE SHALL BE NO WARRANTY BY SELLER FOR DEFECTS ATTRIBUTABLE IN WHOLE OR IN PART TO FACTORS BEYOND SELLER'S CONTROL, INCLUDING BUT NOT LIMITED TO BUYER'S DESIGN, FAILURE OF BUYER OR ITS CUSTOMERS TO PROPERLY PRESERVE, STORE, INSTALL, OPERATE, OR MAINTAIN PARTS MADE BY SELLER.

SELLER ALSO DENIES LIABILITY FOR ANY FAILURE OR DETERIORATION OF PARTS ATTRIBUTABLE TO EXTENDED STORAGE UNDER CONDITIONS OR EXCESSIVE TEMPERATURE OR HUMIDITY, AND FOR MALFUNCTION OR DESIGN DEFICIENCY OCCURRING IN OTHER SYSTEMS OR INSTALLATIONS THAT WOULD IN TURN AFFECT THE PERFORMANCE OF THE PART.

SELLER FURTHER DENIES LIABILITY FOR PERFORMANCE OF THE PARTS WHEN ABNORMAL ENVIRONMENTAL OPERATING CONDITIONS ARE ENCOUNTERED.

D. ANY PART MADE BY SELLER WHICH BUYER CLAIMS TO HAVE FAILED OR TO BE DEFECTIVE AND COVERED BY THIS WARRANTY SHALL BE PRESENTED TO SELLER AT THE SELLER'S FACILITY, FOR EXAMINATION AND DISPOSITION BY SELLER. THE SELLER SHALL DETERMINE CAUSE AND RESPONSIBILITY OF FAILURE, AND SHALL NOTIFY THE BUYER WITHIN 30 DAYS OF THE RESULTS OF THIS EXAMINATION. IF IT IS POSSIBLE TO REWORK THE FAILED UNIT TO THE ORIGINAL QUALITY, IT IS THE SELLERS OPTION TO PERFORM THE REWORK OR SUPPLY A NEW PRODUCT.

E. THE WARRANTIES SET FORTH HEREIN ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, AND THE LIABILITY OF SELLER UNDER THESE WARRANTIES SHALL BE LIMITED TO THE REPAIR OR REPLACEMENT OF NONCONFORMING OR DEFECTIVE PARTS. OTHER THAN EXPRESSLY STATED ABOVE, SELLER SHALL ASSUME NO LIABILITY OF WHATSOEVER NATURE, INCLUDING LIABILITY FOR CONSEQUENTIAL DAMAGES, NOR MAKES ANY REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, AND SPECIFICALLY, THERE IS NO WARRANTY OF MERCHANTABILITY OR OF FITNESS, ARISING BY LAW OR OTHERWISE, WITH RESPECT TO THE MANUFACTURE OR USE OF SAID PARTS.



(OPTIONAL)
FOR TIMER:

2- PIN AMPHENOL

A. RED
B. BLACK

COLOR CODE

1. BLACK
2. WHITE
3. RED
4. GREEN

ATLANTIC NUCLEAR
JOB # - 492293

J. L. SHEPHERD and Associates

DRAWN BY	DATE	APPROVED BY	SCALE
DLS	5-81	DLS	NONE

ELECTRICAL SCHEMATIC for SERIES 492

CALIBRATOR w/ TIMER — A-0492-E

ENCLOSURE 3

M E M O R A N D U M

DATE: September 20, 1996

TO: RMD Managers
Bob Kobistek
NRC License File

FROM: Terry Sheridan
Vice President and General Manager

RE: Authority of Radiation Safety Officer Position

With this letter I am establishing the function of Radiation Safety Officer at RMD and appointing Bob Kobistek to assume its responsibilities. The Radiation Safety Officer shall be authorized to administer and enforce the Keithley RMD Radiation Safety Program and Policies AOP-11-01. The Radiation Safety Officer will have a direct reporting relationship to me in issues regarding radiation safety.

Terrence E Sheridan

Terrence E. Sheridan
Keithley Instruments, Inc.

CSI - Radiation Safety Training
3827 Farragut Avenue
Kensington, MD 20895

Radiation Safety Training

ENCLOSURE 4

RSO,Inc.

Basic Radiation Safety

8 - Hour Course

and

Radiation Safety Officer

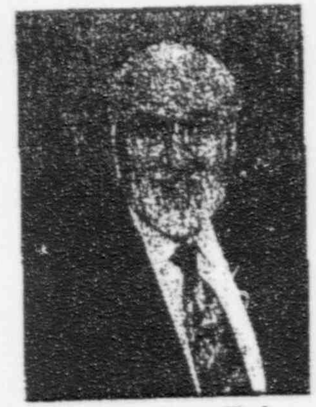
40 - Hour Course

Offered By

Radiation Service Organization
and
CSI - Radiation Safety Training

Leaders in Radiation Safety Training Since 1983

Washington, D.C.



Course Coordinator

Ray Johnson, C.H.P., P.E., will provide coordination and primary instruction in both courses. Ray is a retired U.S. Public Health Service Officer with 30 years of experience in radiation safety. He has presented several hundred workshops and short courses on radiation protection, radiation risks, risk communication, radiation measurements, quality assurance, and communication skills.

Ray has authored over 225 books and publications on radiation protection and risk communication. He is Secretary of the Health Physics Society and a member of the American Nuclear Society.

Course Schedule

Basic Radiation Safety
8 - Hour Course

1996 Mar 5, Apr 9, May 7
Jun 18, Sep 10, Oct 8,
Nov 5, Dec 10

Radiation Safety Officer
40 - Hour Course

1996 Mar 11-15, Jun 10-14
Sep 16-20, Dec 2-6

1997 Mar 10-14, Jun 9-13

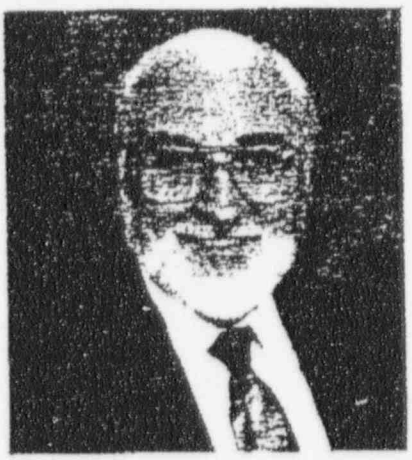
Call 301-942-5946 for details.

Radiation Service Organization (RSO, Inc.) and CSI-Radiation Safety Training, Attn: Ray Johnson, C.H.P., P.E., Training Manager, CSI - Radiation Safety Training, 3827 Farragut Avenue, Kensington, MD 20895; 301-942-5946; FAX: 301-942-5948, or E-Mail: RadTrain@aol.com

TITLE: RADIATION SAFETY OFFICER TRAINING. This is our **13th** year offering this intensive 40-hour course to qualify you as a Radiation Safety Officer on an NRC or Agreement State license. Our course is highly acclaimed by several hundred representatives from government and industry who have attended since 1983. We provide the necessary technical information and practical experience to assure that you are well prepared to serve as an RSO for successfully managing a radiation safety program wherever radioactive materials are used. We specialize in training for radiation safety at facilities engaged in research, medical, biomedical, and educational programs, as well as the safe use of radioactive materials in irradiators, and sealed sources in measurement devices and density gauges. We place special emphasis on meeting the requirements of the NRC (Agreement States), DOT, and EPA and how to motivate your staff to effectively implement your radiation safety program. We use a combination of lecture, hands-on laboratory exercises, and extensive reference materials. General subjects include: a review of radiation fundamentals, radiation measurements, radiation risks, radiation risk communication (based on the Myers-Briggs Type Indicator), radiation protection standards, internal and external dosimetry, radiation statistics, quality assurance, radiation surveys and personnel monitoring, record keeping, transport of radioactive materials, radioactive and mixed waste management, waste minimization, emergency response, radioactive materials licensing, and preparing for inspections. Our highly experienced instructors will provide practical tips on radiation safety program management. Our course manual includes over 1,000 pages of practical reference material developed specifically for this course. Each student will also be given a copy of the Radiological Health Handbook and other publications, including pertinent federal regulations and regulatory guides. Our goal is to provide both the training and the reference materials that you will need to be a successful RSO. Previous training and experience are not required. The course includes a final examination and a certificate suitable for framing. The primary instructor, Ray Johnson, is a well known Certified Health Physicist. Other instructors are also C.H.P.s and Radiation Safety Officers. Continuing education credits are approved by the ABHP and the ABIH.

Dates:
10 - 14 June 1996
16 - 20 September 1996
2 - 6 December 1996
10 - 14 March 1997
9 - 13 June 1997

Fee: $1,275 (includes all materials)
Place: Bethesda, Maryland



Raymond H. Johnson, Jr., C.H.P., P.E.
President, CSI - Radiation Safety Training and Communication Sciences Institute
Kensington, MD

B.S., Civil Engineering, (1961) Univ. of Vermont
M.S., Sanitary Engineering, (1963) M.I.T.
Prof. Engr. Degree, (1963) M.I.T. and Harvard
Ph.D. Studies, Radiochemistry (1966 -1972) R.P.I.
Johns Hopkins Fellow, Organizational Syst.(1984-1985)
ABHP Certified (1983)

Experience

1984 - Pres. Owner and President of CSI. Provide health physics and risk communication training and consulting to nuclear industry, universities, radiopharmaceutical companies, and professional organizations. Consultant to many federal agencies on radiation safety programs.

1988 - Pres. Manager and Contractor to National Institutes of Health for radiation safety audits of 3,000 research laboratories, 100 sealed sources, and 2,000 instrument calibrations a year.

1990 - Pres. President of Key Technology, Inc. a manufacturer and primary laboratory for radon with over 700,000 measurements since 1985. Primary instructor at Rutgers University since 1990 for radon, radiation risks, radiation instruments, and radon risk communication courses.

1986 -1988. Laboratory Director, RSO, Inc.- Directed analytical programs and QA for samples from N.I.H., Aberdeen Proving Ground, radiopharmaceutical companies, and the nuclear industry.

1970 - 1985. Chief, Radiation Surveillance Branch, EPA, Office of Radiation Programs. Directed studies of radiological quality of U.S., coordinated 7 Federal agencies for nuclear fallout events, directed regulatory program for ocean dumping, QA officer for 8 years. Head of several U.S. delegations to I.A.E.A and N.E.A. on radioactive waste disposal. ANSI N-13, 1975 - 1985. Retired PHS Commissioned Officer (O-6) in 1985 with 28 years of service.

1963 - 1970. U.S.P.H.S. - Directed development of radiation monitoring techniques at DOE National Labs, nuclear plants, and shipyards in the U.S. and Chalk River Nuclear Laboratory in Canada.

Health Physics and Professional Activities

HPS plenary member, 1966. HPS Executive Comm. and Secretary since 1992. Vice-Pres., Radon Section, 1993. Co-Chair Local Arrangements Comm. 1991 meeting in D.C., Public Info. Comm., 1985 - 1988. PEP and AAHP instructor. Journal reviewer. Pres., Baltimore-Washington Chapter-1990 and Honorary Life Member. Newsletter Editor, 1983 to Pres. Public Info. Chair 1983 - 1991. New England Chapter: Newsletter Editor, Board of Directors, Education Chair, 1968-1972. Member ANS, 1983. Public Info. Chair, D.C. Section, 1983-1991. Charter Member American Association of Radon Scientists and Technologists, Board of Directors, Newsletter Editor. Member of Sigma Xi - 1966, Society for Risk Analysis - 1984. Studied H.P. communication styles and presented Myers-Briggs seminars to over 1400 H.P.s since 1984. Professional Engineer, 1965.

Publications

Authored over 225 books, articles, professional papers, and presentations on radiation protection. Co-author of monthly column, *"Insights in Communication,"* HPS Newsletter 1984 - 1989.

Basic Radiation Safety

8 - Hour Course

This course is to meet training needs of new radiation workers as required by isotope licenses for all radionuclide users. The course also provides good introduction to radiation fundamentals for others who are interested in radiation safety.

Topics Include:

Atomic Structure and Radioactivity
Natural and Man-made Radiation
Biological Effects of Radiation
Radiation Risks

Radiation Protection Standards
Radiation Detection Instruments
Exposure / Contamination Control
Laboratory Safety

Emergency Response
Radioactive Waste Disposal
Radiation Protection Programs
Your Responsibilities for Safety

Participants in this 8-hour course will receive a manual with over 400 pages of information developed specifically for this course.

Your understanding of course materials will be documented by a written examination at the end of the course.

You will receive a certificate suitable for framing.

This course can also be presented on-site at your facility. We will be happy to make revisions to the course for your particular needs.
Call 301-942-5946 for details.

Radiation Safety Officer

40 - Hour Course

This is an intensive 5-day course designed to meet NRC and Agreement State license requirements for persons who wish to qualify as Radiation Safety Officers.

Topics Include:

Atomic Structure and Radioactivity
Natural and Man-made Radiation
Radiation Quantities and Units
Interaction of Radiation with Matter
Biological Effects of Radiation

Risks of Radiation Exposure
Risks to Pregnant Workers
Health Risk Communication
Radiation Protection Standards
Nuclear Medicine - 10 CFR 35

External/Internal Dosimetry
Radiation Detection Instruments
Counting Statistics
Hands-on Measurements Laboratory

Health Physics Surveys
Emergency Response
Radioactive and Mixed Waste Management
Transport of Radioactive Materials

Quality Assurance Programs
Effective Safety Communications
Requirements of DOT, EPA, OSHA
Materials License Applications
Preparing for Inspections
Radiation Protection Programs
RSO Responsibilities

The course will include a 1,000 page manual, a comprehensive examination, and a certificate.

Registration Form

Basic Radiation Safety - $225
Course Date _____

Radiation Safety Officer - $1275
Course Date _____

Name _____ Position _____

Organization _____

Address _____

City, State, Zip _____

Telephone _____ Fax _____

Send Payment to:
CSI - Radiation Safety Training, 3827 Farragut Ave., Kensington, MD 20895
Phone: 301-942-5946 Fax: 301-942-5948

Cancellation Policy: The registration fee (minus a $40 handling charge) will be refunded for cancellation notice received two weeks before the course date. After that date the fee is transferrable to another course within 12 months.

Directions: CSI - Radiation Safety Training, 3827 Farragut Avenue, Kensington, MD, is located one block from Connecticut Avenue about two miles north of the beltway (I-495). Farragut Avenue crosses Connecticut Avenue at the intersection of Connecticut Avenue and University Avenue. 3827 Farragut Avenue can only be reached from Southbound Connecticut Avenue.

If you are going North on Connecticut Avenue, bear left to stay on Connecticut Avenue at the stop light and intersection with University Avenue. Turn left one block from this intersection at Kaiser-Permanente and make a U-turn to go South on Connecticut Avenue. Farragut Avenue is on the right at the stoplight and intersection with University Avenue. Our office at 3827 Farragut Avenue is in the front and center of a condominium office building at the end of Farragut Avenue.

CSI - Radiation Safety Training

CSI - Radiation Safety Training is a subsidiary of Communication Sciences Institute, Inc. established by Raymond Johnson in 1983 to provide consulting and training in radiation risk assessment, risk communication, and; communication skills. CSI currently has the contract for radiation safety inspections of over 2500 laboratories at the National Institutes of Health. Ray retired as a Commissioned Officer (O-6) from the U.S. Public Health Service in 1985. He has over 30 years of experience in radiation safety programs. He is a Certified Health Physicist and Licensed Professional Engineer.

During his career he was assigned to the U.S. Environmental Protection Agency for 15 years where he served as Chief of the Radiation Surveillance Branch with responsibility for monitoring all sources of radiation in the United States. He has presented several hundred workshops and short courses on radiation protection, radiation risks, risk communication, radiation measurements, quality assurance, and communication skills.

Ray is also President of Key Technology, Inc. Lebanon, PA, one of the largest radon measurement companies in the U.S. He is the principle instructor at Rutgers University on radon measurements and radon risk communication. Ray has authored over 225 books and other publications on radiation protection, radon, and risk communication. He is currently Treasurer of the Health Physics Society, and a member of the American Nuclear Society, the Society for Risk Analysis, the Association for Psychological Type, and the Society of Sigma Xi. He is also President of the American Association of Radon Scientists and Technologists.

CSI-Radiation Safety Training
3827 Farragut Ave., Kensington, MD 20895
(301) 942-5946

Hotel List for CSI Radiation Safety Training Classes

Hotel	Approx. Room Rate
Bethesda Ramada Inn 8400 Wisconsin Ave., Bethesda, MD 301-654-1000	$105.00 Sun-Thur $79.00 Fri, Sat
Holiday Inn Bethesda 8120 Wisconsin Ave., Bethesda, MD 301-652-2000	$129.00
Hyatt Regency Bethesda 1 Bethesda Metro Center, Bethesda, MD 301-657-1234	$89.00 Fri-Sun $175.00 Mon-Thur
Bethesda Marriott 5151 Pooks Hill Rd., Bethesda, MD 301-897-9400	$79.00 Fri-Sun $125.00 Mon-Thur
Residence Inn 7335 Wisconsin Ave., Bethesda, MD 301-718-0200	$164.00

CSI - Radiation Safety Training and
Radiation Service Organization

Radiation Safety Officer

Agenda

Day 1 Monday, June 10, 1996

Instructor: Ray Johnson, C.H.P., P.E., CSI - Radiation Safety Training

8:00 Registration and Orientation

8:15 Overview and Course Objectives,
Radiation Risk Perceptions

8:45 Pre-Test

9:15 Atomic Structure and Radioactivity,
The Natural and Man Made Radiation Environment, Radon,
Units of Radioactive Decay and the Decay Law,
Interactions of Radiation with Matter, Radiation Quantities and Units,

12:00 Lunch (Provided)

1:00 Biological Effects of Radiation, Risks of Radiation Exposure,
Risks to the Pregnant Worker, Radiation Risk Communication

5:00 Adjourn

Day 2 Tuesday, June 11, 1996

8:00 Radiation Protection Standards, 10 CFR Part 19 and 20

Instructor: Terry Johnson, RSO, George Washington University

10:00 Essential Highlights of 10 CFR Part 21, 30, 31, 33

11:00 Medical Use: 10 CFR Part 35, Part 31.11

12:00 Lunch

1: 00 More Part 35

1:30 External Dosimetry, Shielding, and Internal Dosimetry

5:00 Adjourn

Day 3 Wednesday, June 12, 1996

Instructor: Ray Johnson

8:00 Radiation Detection Instruments

Instructors: Ray Johnson, Greg Smith, RSO, Inc., and Steve Tilden, CSI, Inc.

10:00 Radiation Instruments Laboratory

12:00 Lunch

Instructor: Ray Johnson

1:00 Radiation Statistics

2:30 Contamination Control and Health Physics Surveys

5:00 Adjourn

Day 4 Thursday, June 13, 1996

Instructor: Ray Johnson

8:00 Quality Assurance

10:00 Radioactive Waste Management, Waste Minimization, Mixed Wastes

12:00 Lunch

1:00 Communication Styles and Effective Risk Communications

3:00 Communication Factors in Implementing Radiation Safety Programs

5:00 Adjourn

Day 5 Friday, June 14, 1996

Instructor: Terry Johnson

8:00 Transport, Shipment, and Receipt of Radioactive Materials, Ordering, Receipt, and Opening Procedures.

10:00 Preparing a Regulatory License Application,

12:00 Lunch (Provided)

Instructor: Ray Johnson and Terry Johnson

1:00 Preparing for Regulatory Inspections and Program Audits

2:30 Radiation Protection Program Management, Challenges for RSO's, Information Resources

3:30 Final Exam and Review

5:00 Presentation of Certificates

ENCLOSURE 5

Certificate of Training

This Certifies That

Robert J. Kobistek

has successfully completed the 40-hour course of instruction for

Radiation Safety Officer

June 10-14, 1996

Presented By

CSI-Radiation Safety Training
3827 Farragut Avenue
Kensington, MD 20895

and

Radiation Service Organization
P.O. Box 1526
Laurel, MD 20725

Ray Johnson

Raymond Johnson, C.H.P., P.E.
Course Director

Enclosure 6

Robert J. Kobistek

Born: 1954, Greensburg, PA
Married: 1984 (Mary); no children

Education:

B.S.: 1990, Cleveland State University, Major: Computer Science
Minor: Mathematics (applied)

M.S.: 1993, Cleveland State University, Major: Physics; Research: Computer modeling of atomic-level behavior of surfaces of ordered crystalline alloys.

Cont. Ed.: 1991, American College of Radiology Mammography Quality Assurance Course.

1993, American Association of Physicists in Medicine Radiation Therapy Physics Review Course.

1994, TubeMaster, Inc., Principles of Fluoroscopic Imaging Systems.
Various refresher courses and seminars at annual meetings of the American Association of Physicists in Medicine and the Radiological Society of North America

1996, CSI - Radiation Safety Training, Forty hour Radiation Safety Officer training course.

Professional Experience:

1979 - 1994: Victoreen, Inc., manufacturer of radiation measurement instrumentation. Held various positions over 15 year tenure including product manager, engineer, programmer, staff physicist, and technician. Worked with radiation-generating equipment as well as radioactive nuclides for purposes of testing and calibration.

1994 - present: Keithley Instruments, Inc., manufacturer of radiation measurement instrumentation. Calibration laboratory physicist and supervisor. Also performing technical support and education for Sales and customers.

1995 - present: Lakeland Community College, part-time faculty, teaching mathematics.

Professional Societies:

American Association of Physicists in Medicine; full member. Member of Task Group 12, Quality Control in Diagnostic Radiology.

Health Physics Society; plenary member.

Council on Ionizing Radiation Measurements and Standards. Member of Medical Subcommittee.

Northern Ohio Chapter, Health Physics Society; Chairman of Education Committee (1994-95), President-Elect, (1995-96), President (1996-97), Chairman of Publications Committee (1995 -)

Association for the Advancement of Medical Instrumentation.

Cleveland Area Medical Physicists.

Publications: 2 publications in peer-reviewed journals, 6 meeting presentations.

ENCLOSURE 7

Thomas Kostas Stefanakos

2922 Woodbridge Road
Hudson, Ohio 44236

Home: (216) 656-3482
Work: (216) 447-9747

PERSONAL

Date and Place of Birth: November 26, 1940-New York, New York

Citizenship: United States

Marital Status: Married-Juva Ann Scholl Stefanakos (1966)

Children: (3) Michael Kostas (1968)
Robert Thomas (1970)
James Howard (1973)

EDUCATION

1959-1962 Bucknell University, Lewisburg, Pennsylvania
No degree

1963-1964 Upper Iowa University, Fayette, Iowa, B.S. Degree in Chemistry. Psychology and Mathematics Minors.

1965 National Naval Medical Center, Bethesda, Maryland. Course of Instruction in Radioisotope Technique and Nuclear Medicine. (4 months)

1965 Naval Training Unit, Fort McClellan, Alabama
Nuclear Biological and Chemical Warfare Defense (6 weeks)

1966 Sandia Base, Albuquerque, New Mexico.
Nuclear Weapons Safety Officer's Course. (6 weeks)

1969 Dugway Proving Grounds, Utah
Chemical Warfare Indoctrination Course. (1 week)

1971-1973 Georgia Institute of Technology, Atlanta, Georgia
M.S. Degree in Nuclear Engineering.
Radiological Physics Specialty

1973	Emory University, Atlanta, Georgia Internship in the Physics of Radiation Therapy
1975	University of Texas, M.D. Anderson Hospital and Tumor Institute, Houston, Texas External Beam, Interstitial and Intracavity Dosimetry: Manual and Computer Methods of Calculation (2 weeks)

EMPLOYMENT

1993-Present	Radiation Therapy Physicist, Independence Oncology, Independence Ohio and at St. Luke's Medical Center, Cleveland, Ohio. Responsible for the radiation therapy physics, unit calibrations and treatment planning. Therapy units include 2 AECL Theratron 780-C Cobalt 60 and a Siemens Mevatron 7440Linear Accelerator. Responsible for maintaining the U.S. Nuclear Regulatory license for the Radiation Therapy Division of St. Luke's Medical Center, Conducts monthly, quarterly, semi-annual and annual NRC required inspections/audits; maintains the photodosimetry program; calibration of diagnostic radiographic units annually, or as needed. Shielding design and acceptance testing, weekly calculations, annual calculations and spot checks for MEV 7440 accelerator at Independence Oncology.
1984-1993	Radiation Therapy Physicist, Radiation Safety Officer and Supervisor of Radiation Therapy Technologists at the Mt. Sinai Medical Center, Cleveland, Ohio. Responsible for the radiation therapy physics support, including brachytherapy, calibrations and treatment planning. Therapy units include an AECL Theratron 780 Cobalt-60. Siemens Mevatron 77 Linear Accelerator, Picker C9 Cobalt 60, 2 Picker Zephyr Superficial and a Picker Vanguard Orthovoltage. Responsible for maintaining the U.S. Nuclear Regulatory licenses for the Radiation Therapy and Nuclear Medicine Divisions as well as the license for the Mt. Sinai Suburban Radiology Group, Beachwood, Ohio. Conducted monthly, quarterly, semi-annual and annual NRC required inspections/audits;

maintains the photodosimetry program; calibration of diagnostic radiographic units annually, or as needed at the above listed locations.

1976-1984 Chief, Radiological Physics Branch Radiology Service, Naval Regional Medical Center, Portsmouth, Virginia; Radiation Therapy Physicist; Administrator, Radiation Safety Program.

Responsible for the calibration of radiation therapy machines and diagnostic x-ray units; supervised 7 officers and 26 technicians; provided physics support to the Diagnostic Radiology and Nuclear Medicine Branches of the Radiology Service; maintained the U.S. Nuclear Regulatory Commission licenses for the Radiation Therapy and Nuclear Medicine Branches; resolved a variety of problems pertaining to instrumentation; taught pertinent topics in radiation safety and radiation hazards and their biological effect to student x-ray technicians, x-ray technicians, radiation therapy technicians, and radiology residents.

Member of the faculty at Eastern Virginia Medical School, Norfolk, Virginia and George Washington University Medical School, Washington D.C. Senior Watch Officer for the Command Administrative Advisory Watch Bill comprised of 20 officers. Director of Physics for Naval Medical Command Mid-Atlantic Region, which includes all of Virginia, North Carolina, South Carolina, Tennessee, Kentucky, parts of West Virginia, Naval Medical Facilities at Puerto Rico, Bermuda, and Gauntonimo Bay, Cuba.

Responsibilities included the supervision of physics support throughout the region, detail physicists to provide support where needed. Called upon to determine what equipment would best satisfy the needs of the various medical facilities. Collateral duties included Chairman, Civilian Performance Rating Board; Chairman, Commissioned Officers Mess (Open) Advisory Board; Quality Assurance Representative for Radiology Service; Vice-Chairman, Radioisotope/Radiation Safety Committee, and others. Assumed the position of Acting Director of Administrative Services, Naval Regional

Medical Center, Portsmouth. Physics Advisor to the Advisor in Radiology for the Surgeon General of the Navy for purchase and evaluation of x-ray equipment.

1973-1976 Radiological Physicist, Naval Regional Medical Center, Oakland, California. Assisted the Radiation Safety Officer in making license request, hospital instructions, and assuring radiation safety regulations were followed in Oakland, California. Provided primary physics support to the Radiation Therapy Branch and secondary physics support to the Diagnostic and Nuclear Medicine Branches. As such, designed and built numerous devices which enabled the therapist to optimize his treatment of cancer patients.

1968-1971 Radiological Physicist/Instructor, NBC Warfare Defense School, Naval Damage Control Training Center, Philadelphia, Pennsylvania.
Responsible for the NRC licensed material.

Radiological Physicist/Instructor, NBC Warfare Defense School, Naval Damage Control Training Center, Philadelphia, Pennsylvania.

Responsible for the NRC licensed materials, maintained established radiation safety procedures, including NRC license amendments and requests, taught subjects on nuclear weapons effects, safety, radiation instrumentation, decontamination and monitoring. Also, was the primary instructor in the medical aspect of nuclear weapons.

1966-1968 Radiological Health Officer/Dispensary Administrative Officer, Submarine Base, Pearl Harbor, Hawaii.

Responsible for the personnel administration and supervision of dispensary staff (26 corpsmen, 8 doctors and 8 civilians) and equipment. Administered an annual budget of $80K and a plant property account of $250K.

Administered staff training programs and schedules. Maintained the radiological training program and the photodosimetry program. Responsible for the radiation

safety of the command and the submarines tied to the pier for support.

1965-1966 Radiation Health Office/Administrative Assistant, Medical Department, USS NEREUS (AS-17), San Diego, California

Responsible for the maintenance of the Radiological Safety Programs for the ship and submarines tied along side for repairs. This included radiation safety training programs and the photodosimetry program. Responsible for the personnel administration and supervision of 16 hospital corpsmen, an annual budget of $15K and a plant property account of $40K, the collateral duty of Submarine Flotilla I Recreation Fund with a budget of $250K and a plant property of $1.5M.

LICENSURE

Professional Radiological Physicist:
- State of Ohio (qualified expert)
- State of Texas (licensed)
- State of Virginia (qualified expert)
- State of West Virginia (qualified expert)
- State of Maryland (qualified expert)
- State of Indiana (qualified expert)
- State of Pennsylvania (qualified expert)

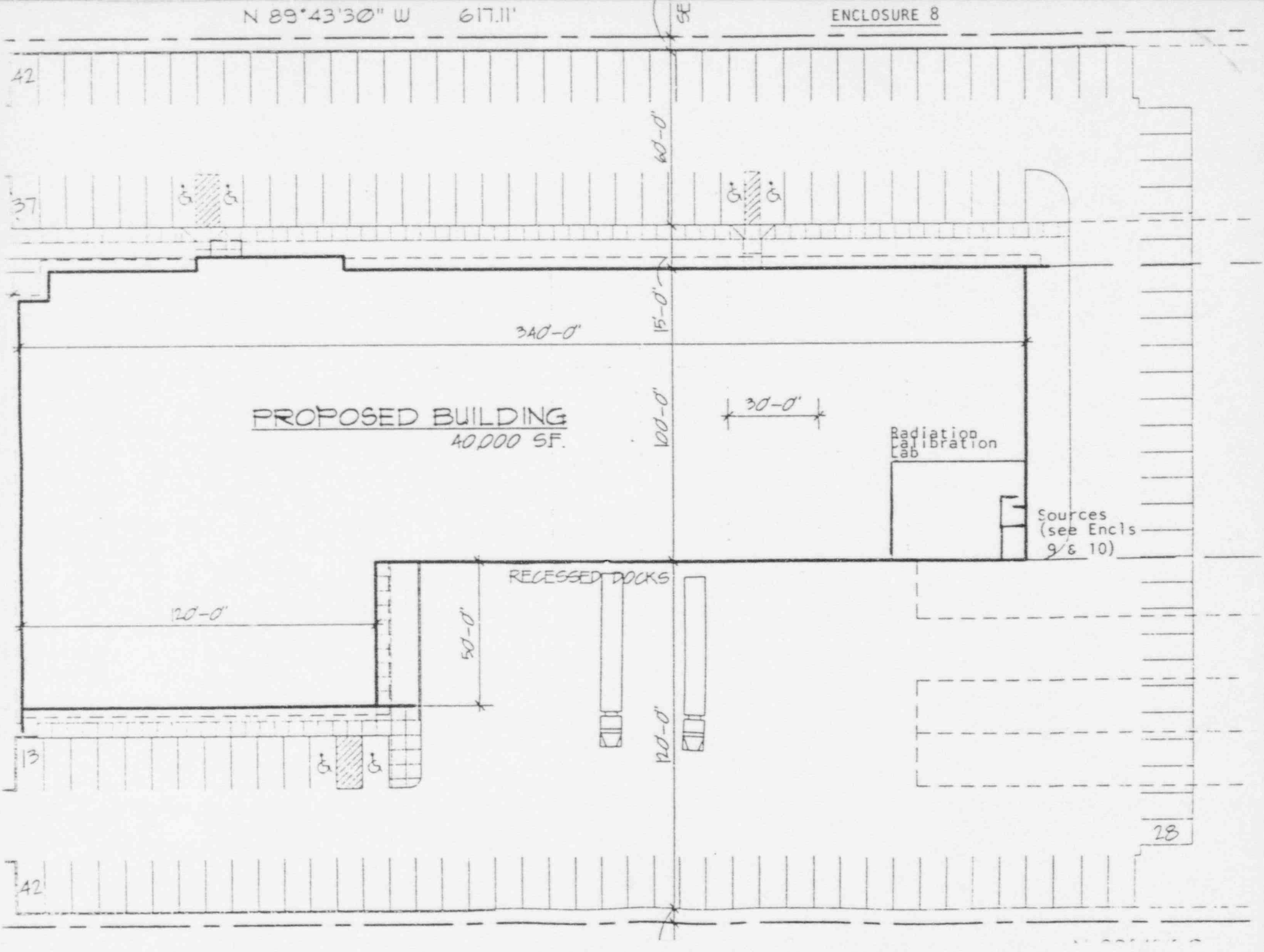
PUBLICATIONS

Droege, Ronald T., Ph.D., and Stefanakos, Thomas K., M.S.: Portal Film Technique Charts. Int. J. Radiation Oncology Biol. Phys., Vol. 11, pp. 2027-2031, 1985.

SOCIETIES/MEMBERSHIPS

Nuclear Engineering Policy
American Association of Physicists in Medicine
San Francisco Bay Area Chapter, American Association of Physicists in Medicine
Cleveland Area Medical Physics Society (Past President)
Tidewater Radiological Society

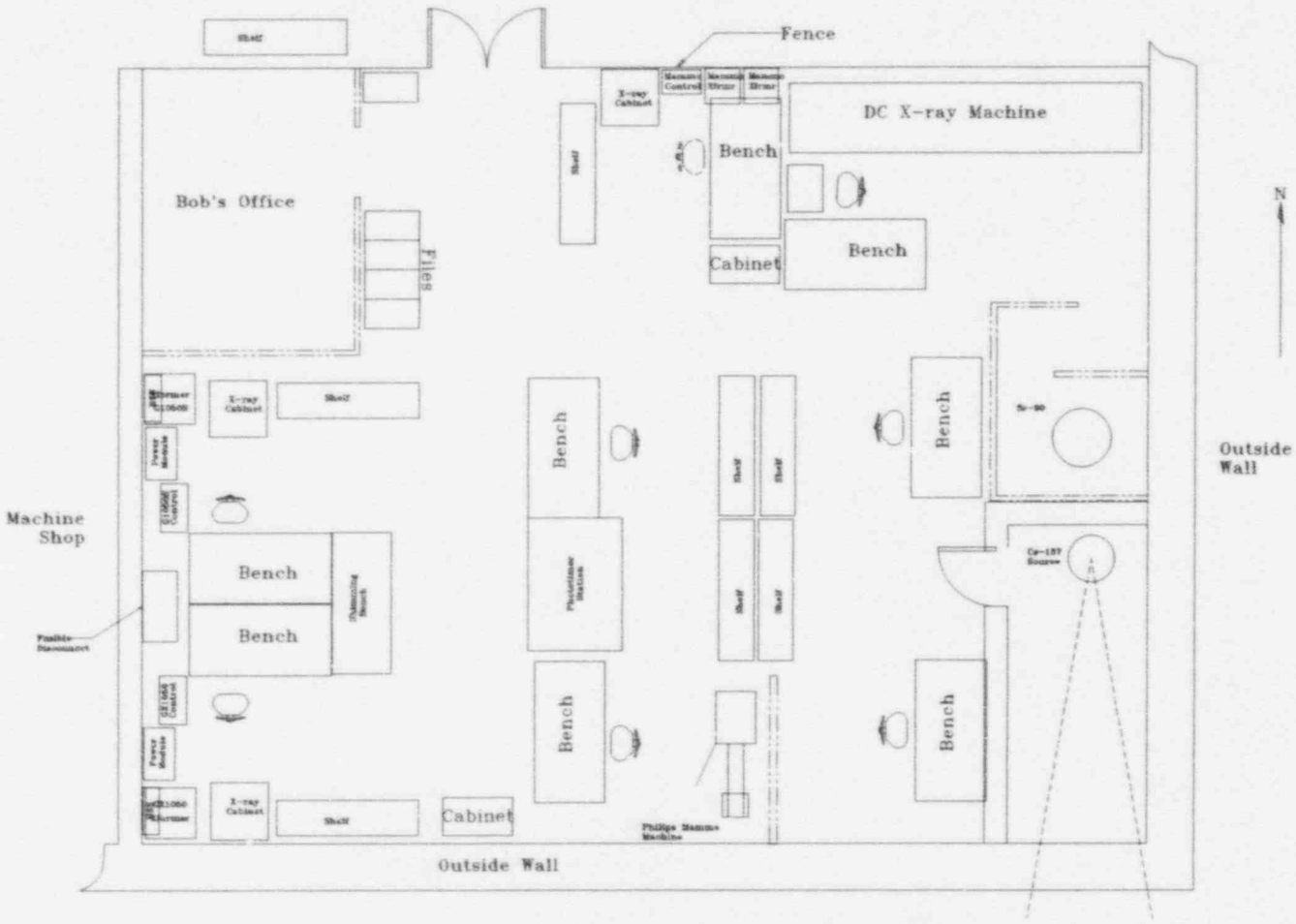
ENCLOSURE 8


N 89°43'30" W 617.11'
SE
42
37
60'-0"
15'-0"
340'-0"
PROPOSED BUILDING
40,000 SF.
100'-0"
30'-0"
Radiation calibration Lab
Sources (see Encls 9 & 10)
RECESSED DOCKS
120'-0"
50'-0"
120'-0"
13
28
42

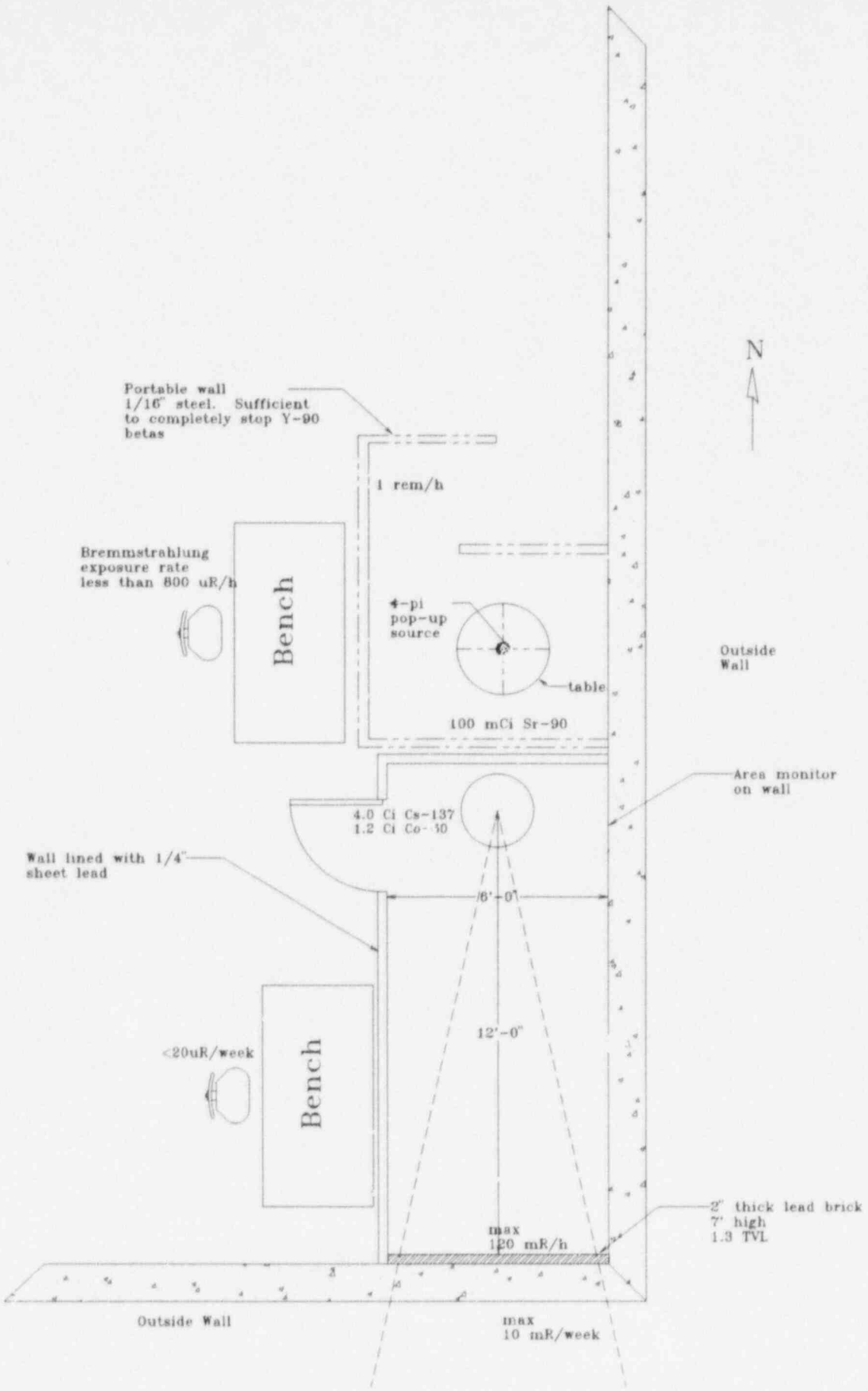
Enclosure 9

RMD X-ray Calibration Lab

1/8" = 1'



Enclosure 10



Keithley RMD X-ray, Gamma-ray Lab

6045 Cochran Rd. Solon, Ohio 1/4"=1'

Enclosure 11

Document Change Log

Changed By	Description of Change	Change Date

General Manager Approval Required Prior to Use	**Approval:** T Stenderm	**Date:** 9/20/96

1. Purpose

This AOP is intended to set forth policies and procedures governing the safe use and handling of radioactive materials and radiation-generating equipment at RMD.

2. Scope

The policies, practices, and procedures described herein apply to all Keithley personnel, visitors, officers, and managers. Strict compliance with this document is mandatory under penalty of disciplinary action and/or termination.

2.1. Governing Regulations

2.1.1. Federal Regulations

US Code of Federal Regulations, Title 21

2.1.2. State Regulations

State of Ohio Department of Health Radiation Protection Rules

3. Policies

3.1. Access to Radiation Calibration Laboratory

The Radiation Calibration Laboratory is physically segregated from the manufacturing area by a wall and fence for limited access and is considered a secured area. The secured area does not include the laboratory supervisor's office or the path from the fence doorway to the office, as marked by tape on the floor. Only authorized personnel may enter the designated, secured area.

3.1.1. Radiation Workers

Radiation workers, who have undergone the required training (§5.3) and who have been issued personal dosimeters (§3.4) may enter the laboratory at any time provided they are wearing their dosimeter. If an employee has lost his dosimeter or left it at home, he must see the RSO for issuance of a temporary dosimeter before entering the lab.

3.1.2. Non-radiation Workers

Occasionally, a Keithley employee, to whom a dosimeter has not been issued, may require access to the Calibration Laboratory. The employee may be granted permission to access the facility by the RSO. The employee must demonstrate a valid need to enter the lab, after which the RSO will issue a temporary film badge or direct-reading dosimeter. The dosimeter must be worn at all times while the employee is in the lab. The dosimeter must be returned to the RSO after business in the lab is finished. The RSO will keep a log per §3.4.6.

3.1.3. Visitors

Provision is made for access to the lab facilities by visitors, such as X-ray equipment service engineers, consultants, contractors, sales reps, or visiting customers. All visitors must wear a personal dosimeter when in the lab. The dosimeter may be the property of the visitor, as is the case with X-ray service engineers and some consultants. If the visitor does not have his own dosimeter, he must be issued a temporary film badge or direct-reading dosimeter by the RSO. The dosimeter must be worn at all times while the employee is in the lab. The dosimeter must be returned to the RSO after business in the lab is finished. The RSO will keep a log per §3.4.6.

3.1.4. Janitorial Personnel

Janitorial personnel need not wear dosimeters provided they perform their cleaning services at a time in which all X-ray generating equipment is turned off. Janitorial personnel may not enter any of the shielded areas containing radioactive isotopes. Prior to their first access to the Radiation Calibration Laboratory, the RSO will meet with the janitorial personnel and advise them of off-limit areas and radiation safety.

3.2. Other Areas Where Radiation is Used

Use of radiation producing equipment and/or non-licensed material in other areas of the building must be carried out with the knowledge and control of the RSO. Some examples of this type of use of radiation include small cabinet X-ray machines, check sources and other exempt quantities.

3.2.1. Notification of the RSO

The RSO must be made aware of all ionizing radiation-producing equipment and sources on the premises.

3.2.2. Radiation Safety

The RSO will take the necessary steps to assure safety. This may include posting signs, setting up temporary barriers, and/or restricting access to the area.

3.2.3. Personal Dosimeters

Radiation detection devices must be worn by personnel operating radiation-producing equipment located outside the Calibration Laboratory. If the RSO deems it necessary, he may designate the area as restricted to trained radiation workers, in which case all personnel in the vicinity must wear radiation detection devices.

3.3. Operation of Radiation-Producing Equipment

Possession of a personal dosimeter entitles the bearer to enter the Calibration Laboratory area, but does not imply permission to operate radiation-producing equipment. Only employees who have been properly trained and have written permission of the RSO may operate the equipment.

3.4. Personal Dosimeters and Records

3.4.1. Issuance of personal dosimeters

Dosimeters are issued by the RSO to Keithley employed personnel and other persons who have demonstrated a valid need to regularly enter the Calibration Laboratory to perform company business. Prior to issuance of dosimeters, the individual must attend a radiation safety training session, per §5.3.

3.4.2. When must an employee wear his/her dosimeter.

Personal dosimeters must be worn at all times in which the employee is in the Calibration Laboratory and when the employee is in an outside facility in which dosimeters are required by the facility.

3.4.3. When must an employee not wear his/her dosimeter.

The employee may not wear his/her dosimeter when he/she is receiving a radiation exposure that is not related to work for Keithley, such as medical X-rays or doses received during employment by another company. Dosimeters are to remain on the RMD premises when the employee leaves, except in those cases in which the employee is traveling to an outside radiation facility on Keithley business.

3.4.4. Lost or misplaced dosimeters

In the event that the employee misplaces or loses his/her dosimeter, he/she must report the loss to the RSO before entry to the Calibration Laboratory is permitted. The RSO will issue a temporary dosimeter to be used until the assigned dosimeter is located or replaced.

3.4.5. Dosimetry records

Personal dosimeters are to be read and maintained by ICN or equivalent dosimetry service. Records of doses are kept in a file by the RSO. An employee's dosimetry record may be reviewed by that employee at any time. Annually, the RSO will supply each employee with a written report of his/her annual dose.

3.4.6. Visitor dosimeters

The RSO will maintain film badges and/or direct-reading dosimeters for the use of personnel to whom permanent badges have not been issued. The RSO will also keep a log of the names and companies of dosimeter users along with a record of doses measured by the dosimeters.

3.5. Other rules and policies

3.5.1. Food or beverage may not be consumed in any area containing radioactive material. Smoking and application of cosmetics are also prohibited in these areas.

3.5.2. Anyone who purposely irradiates a personal dosimeter will be subject to disciplinary action.

3.5.3. No employee may intentionally defeat the safety interlocks on X-ray machines and radioactive sources.

4. Responsibilities

4.1. Radiation Safety Officer

The RSO is ultimately responsible for administering this Radiation Safety Program. He is responsible for maintaining records, seeing that the equipment is safe and well maintained, training employees, complying with regulations, and all other tasks related to this Program.

4.2. Radiation Workers

The Radiation Workers are responsible for complying with the policies set forth in this Program. Any employee found not complying with this Program may face disciplinary action.

4.3. Manufacturing Manager and Division General Manager

RMD management will provide authority and support to the RSO for carrying out this policy.

5. Procedures

5.1. Administration of Personnel Dosimeters

Film or TLD badges will be used for the purposes of personnel dosimetry. The badges will be serviced by a commercial dosimetry service. Dosimeters will be submitted monthly. Dosimetry records will be maintained by the RSO and made available for personnel review. A rack will be located near the entrance of the Calibration Laboratory for storage of the dosimeters when not being worn.

5.2. Surveys

Radiation surveys will be performed quarterly. An ionization chamber survey meter is used to survey the gamma sources and X-ray machines, and a pancake-type GM tube is used for surveying the beta source. Survey locations are indicated in Figure 1.

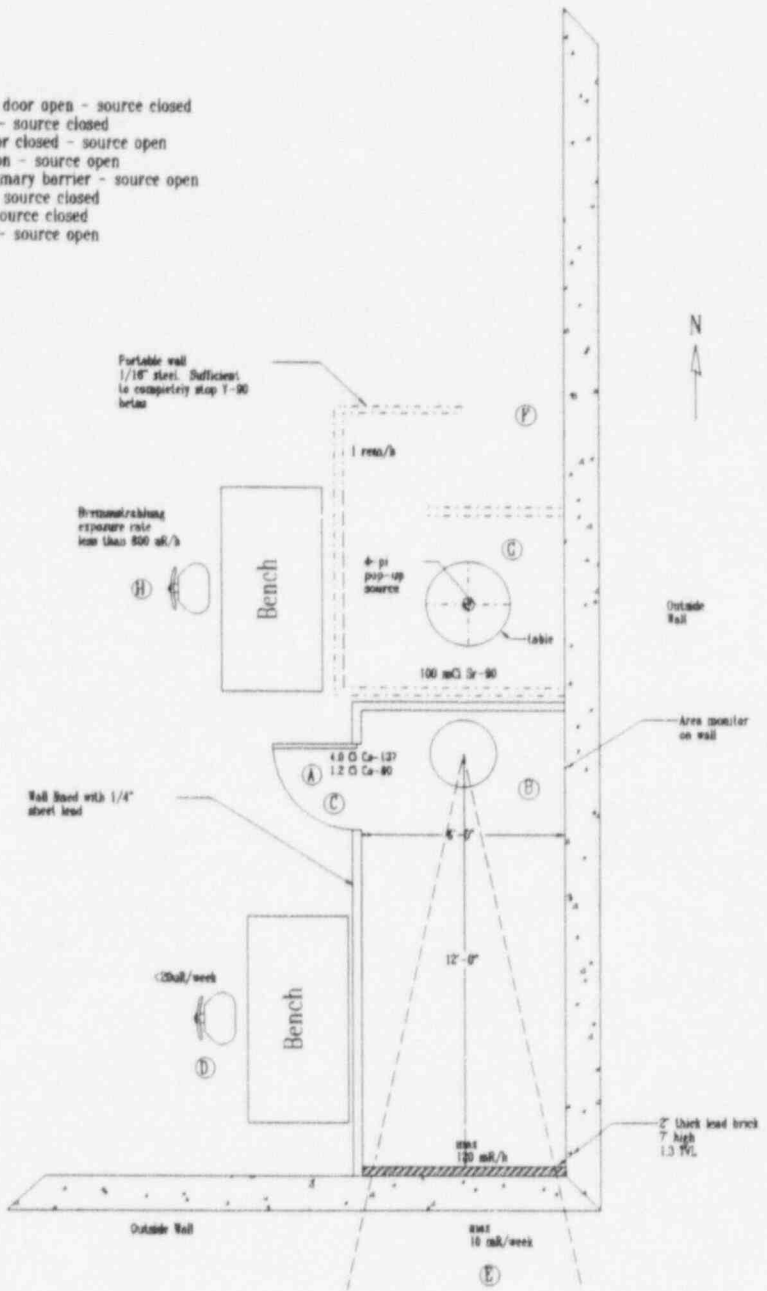
Swipes will be taken at intervals of 6 months.

Sources will be inventoried at quarterly intervals.

Survey records are maintained by the RSO for a minimum of 3 years.

Survey Locations:

(A) Gamma source doorway - door open - source closed
(B) Gamma source enclosure - source closed
(C) Gamma source door - door closed - source open
(D) Gamma source work station - source open
(E) Gamma source outside primary barrier - source open
(F) Beta source entry maze - source closed
(G) Beta source enclosure - source closed
(H) Beta source work station - source open



Keithley RMD X-ray, Gamma-ray Lab
6045 Cochran Rd. Solon, Ohio

Figure 1

General Manager Approval Required Prior to Use	**Approval:** T Sheridan	**Date:** 9/20/96

5.3. Training

All radiation workers are required to participate in a four-hour training program prior to their receiving clearance to work in the Calibration Laboratory. In addition, two-hour refresher courses will be held annually. Training records will be maintained in the employee training files and the radiation safety files. Training sessions will consist of six parts:

1. Introductory comments
2. Viewing of instructional video cassette
3. Discussion
4. Hands-on demonstration of types of radiation, shielding, and distance using survey meter and sources. Session to include instructions on operation of survey meters.
5. Tour of the Lab and safe use of radiation-generating equipment.
6. Exam

Topics to be covered include:

- Atomic structure and radioactivity
- Natural and man-made radiation
- Biological effects of radiation
- Radiation risks
- Radiation protection standards
- Radiation detection instruments
- Exposure contamination control
- Laboratory safety
- Emergency response/procedures

5.4. QA of Interlocks and Safety Equipment

Door interlocks, area monitors, kill switches, etc., will be tested daily.

5.5. Emergency Procedures

5.5.1. Accidental Exposure to Radiation

An employee who believes he has accidentally received direct exposure to a radioactive source or X-ray tube must contact the RSO as soon as possible thereafter. The RSO will gather information regarding length of exposure, distance to source, etc., so he may calculate the approximate dose received by the employee. The employee's dosimeter will be sent out for an immediate reading. The RSO will take whatever action is necessary depending on the estimated dose, and badge reading.

5.5.2. Area Monitor Alarms

Personnel must always observe area monitor warning lights before entering radiation areas. Employees may not enter a radiation area if the area monitor displays a high radiation condition. If an area monitor shows high radiation but the source control panel indicates the source is closed, the door to the source room should be kept closed, and the RSO should be notified immediately.

6. Electronic Files Listing

The table below lists all of the electronic master files which pertain to this AOP revision.

Name	Date	Description	Comments
AOP1101A.DOC	9/20/96	This Document	Initial Release

[1] Storage directory: ..\ADM_DATA\AOP\MASTER

JAN 2 3 1997

Robert J. Kobistek
Keithley Instruments, Inc.
Radiation Measurements Division
28775 Aurora Road
Cleveland, OH 44139

Dear Mr. Kobistek:

Enclosed is your NRC Material License Number 34-26760-01 in accordance with your request.

Please review the enclosed document carefully and be sure that you understand all conditions. If there are any errors or questions, please notify the U.S. Nuclear Regulatory Commission, Region III office at (630) 829-9887 so that we can provide appropriate corrections and answers.

Please be advised that your license expires at the end of the day, in the month, and year stated in the license. Unless your license has been terminated, you must conduct your program involving byproduct materials in accordance with the conditions of your NRC license, representations made in your license application, and NRC regulations. In particular, note that you must:

1. Operate in accordance with NRC regulations 10 CFR Part 19, "Notices, Instructions and Reports to Workers; Inspections," 10 CFR Part 20, "Standards for Protection Against Radiation," and other applicable regulations.

2. Not possess and use materials authorized in Items 6, 7, and 8, on the license until:

   a. You have constructed the facilities and obtained the equipment described in the license application and supporting documentation; and

   b. You have notified the U. S. Nuclear Regulatory Commission, Region III, ATTN: Chief, Nuclear Materials Licensing Branch, in writing, that activities authorized by the license will be initiated.

3. Notify NRC, in writing, within 30 days:

   a. When the Radiation Safety Officer permanently discontinues performance of duties under the license or has a name change; or

301903

b. When the licensee's mailing address changes (no fee is required if the location of byproduct material remains the same).

4. In accordance with 10 CFR 30.36(b) and/or license condition, notify NRC, promptly, in writing, and request termination of the license:

   a. When you decide to terminate all activities involving materials authorized under the license; or

   b. If you decide not to complete the facility, acquire equipment, or possess and use authorized material.

5. Request and obtain a license amendment before you:

   a. Change Radiation Safety Officers;

   b. Order byproduct material in excess of the amount, or radionuclide, or form different than authorized on the license;

   c. Add or change the areas of use or address or addresses of use identified in the license application or on the license; or

   d. Change ownership of your organization.

6. Submit a complete renewal application with proper fee or termination request at least 30 days before the expiration date of your license. You will receive a reminder notice approximately 90 days before the expiration date. Possession of byproduct material after your license expires is a violation of NRC regulations. A license will not normally be renewed, except on a case-by-case basis, in instances where licensed material has never been possessed or used.

In addition, please note that NRC Form 313 requires the applicant, by his/her signature, to verify that the applicant understands that all statements contained in the application are true and correct to the best of the applicant's knowledge. The signatory for the application should be the licensee or certifying official rather than a consultant.

You will be periodically inspected by NRC. Failure to conduct your program in accordance with NRC regulations, license conditions, and representations made in your license application and supplemental correspondence with NRC will result in enforcement action against you. This could include issuance of a notice of violation, or imposition of a civil penalty, or an order suspending, modifying or revoking your license as specified in the General Policy and Procedures for NRC Enforcement Actions. Since serious consequences to employees and the public can result from failure to comply with NRC requirements, prompt and vigorous

enforcement action will be taken when dealing with licensees who do not achieve the necessary meticulous attention to detail and the high standard of compliance which NRC expects of its licensees.

Sincerely,

Original Signed By
Evelyn R. Matson
Nuclear Materials Licensing Branch

License No. 34-26760-01
Docket No. 030-34256

Enclosure: License No. 34-26760-01

DOCUMENT NAME: M:\03034256.CL6
To receive a copy of this document, indicate in the box: "**C**" = Copy without attachment/enclosure "**E**" = Copy with attachment/enclosure "**N**" = No copy

OFFICE	DNMS/RIII	N							
NAME	ERMatson:brt								
DATE	01/8/97								

OFFICIAL RECORD COPY

KEITHLEY RADIATION MEASUREMENTS

Radiation Measurements Division
Keithley Instruments, Inc.
28775 Aurora Road
Cleveland, Ohio 44139
(216) 248-0400 • Fax: (216) 349-2307

January 2, 1997

Ms. Evelyn R. Matson
US Nuclear Regulatory Commission, Region III
801 Warrenville Rd.
Lisle, IL 60532-4351

Re: 301903, your conversation record of 12/30/96

Dear Ms. Matson:

This letter is in response to the conversation record of 12/30/96. Responses to your questions appear below, numbered accordingly.

With this letter, please find the enclosures:

- Enclosure 1 - draft of revision B of Administrative Operating Procedure AOP-11-01. It has been labeled, revision B-01-02-97 to differentiate it from the previous revision sent on November 27, 1996. Following award of radioactive material license, this AOP revision will be formally released as revision B.
- Enclosure 2 - Specification sheet for the Ludlum Model 180-2 Sample Holder
- Enclosure 3 - Leak Test Analysis Worksheet (draft)
- Enclosure 4 - East elevation view of the gamma ray calibration range.
- Enclosure 5 - Revised floor plan.

1. Additional text has been added to AOP-11-01 to address hands-on training. It may be found in section 5.5. The additional language specifies the requirement for hands-on training of calibrator operation.

2a. During analysis of leak test wipes, constant geometry will be maintained by the use of a Ludlum Model 180-2 Sample Holder. I have enclosed a specification sheet as Enclosure 2.

2b. The following table summarizes the considerations that went into determining the minimum counting times to attain the minimum detectable activity of 185 Bq. The background count rate was experimentally determined to be approximately 35 cpm. Through the use of check sources it was determined that the system must be capable of measuring 100 cpm above background. To assay a wipe, a 6 min background count will be followed by an 11 minute count of the wipe. The count rates, so determined will then be subtracted. The count times were chosen by an optimization algorithm that minimized the total count time while keeping the overall relative uncertainty less than 10%.

Operation	Count Rate (cpm)	Count Time (min)	σ (cpm)
Background Measurement	35	6	2.42
Swipe Assay	135	11	3.50
		Quad. Sum	4.26
		2σ	8.63
		Relative Uncertainty due to counting statistics	8.6%
		Uncertainty of NIST calibrated sources	5.0%
		Counting error of activity calibration	1.4%
		Overall Uncertainty	10.0%

2c. Three NIST-traceable calibrations sources will be used. 1) a ^{60}Co source, 2) a ^{137}Cs source, and 3) a ^{90}Sr source. Energies of the radiation produced by the sources are identical to those of the sources being leak-tested: 1) 1.2 MeV (avg) gamma, 2) 662 keV gamma, and 3) 2.3 MeV (max) beta (from ^{90}Y). The sources have NIST traceable calibrations and are accurate to ±5%.

2d. To convert the meter readings to μCi, a worksheet similar Enclosure 3 will be used. This worksheet contains counting instructions and calculations. This is a draft worksheet; a similar sheet will be used in practice. It is likely that this worksheet (or equivalent) will be implemented as a computer spreadsheet.

3. The beta source room is a maze-type arrangement with no door. Therefore, there are no barriers that would prevent a worker from exiting the high-radiation area. The gamma range will be equipped with a door that is lockable only to prevent persons from entering from the outside. The door will always remain openable from the inside.

4a. A table, similar to the one used in my letter to you of November 27, 1996, is shown below to illustrate dose rates on the roof. In addition, an elevation drawing is included as Enclosure 4.

As you can see from the elevation, the irradiator range is enclosed by the shielded walls to a height of 7 feet. The space above the range is open, and the ceiling is 18 feet above the floor. The ceiling consists of corrugated 1/16" steel.

In the following analysis, the scattering target is assumed to be the primary lead wall. A 90° scatter angle is assumed.

$$H = A\Gamma\left[\frac{ae^{-\mu T_{Steel}}}{d_1^2 d_2^2} \times \frac{F}{400cm^2}\right]$$

Variable	Meaning	^{60}Co Value	^{137}Cs Value
A	Source activity	44,400 MBq	148,000 MBq
Γ	Specific gamma ray dose constant	3.703×10^{-4} mSv·m^2/h·MBq	1.032×10^{-4} mSv·m^2/h·MBq
d_1	Distance from source to primary barrier	3.6 m	3.6 m
d_2	Distance from primary barrier to point 30 cm above roof.	4.8 m	4.8 m
μ	Linear attenuation coefficient for radiation scattered at 90°	0.733 cm^{-1} (for 358 keV γ)	0.858 cm^{-1} (for 288 keV γ)
F	Field size at primary barrier	25,500 cm^2	25,500 cm^2
T_{steel}	Thickness of the steel secondary barrier	0.159 cm	0.159 cm
a	Fraction of radiation scattered at 90° for a field area of 400cm^2, measured at a distance of 1 m	0.0009 m^2	0.0028 m^2
H	Dose-equivalent rate at roof when source is "on".	2.8 μSv/h 0.28 mrem/h	8.0 μSv/h 0.80 mrem/h

In order to receive the annual limit of 100 mrem, a roof maintenance worker would have to work 156 eight-hour work days in a given year in the area directly over the source range, given an estimated usage factor of 0.1. It is impossible to conceive of any maintenance activity that would require such an extended presence.

4b. The exterior walls consist of vermiculite-filled cinder block with a solid, decorative, concrete facing on the outside. The concrete facing is three inches thick with a one-inch

layer of mortar between it and the cinder block. For the purpose of these calculations, the entire wall was assumed to have the shielding equivalence of 5 inches of concrete.

Five inches of concrete is greater than the range of ^{90}Y beta particles, therefore the dose to the public from the beta source will be zero.

For the gamma range, it was determined that the location of greatest dose rate due to scatter was at a point closest to the primary barrier. The following table illustrates the values that went into calculating the dose rate at that location.

$$H = A\Gamma\left[\frac{ae^{-\mu T_{Con}}}{d_1^2 d_2^2} \times \frac{F}{400cm^2}\right]$$

Variable	Meaning	^{60}Co Value	^{137}Cs Value
A	Source activity	44,400 MBq	148,000 MBq
Γ	Specific gamma ray dose constant	3.703×10^{-4} mSv·m²/h·MBq	1.032×10^{-4} mSv·m²/h·MBq
d_1	Distance from source to primary barrier	3.6 m	3.6 m
d_2	Distance from primary barrier to point 30 cm outside the building.	1.5 m	1.5 m
μ	Linear attenuation coefficient for radiation scattered at 90°	0.23 cm^{-1} (for 358 keV γ)	0.25 cm^{-1} (for 288 keV γ)
F	Field size at primary barrier	25,500 cm^2	25,500 cm^2
T_{Con}	Thickness of the concrete secondary barrier	12.7 cm	12.7 cm
a	Fraction of radiation scattered at 90° for a field area of 400cm², measured at a distance of 1 m	0.0009 m^2	0.0028 m^2
H	Dose-equivalent rate at roof when source is "on".	1.7 μSv/h 0.17 mrem/h	3.9 μSv/h 0.39 mrem/h

The area directly outside the east wall consists of a fifteen-foot strip of landscaping. Beyond the landscaping is a parking lot. The nearest parking space is thirty feet from the landscaped area, so the maximum instantaneous dose rate (when source is on) to a person in a parked car is 5 μrem/h. Given the usage factor of 0.1, a person would have to spend 214,000 hours in his car to accumulate 100 mrem. Since there are only 8,760 hours in a year, this is clearly impossible.

The only other possible occurrence of exposure to the public would to a landscape worker, working in the fifteen foot strip. The worker would have to spend 2,564 hours at that location to accumulate 100 mrem (given the 0.1 usage factor). In order to accomplish this in a year, the worker would have to spend 320 eight-hour work days in the location outside the wall. This is impossible. A typical work year consists of 260 work days.

4c. Thank you for pointing out my error. The correct shielding thickness is 0.318 cm of lead. If one corrects this value in my calculations, the resulting dose equivalent rates are 0.40 mrem/h for the cobalt source and 0.88 mrem/h for the cesium source. This is a controlled area.

4d. Please disregard the "10 mR/week" annotation on the site plan. This was erroneously left in the drawing and was the result of an earlier calculation that assumed three inches of lead instead of two. The calculations submitted in my November 27 letter indicate 20 mrem / week for a usage factor of 0.1 and a work week of 40 hours. I have generated a new drawing and enclosed it as Enclosure 5.

The area directly outside the primary shield is paved and unoccupied. As you can see from the site plan submitted in my initial application (Enclosure 10 of original application), there is no parking, recreation or any other activity associated with that area. The large dead space is designed for trucks to turn around when maneuvering the loading dock area. If a person chooses to stand in that location, to eat his lunch, smoke a cigarette, etc., he would have to occupy that position for 200 hours in a year's time, in order to accumulate a 100 mrem dose. Keithley employees are allowed 30 minutes for lunch plus two fifteen minute breaks per day. Given a 260 day work year, an employee would have to spend 77% of his allotted lunch/break time standing 30 cm from the primary barrier to accumulate 100 mrem in a year.

5. Upper management (i.e. Mr. Terry Sheridan, VP and General Manager) or his successor will review the results of the annual audit and will support effective and timely corrective actions to identified deficiencies.

Thank you for your phone call and the expedience with which you are processing my application. If you have need to discuss this response, please contact me at (216)498-2577.

Sincerely,

Robert J. Kobistek, MS
Radiation Safety Officer

Encl.

Encl. 1
Document Change Log

Changed By	Description of Change	Change Date
R.J.K.	Modified to incorporate additional information requested by NRC	

1. Purpose

This AOP is intended to set forth policies and procedures governing the safe use and handling of radioactive materials and radiation-generating equipment at RMD.

2. Scope

The policies, practices, and procedures described herein apply to all Keithley personnel, visitors, officers, and managers. Strict compliance with this document is mandatory under penalty of disciplinary action and/or termination.

2.1 Governing Regulations

2.1.1 Federal Regulations

US Code of Federal Regulations, Title 10

2.1.2 State Regulations

State of Ohio Department of Health Radiation Protection Rules

3. Policies

3.1 Access to Radiation Calibration Laboratory

The Radiation Calibration Laboratory is physically segregated from the manufacturing area by a wall and fence for limited access and is considered a secured area The secured area does not include the laboratory supervisor's office or the path from the fence doorway to the office, as marked by tape on the floor. Only authorized personnel may enter the designated, secured area.

3.1.1 Radiation Workers

Radiation workers, who have undergone the required training (§5.3) and who have been issued personal dosimeters (§3.4) may enter the laboratory at any time provided they are wearing their dosimeter. If an employee has lost his dosimeter or left it at home, he must see the RSO for issuance of a temporary dosimeter before entering the lab.

3.1.2 Non-radiation Workers

Occasionally, a Keithley employee, to whom a dosimeter has not been issued, may require access to the Calibration Laboratory. The employee may be granted permission to access the facility by the RSO. The employee must demonstrate a valid need to enter the lab, after which the RSO will issue a temporary film badge or direct-reading dosimeter. The dosimeter must be worn at all times while the employee is in the lab. The dosimeter must be returned to the RSO after business in the lab is finished. The RSO will keep a log per §3.4.6.

3.1.3 Visitors

Provision is made for access to the lab facilities by visitors, such as X-ray equipment service engineers, consultants, contractors, sales reps, or visiting customers. All visitors must wear a personal dosimeter when in the lab. The dosimeter may be the property of the visitor, as is the case with X-ray service engineers and some consultants. If the visitor does not have his own dosimeter, he must be issued a temporary film badge or direct-reading dosimeter

by the RSO. The dosimeter must be worn at all times while the employee is in the lab. The dosimeter must be returned to the RSO after business in the lab is finished. The RSO will keep a log per §3.4.6.

3.1.4 Janitorial Personnel

Janitorial personnel need not wear dosimeters provided they perform their cleaning services at a time in which all X-ray generating equipment is turned off. Janitorial personnel may not enter any of the shielded areas containing radioactive isotopes. Prior to their first access to the Radiation Calibration Laboratory, the RSO will meet with the janitorial personnel and advise them of off-limit areas and radiation safety.

3.2 Other Areas Where Radiation is Used

Use of radiation producing equipment and/or non-licensed material in other areas of the building must be carried out with the knowledge and control of the RSO. Some examples of this type of use of radiation include small cabinet X-ray machines, check sources and other exempt quantities.

3.2.1 Notification of the RSO

The RSO must be made aware of all ionizing radiation-producing equipment and sources on the premises.

3.2.2 Radiation Safety

The RSO will take the necessary steps to assure safety. This may include posting signs, setting up temporary barriers, and/or restricting access to the area.

3.2.3 Personal Dosimeters

Radiation detection devices must be worn by personnel operating radiation-producing equipment located outside the Calibration Laboratory. If the RSO deems it necessary, he may designate the area as restricted to trained radiation workers, in which case all personnel in the vicinity must wear radiation detection devices.

3.3 Operation of Radiation-Producing Equipment

Possession of a personal dosimeter entitles the bearer to enter the Calibration Laboratory area, but does not imply permission to operate radiation-producing equipment. Only employees who have been properly trained and have written permission of the RSO may operate the equipment.

3.4 Personal Dosimeters and Records

3.4.1 Issuance of personal dosimeters

Dosimeters are issued by the RSO to Keithley employed personnel and other persons who have demonstrated a valid need to regularly enter the Calibration Laboratory to perform company business. Prior to issuance of dosimeters, the individual must attend a radiation safety training session, per §5.3.

3.4.2 When must an employee wear his/her dosimeter.

Personal dosimeters must be worn at all times in which the employee is in the Calibration Laboratory and when the employee is in an outside facility in which dosimeters are required by the facility.

3.4.3 When must an employee not wear his/her dosimeter.

The employee may not wear his/her dosimeter when he/she is receiving a radiation exposure that is not related to work for Keithley, such as medical X-rays or doses received during employment by another company. Dosimeters are to remain on the RMD premises when the employee leaves, except in those cases in which the employee is traveling to an outside radiation facility on Keithley business.

3.4.4 Lost or misplaced dosimeters

In the event that the employee misplaces or loses his/her dosimeter, he/she must report the loss to the RSO before entry to the Calibration Laboratory is permitted. The RSO will issue a temporary dosimeter to be used until the assigned dosimeter is located or replaced.

3.4.5 Dosimetry records

Personal dosimeters are to be read and maintained by ICN or equivalent dosimetry service. Records of doses are kept in a file by the RSO. An employee's dosimetry record may be reviewed by that employee at any time. Annually, the RSO will supply each employee with a written report of his/her annual dose.

3.4.6 Visitor dosimeters

The RSO will maintain film badges and/or direct-reading dosimeters for the use of personnel to whom permanent badges have not been issued. The RSO will also keep a log of the names and companies of dosimeter users along with a record of doses measured by the dosimeters.

3.5 Operating procedures

- Procedures must be generated to guide workers in safe operation of radiation-producing equipment. Each operator will have a copy of the operating and emergency procedures available during the use of the irradiators.

For each piece of radiation generating equipment, there must be a formal, written procedure in place that discusses the following:

- A requirement that the equipment be secured when unattended.
- A description of the actions to be taken to ensure that no one is in a range when the beam is turned on.
- A requirement that safety devices be checked for proper operation and that malfunctions or defects be corrected promptly. These records are to be retained for a minimum of two years.

3.6 Security

3.6.1 Entrance to the Calibration Laboratory

The gate entrance to the Calibration Laboratory shall be equipped with a key lock. It shall be locked during non-business hours. Only laboratory personnel, the supervisor, and the plant manager shall possess keys.

3.6.2 Entrances to the source ranges

The door to the cesium / cobalt range shall have a lockable door. The lab supervisor shall have a key. A second key for use by laboratory personnel will be stored in a secure enclosure inside the Laboratory gate. The door to the source range shall be locked and keys removed whenever the Laboratory is left unattended.

3.6.3 Source control panels

The control panels for the cesium / cobalt range and the beta range are equipped with key interlocks. Keys for use by laboratory personnel will be stored in a secure enclosure inside the Laboratory gate. The source control panels shall be locked whenever the Laboratory is left unattended

3.7 Purchase and receipt of radioactive materials and/or ionizing radiation-producing equipment

3.7.1 Purchase of radioactive materials and/or ionizing radiation producing equipment

The RSO must be notified by the responsible party prior to the purchase, leasing, renting, or borrowing of any radioactive material (including exempt quantities) or X-ray equipment. The responsible individual, the purchasing department, and the RSO will then work together to coordinate regulatory requirements with additional facilities (if necessary) and delivery of the source.

3.7.2 Receipt of radioactive materials

The RSO must be notified by the receiving department of the receipt of any parcel bearing a radioactive materials label.

3.8 Other rules and policies

3.8.1 Food or beverage may not be consumed in any area containing radioactive material. Smoking and application of cosmetics are also prohibited in these areas.

3.8.2 Anyone who purposely irradia[illegible] personal dosimeter will be subject to disciplinary action.

3.8.3 No employee may intentionally defeat the safety interlocks on X-ray machines and radioactive sources.

3.8.4 No irradiator at Keithley RMD may be used to irradiate flammable or corrosive materials.

4. Responsibilities

4.1 Radiation Safety Officer

The RSO is ultimately responsible for administering this Radiation Safety Program. He is responsible for maintaining records, seeing that the equipment is safe and well maintained, training employees, complying with regulations, and all other tasks related to this Program.

4.2 Radiation Workers

The Radiation Workers are responsible for complying with the policies set forth in this Program. Any employee found not complying with this Program may face disciplinary action.

4.3 Manufacturing Manager and Division General Manager

RMD management will provide authority and support to the RSO for carrying out this policy.

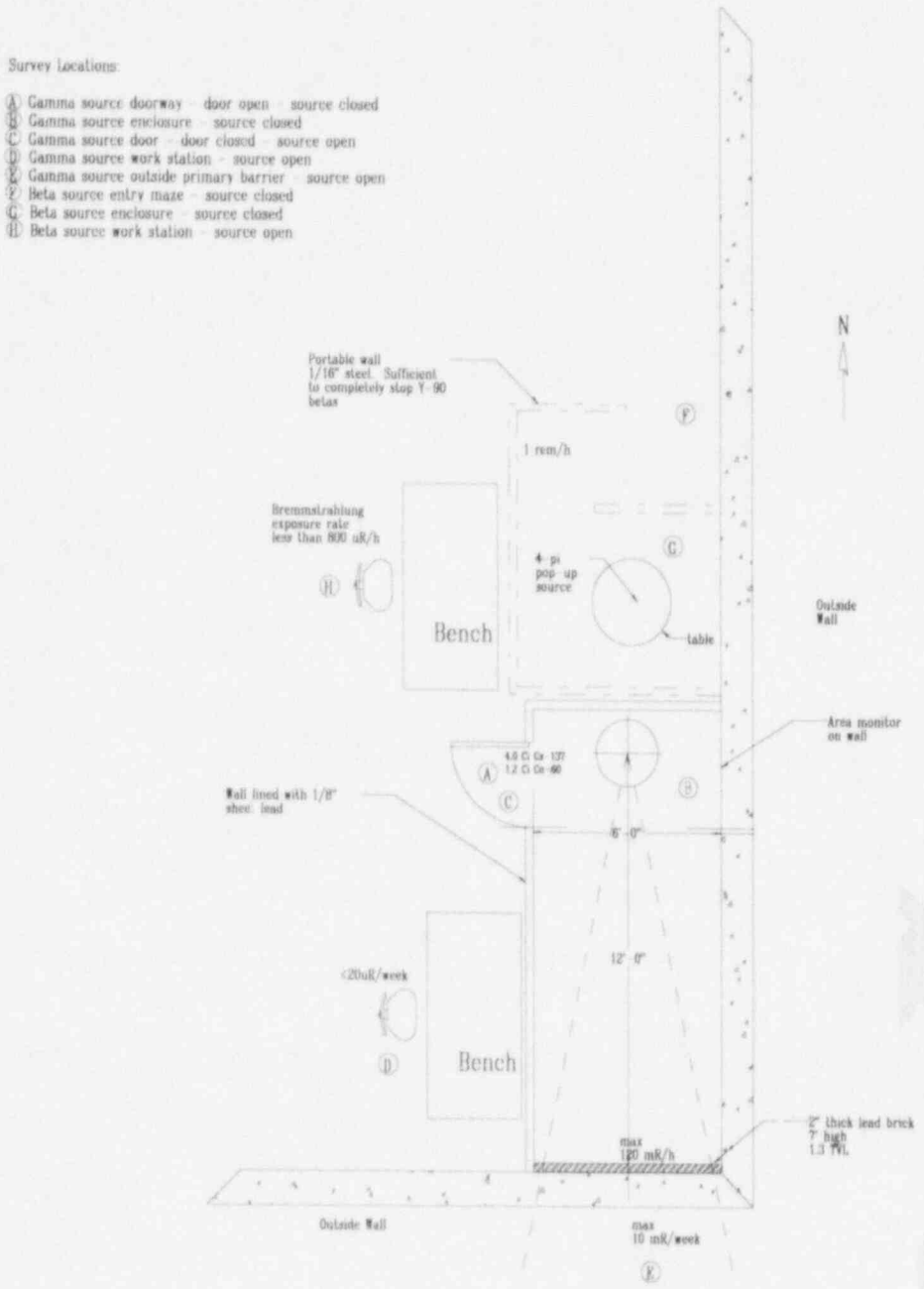
5. Procedures

5.1 Administration of Personnel Dosimeters

Film or TLD badges will be used for the purposes of personnel dosimetry. The badges will be serviced by a commercial dosimetry service. Dosimeters will be submitted monthly. Dosimetry records will be maintained by the RSO and made available for personnel review. A rack will be located near the entrance of the Calibration Laboratory for storage of the dosimeters when not being worn.

5.2 Surveys

Radiation surveys will be performed quarterly. An ionization chamber survey meter is used to survey the gamma sources and X-ray machines, and a pancake-type GM tube is used for surveying the beta source. Survey locations are indicated in Figure 1. Survey records are maintained by the RSO for a minimum of 3 years.



Keithley RMD X-ray, Gamma-ray Lab
6045 Cochran Rd. Solon, Ohio

Figure 1

General Manager Approval Required Prior to Use	**Approval:**	**Date:**

5.3 Leak Test

Leak tests are to be performed at six-month intervals according to the procedures recommended by the manufacturer and listed in the operator's manual. The survey meter used to measure the wipes must be calibrated annually and must be capable of detecting 0.005 μCi (185 Bq) of the radionuclide being tested. The RSO will verify the minimum detectability annually using check sources.

5.4 Inventory

All sources will be inventoried at quarterly intervals.

5.5 Training

Training will be conducted in the areas of radiation safety and safe operation of sources and X-ray machines. Personnel who have successfully completed radiation safety training (§5.5.1) will be issued dosimeter badges and will be permitted unsupervised access to the Calibration Laboratory. However, no person may operate radiation-generating equipment unless he/she has completed a training course in safe operation of the specific piece of equipment (§5.5.2).

5.5.1 Radiation Safety Training

All radiation workers are required to participate in a four-hour training program prior to their receiving clearance to work in the Calibration Laboratory. In addition, two-hour refresher courses will be held annually. Training records will be maintained in the employee training files and the radiation safety files. Training sessions will consist of six parts:

1. Introductory comments
2. Viewing of instructional video cassette
3. Discussion
4. Hands-on demonstration of types of radiation, shielding, and distance using survey meter and sources. Session to include instructions on operation of survey meters.
5. Tour of the Lab and safe use of radiation-generating equipment.
6. Exam

Topics to be covered include:

- Atomic structure and radioactivity
- Natural and man-made radiation
- Biological effects of radiation
- Radiation risks
- Radiation protection standards
- Radiation detection instruments
- Exposure contamination control
- Laboratory safety
- Emergency response/procedures
- Safe operation of radiation-generating equipment, including internal operating procedures.
- A discussion of the on-the-job training to be given following the training program.

The annual refresher course will include.

- Viewing of instructional video tape
- Discussion of changes in operating and emergency procedures
- Changes in regulations and license conditions
- Reports on accidents
- Results of inspections
- Emergency practice drills
- Exam

5.5.2 Operation of Radiation-Producing Equipment

Separate training sessions will be conducted to cover operating procedures for X-ray machines, the gamma irradiator, and the beta irradiator. No employee may operate a piece of radiation-generating equipment without successful completion of the appropriate training.

5.5.2.1 X-ray machine training

Training of proper use of X-ray machines will last a minimum of one hour, but may continue for a longer period of time. Training will continue until the employee(s) are able to demonstrate their ability to safely operate the equipment with no help from the instructor. Topics to be covered include:

- Location and function of controls.
- Interlocks
- Practices to avoid damaging the equipment
- Radiation and electrical safety
- Emergency procedures
- Hands-on practice
- Oral exam and demonstration of employee's proficiency in operating equipment

5.5.2.2 Gamma ray and beta range training

Training of proper use of the source ranges will last a minimum of one hour for each range, however the training will continue until the trainee(s) are able to demonstrate their ability to safely operate the equipment. Topics to be covered include:

- Procedures for setting up products to be irradiated
- Operation of source control panel
- Location and function of area monitor
- Interlocks
- Radiation safety
- Emergency procedures
- Hands-on practice
- Oral exam and demonstration of employee's proficiency in operating equipment

5.6 QA of Interlocks and Safety Equipment

- Door interlocks and area monitor will be tested daily.
- Operation of the source position indicator will be tested weekly.

- Emergency source return mechanisms will be tested weekly.
- The mechanical integrity of the source transport mechanism will be inspected quarterly.
- Irradiator maintenance will be carried out according to manufacturer's recommendations

5.7 Emergency Procedures

5.7.1 Accidental Exposure to Radiation

An employee who believes he has accidentally received direct exposure to a radioactive source or X-ray tube must contact the RSO as soon as possible thereafter. The RSO will gather information regarding length of exposure, distance to source, etc., so he may calculate the approximate dose received by the employee. The employee's dosimeter will be sent out for an immediate reading. The RSO will take whatever action is necessary depending on the estimated dose, and badge reading.

5.7.2 Area Monitor Alarms

Personnel must always observe area monitor warning lights before entering radiation areas. Employees may not enter a radiation area if the area monitor displays a high radiation condition. If an area monitor shows high radiation but the source control panel indicates the source is closed, the door to the source room should be kept closed, and the RSO should be notified immediately.

5.8 Reviews and Audits

This Radiation Safety Policy, its content and effectiveness shall be reviewed annually. The RSO is primarily responsible for organizing the annual review.

5.8.1 Content of Audit

The following items will be reviewed during the annual audit:

- Content of this document
- Compliance of RSO and radiation workers with the Radiation Safety Program
- Compliance of RSO and radiation workers with regulations
- Personnel dosimetry records
- Results of NRC and/or State audits
- Worker training program – relevance, effectiveness, and implementation

5.8.2 Management responsibility

The Division General Manager and any other manager to whom the RSO must report shall be given copies of all correspondence with the NRC including the original license application, the license, amendments, inspection findings, and any relevant regulation changes. Management will utilize this information on a continuous basis, as well as during the annual audit, to evaluate the performance of the Radiation Safety Program and the RSO.

5.8.3 RSO Performance Evaluation

The performance of the RSO will be evaluated as part of his/her annual employee performance evaluation, conducted according to guidelines established by the Human Resources Department. If, in addition to radiation safety duties, the RSO also performs another function (e.g. Calibration Lab Physicist / Supervisor), a separate section will exist in the evaluation document for the RSO function. The RSO will be evaluated on his/her performance of the duties listed in §4.1, as well as his/her proficiency at attaining agreed-upon personal goals. The

RSO portion of the performance evaluation will be conducted by the Division General Manager, to whom the RSO has direct report.

5.8.4 Audit review

During the annual audit, a review shall be made of audits conducted by the RSO during the year. The annual review shall determine whether the RSO has audited authorized users for regulatory compliance and adherence to the content of RMD's license.

6. Electronic Files Listing

The table below lists all of the electronic master files which pertain to this AOP revision.

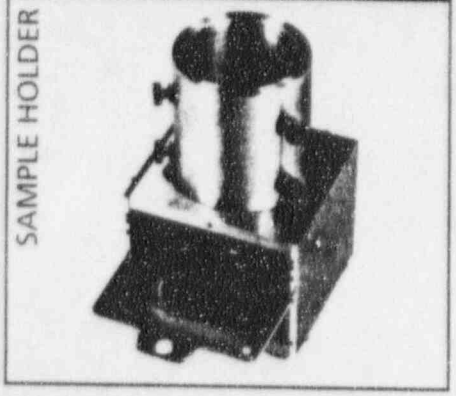
Name	Date	Description	Comments
AOP1101A.DOC	9/20/96	This Document	Initial Release
AOP1101B.DOC		This Document	Revision B

Storage directory: ..\ADM_DATA\AOP\MASTER

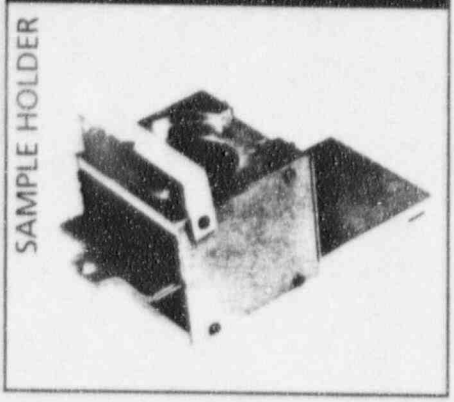
Sample Holders

Enclosure 2

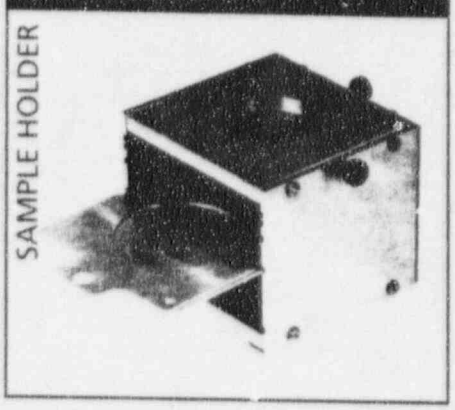
Model 180-1



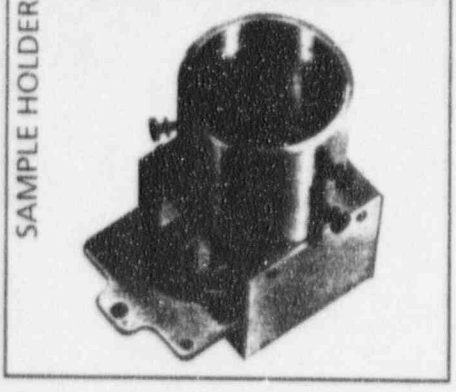
Model 180-2



Model 180-4



Model 180-7



Common Specifications

INDICATED USE: Repeatable geometry counting of wipes, filter paper, or slides
SAMPLE SIZE: 4.7 cm diameter maximum
SAMPLE TRAY: Selectable spacing of 0.125" (0.32 cm), 0.25" (0.64 cm), 0.5" (1.3 cm), 1"(2.5 cm), and 2" (5.1 cm) from detector
CONSTRUCTION: Anodized aluminum frame and sample tray
WEIGHT: 1.1lbs (0.5kg)

	180-1	180-2	180-4	180-7
COMPATIBLE DETECTORS	43-2, 44-1, 44-2, 44-3, 44-21, 44-98 (all 2" OD detectors)	44-9	44-7	44-10, 44-17 (all 2.6" OD detectors)
SIZE	5.5"(13.9cm)H 3.3"(8.4cm)W 3.8"(9.7cm)L	3.6"(9.1cm)H 3"(7.6cm)W 6"(15.2cm)L	2.6"(6.6cm)H 3.5"(8.9cm)W 3.8"(9.7cm)L	5.7"(14.5cm)H 3.3"(8.4cm)W 3.8"(9.7cm)L

Enclosure 3

Leak Test Analysis Worksheet

Keithley RMD

Date: Check Source SN:

Source: Probe: Counter:

Background Measurement.

1. Place probe in sample holder. No sample in drawer
2. Count for 6 minutes.
3. Record reading A _____

4. Calculate background rate: A / 6 = B _____

Calibration.

1. Place NIST calibrated source in sample drawer
2. Count for 1 minute
3. Record reading C _____

4. Subtract background C - B = D _____
5. Calculate source activity

Date of source calibration: E _____

Number of years since calibration: F _____

Source half-life (years) G _____

Activity on calibration date (μCi) H _____

Current activity $H \times 2^{-F/G}$ = I _____

6. Calculate calibration factor (μCi / cpm) I / D = J _____

Measure Wipe:

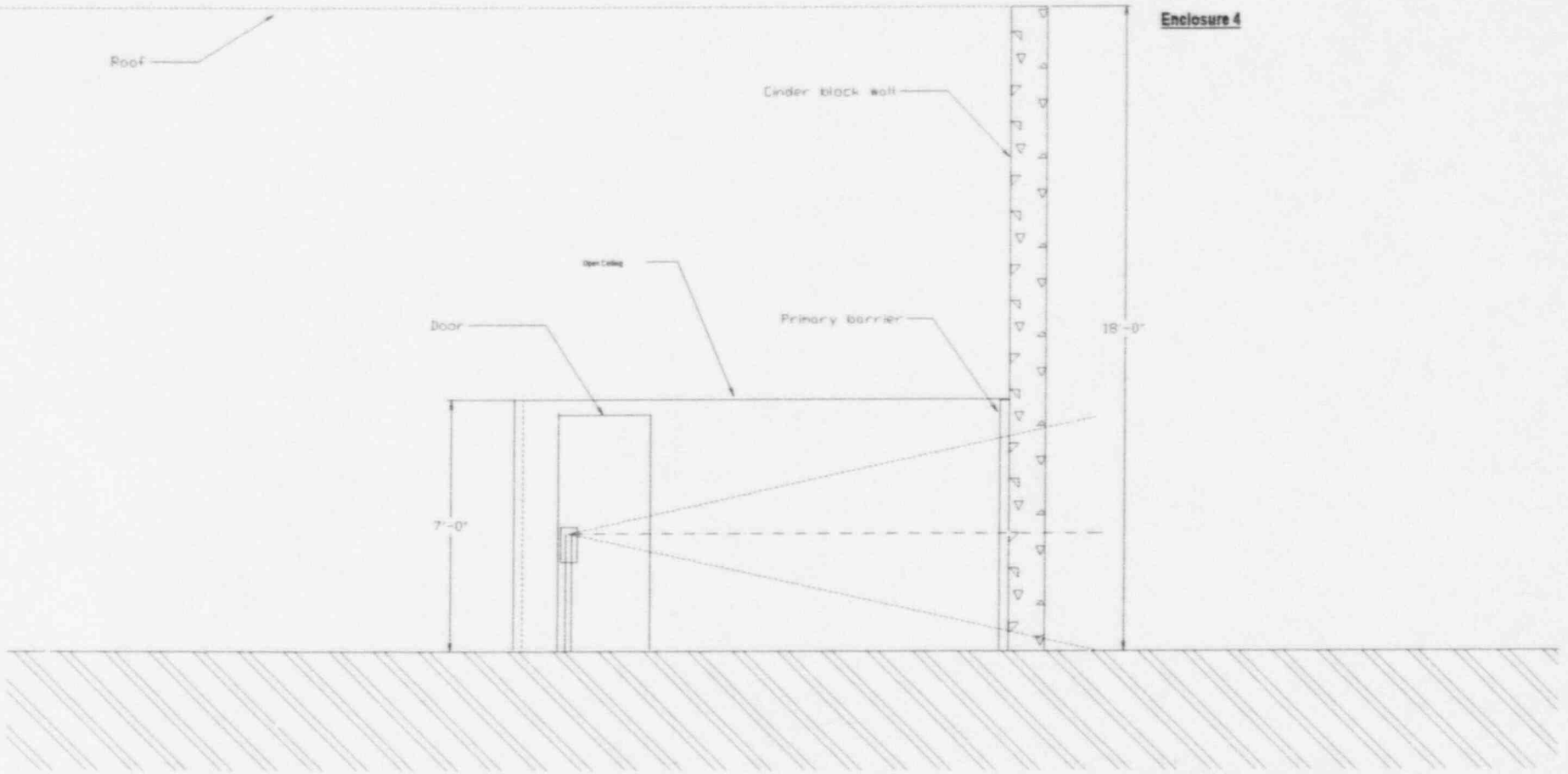
1. Insert wipe in drawer.
2. Count for 11 min.
3. Record reading — K _____
4. Calculate rate — K / 11 = L _____
5. Subtract background — L - B = M _____
6. Calculate activity (μCi) — M × J = N _____

Is N > 0.005 μCi ?

Date: _____

Physicist: _____

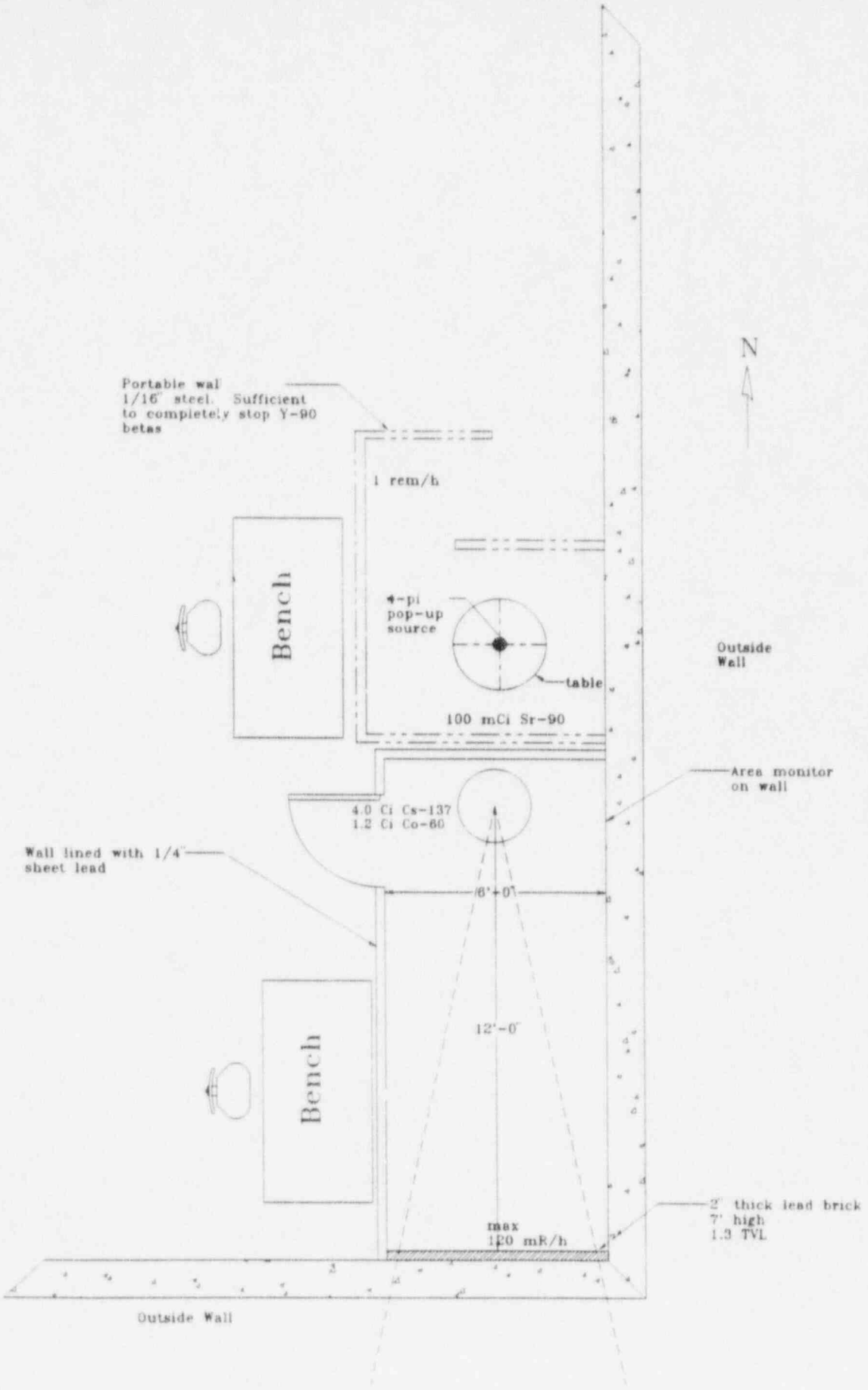
Enclosure 4



Gamma Ray Irradiator Range
East Elevation

Keithley RMD

Enclosure 5



Keithley RMD X-ray, Gamma-ray Lab

6045 Cochran Rd. Solon, Ohio 1/4"=1'

UNITED STATES NUCLEAR REGULATORY COMMISSION
REGION III
CONVERSATION RECORD

(X) TELEPHONE (X) OUTGOING ( ) INCOMING ( ) CONVERSATION TIME: 11am DATE: 12\30\96

NAME OF PERSON(S) CONTACTED: ORGANIZATION: TELEPHONE NO.:
Bob Kobistek
216-498-2577
Keithley Instruments Inc.

SUBJECT:
new license application
control no. 301903

SUMMARY:
After reviewing letter dated November 27,1996, the NRC finds that it needs that following additional information:

1. From your response, it is unclear that calibrator operators will be required to have an on-the-job training in use of the calibrators. Therefore, state that operator trainees will have in actual hands-on practice operation of the equipment. Describe the duration of this training before the operator is allowed to independently operate the equipment.

2. You have elected to analyze your own sealed source leak test samples using a survey meter. In light of this technique, we need specific information to determine if your procedures are adequate. Please provide the following:

   A. Describe how you will maintain constant geometry with each sample and the calibration standard.

   B. Specify the counting time you will use and that is necessary to achieve the necessary sensitivity.

   C. Describe the check source used (radionuclides and energies). Is it comparable to the samples that you will be testing? Is it NIST traceable?

   D. Describe the procedure you will use for converting the meter readings (cpm?) to microcuries.

3. 10 CFR 20.1601(d) requires the licensee to establish the controls in a way that does not prevent individuals from leaving a high radiation area. Therefore, please describe how you will assure that closed and/or locked doors do not prevent a person from exiting the high radiation area.

4. Shielding Calculations:

   A. Provide a calculation for an estimate of the dose rates expected on the roof. Even if this area is not occupied, it is an uncontrolled area which can potentially be accessed during roof maintenance and must meet the Part 20 limits. Demonstrate that the dose rate to an individual will not exceed 20.1301 limit of 100 mrem in a year.

B. Provide a calculation for an estimate of the dose rate on the outside east walls for the beta and gamma ranges. Your letter did not provide an estimate, nor did it describe the wall material or thickness. Demonstrate that dose rates will not exceed the limits specified in 10 CFR 20.1301 including the limit of 100 mrem in a year.

C. In your table of calculations for the secured area outside the secondary barrier, you show the shielding thickness as 0.635 cm (¼ in) of lead. However, your letter states that the shielding thickness will be ⅛ in. of lead. Please clarify and resubmit the dose-equivalent rates if necessary.

D. Based on the dose rates that you provided, it appears that the south wall area outside of the primary barrier will exceed the limits of 10 CFR 20.1301 (100 mrem in a year). Therefore, describe how you will assure compliance with this yearly limit. Please describe the use of the south and east outside wall areas.

5. Regarding the annual program review, please confirm that upper management will review the results of the annual audit and will support effective and timely corrective actions to identified deficiencies.

ACTION REQUIRED:

Please respond in writing within 15 days, provide two copies of your response and refer to Control No. 301903.

ACTION TAKEN

A copy of this record was faxed to Mr. Kobistek.

NAME OF PERSON DOCUMENTING CONVERSATION	SIGNATURE	DATE
Evelyn R. Matson 630-829-9822		12/30/96

FAX TRANSMISSION

U.S. NUCLEAR REGULATORY COMMISSION
801 WARRENVILLE ROAD
LISLE, IL 60532
630-829-9822
FAX: 630-515-1259

To:	Bob Kobistek	**Date:**	December 30, 1996
Fax #:	216-349-1927	**Pages:**	3, including this cover sheet.
From:	Evelyn R. Matson		
Subject:	new license application. More questions.		

COMMENTS:

UNITED STATES NUCLEAR REGULATORY COMMISSION
REGION III
CONVERSATION RECORD

(X) TELEPHONE (X) OUTGOING ( ) INCOMING ( ) CONVERSATION TIME: 11am DATE: 12\30\96

NAME OF PERSON(S) CONTACTED: ORGANIZATION: TELEPHONE NO:
Bob Kobistek
216-498-2577
Keithley Instruments Inc.

SUBJECT:
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control no. 301903

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   A. Describe how you will maintain constant geometry with each sample and the calibration standard.

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   C. Describe the check source used (radionuclides and energies). Is it comparable to the samples that you will be testing? Is it NIST traceable?

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   A. Provide a calculation for an estimate of the dose rates expected on the roof. Even if this area is not occupied, it is an uncontrolled area which can potentially be accessed during roof maintenance and must meet the Part 20 limits. Demonstrate that the dose rate to an individual will not exceed 20.1301 limit of 100 mrem in a year.

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C. In your table of calculations for the secured area outside the secondary barrier, you show the shielding thickness as 0.635 cm (¼ in) of lead. However, your letter states that the shielding thickness will be ⅛ in. of lead. Please clarify and resubmit the dose-equivalent rates if necessary.

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5. Regarding the annual program review, please confirm that upper management will review the results of the annual audit and will support effective and timely corrective actions to identified deficiencies.

ACTION REQUIRED:

Please respond in writing within 15 days, provide two copies of your response and refer to Control No. 301903.

ACTION TAKEN:

A copy of this record was faxed to Mr. Kobistek.

NAME OF PERSON DOCUMENTING CONVERSATION	SIGNATURE	DATE
Evelyn R. Matson 630-829-9822		12/30/96

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION III
801 WARRENVILLE ROAD
LISLE, ILLINOIS 60532-4351

October 2, 1996

Robert J. Kobistek
Radiation Safety Officer
Keithley Instruments Incorporated
Radiation Measurements Division
28775 Aurora Road
Cleveland, OH 44139

SUBJECT: ACKNOWLEDGEMENT OF CORRESPONDENCE
(Letter & Application Dated 09/20/96)

Dear Licensee:

In response to your request, we have completed the initial processing, which is an administrative review of your application for a(n):

X New License ___ Amendment ___ Renewal
___ Termination ___ Auth User (Amendment not required)
___ Other_____

No administrative deficiencies were identified during this initial review. However, it should be noted that a technical review may identify omissions in the submitted information.

It appears that your request is routine (see 1-3 below, as applicable).

1. New and amendment actions are normally processed within 90 days, unless we find major deficiencies, or policy issues requiring central program office assistance.

2. Renewal actions are normally processed within 180 days, however, under timely filing (before expiration), you may continue to operate under your existing license.

3. Termination actions are normally processed within 90 days, unless confirmatory surveys following decontamination/decommissioning activities are involved.

A copy of your correspondence has been forwarded to our Licensing Fee and Debt Collection Branch (301/415-6097) for approval of the fee category and amount, if required.

If you have a compelling safety or business-related reason for requesting expedited review, please contact the Materials Licensing Branch at (630) 829-9887. We will try to complete your request as soon as practicable. Any correspondence about this request should reference the control number.

Nuclear Materials Support Branch

Mail Control No. 301903
License No. 34-26760-01

KEITHLEY RADIATION MEASUREMENTS

Radiation Measurements Division
Keithley Instruments, Inc.
28775 Aurora Road
Cleveland, Ohio 44139
(216) 248-0400 • Fax: (216) 349-2307

November 27, 1996

Evelyn R. Matson
US Nuclear Regulatory Commission, Region III
801 Warrenville Rd.
Lisle, IL 60532-4351

Re: 301903

Dear Ms. Matson:

Thank you for your letter dated November 7, 1996. I am herein providing you with responses, enumerated in the same manner as your questions. Also enclosed you will find:

Encl.1. Keithley RMD Draft Administrative Operating Procedure AOP-11-01. Revision A of this document was submitted as Enclosure 11 of our initial application. It has been revised to include more specific language as suggested in your letter and will be released as Revision B after approval by the NRC.

Encl.2. A revised floor plan, originally designated as Enclosure 10 in the original submission.

Encl.3. A photocopy of the leak test procedures from the irradiator manufacturer's manual.

Encl.4. Specifications of the automatic fire extinguishing system in use in the lab.

Also, please change the name in Item 4 of the initial application (person to be contacted regarding the application) to Robert J. Kobistek, at the address shown on this letterhead.

The following are the responses to your questions:

1. Policies and procedures for performing annual program audits have been documented in Encl. 1, Administrative Operating Procedure, AOP-11-01. Please refer to section 5.8 for details.

   a. A description of senior management's role is detailed in section 5.8.2.
   b. The RSO's performance evaluation will be conducted according to section 5.8.3
   c. Section 5.8.4 details annual review requirements for review of RSO's audits.

Pm: 11-27-96

2. Radiation worker training will only be performed by the RSO, Robert J. Kobistek, or Keithley's consultant, Thomas K. Stafanakos, as indicated in our license application.

3. The amended training program is described in the Encl. 1, AOP11-01, section 5.5.

4. Section 5.3 of the enclosed Administrative Operating Procedure, (Encl. 1) has been revised to include more specific information regarding leak test procedures.

   a. The procedures for collecting leak test samples are given by the manufacturer in the operator's manual. Section 5.3 of AOP-11-01 (Encl. 1) requires that the recommended procedure be followed. For your convenience, a photocopy of the relevant manual pages has been enclosed (Encl. 3).
   b. The Ludlum Model 3 survey meter with a model 44-9 pancake GM probe, as listed in Item 10 of the original license application, will be used to read the wipes.

5. The gamma-ray range will be located in a vault with lead-lined walls seven feet high. A single door provides entry to the vault. The door will be locked during non-business hours and will be equipped with an interlock switch. The switch will prevent movement of the source to the "on" position while the door is open and will cause the source to drop into the "off" position if the door is opened while the source is in operation. The manufacturer specifies that, while in the "off" position, radiation levels will be less than 2.5 mR/h at 30 cm from the source. An area monitor and "source on" warning lights will also be visible.

   The beta range will be located behind temporary steel walls with a maze entry. During non-working hours, the source will be locked in the off position, and the entry to the maze will be blocked with magenta and yellow rope and a warning sign. During normal working hours, personnel will be protected from accidental irradiation by a photoelectric device in the maze that trips when a person breaks a light beam. If a person enters the maze while the source is in use, the device causes the source to be retracted.

6. Dose rate calculations for secured and unsecured areas.

   Doses for workers and the public were estimated using the calculations that follow. Although the calculations yield estimates only, all attempts were made to err on the side of increased safety. During installation of the irradiators, the areas will be surveyed to verify calculated doses.

   Dose equivalent rates were calculated for restricted areas and unrestricted areas outside the lab. The building is a single-story structure with no occupancy above or below the irradiators.

   Please note by referring to the enclosed floor plan (Enclosure 10) that the thickness of lead used in the secondary barriers for the dual ^{137}Cs / ^{60}Co source has been changed from

¼" to 1/8". The calculations show that worker doses will remain below legal limits following this change.

Unsecured area outside primary barrier, dual cobalt/cesium source.

For the gamma sources, the following formula was used to calculate the dose-equivalent rate outside the primary barrier:

$$H = \frac{A\Gamma}{d^2} \times 10^{-\frac{T_{Pb}}{TVL}} \times U$$

The table, below, explains the meanings of the variables and gives values for each source. The column labeled, "Ref." contains references to the sources of certain numerical values. The final results are found in the last row of the table and are well within safe limits.

Variable	Meaning	^{60}Co Value	^{137}Cs Value	Ref.
A	Source activity	44,400 MBq	148,000 MBq	
Γ	Specific gamma ray dose constant	3.703×10^{-4} mSv·m²/h·MBq	1.032×10^{-4} mSv·m²/h·MBq	1.
d	Distance from source to unsecured area	4.3 m	4.3 m	
TVL	Tenth-value layer of lead	4.0 cm	2.1 cm	1.
T_{Pb}	Thickness of the lead primary barrier	5.08 cm	5.08 cm	
U	Usage factor	0.1	0.1	
H	Dose-equivalent rate at specified location when source is "on".	0.005 mSv/h (0.5 mrem/h)	0.0003 mSv/h (0.03 mrem/h)	

1. The Health Physics and Radiological Health Handbook, Revised Edition.

Secured area - worker's station outside secondary barrier.

The scattered radiation, to which the source operator will be exposed, was considered to consist of the sum of two contributions: 1) the radiation scattered off the primary barrier, and 2) possible radiation scattered off a target placed in the path of the primary beam, and located such that the radiation scattered toward the worker makes a 90° angle with the primary beam.

$$H = A\Gamma\left[\frac{a_1 e^{-\mu_1 T_{Pb}}}{d_1^2 d_2^2} \times \frac{F_1}{400cm^2} + \frac{a_2 e^{-\mu_2 T_{Pb}}}{d_3^2 d_4^2} \times \frac{F_2}{400cm^2}\right]$$

The final row of the table shows the results.

Variable	Meaning	^{60}Co Value	^{137}Cs Value	Ref.
A	Source activity	44,400 MBq	148,000 MBq	
Γ	Specific gamma ray dose constant	3.703×10^{-4} mSv·m^2/h·MBq	1.032×10^{-4} mSv·m^2/h·MBq	1.
d_1	Distance from source to primary barrier	3.6 m	3.6 m	
d_2	Distance from primary barrier to worker station	2.5 m	2.5 m	
d_3	Distance from source to irradiation target	2.4 m	2.4 m	
d_4	Distance from irradiation target to worker station.	2.2 m	2.2 m	
μ_1	Linear attenuation coefficient for radiation scattered at 90°	3.57 cm^{-1}	4.54 cm^{-1}	2.
μ_2	Linear attenuation coefficient for radiation scattered at 150°	11.3 cm^{-1}	11.3 cm^{-1}	2.
F_1	Field size at primary barrier	25,500 cm^2	25,500 cm^2	
F_2	Field size at irradiation target	11,300 cm^2	11,300 cm^2	
T_{Pb}	Thickness of the lead secondary barrier	0.635 cm	0.635 cm	
a_1	Fraction of radiation scattered at 90° for a field area of 400cm^2, measured at a distance of 1 m	0.0009 m^2	0.0028 m^2	3.
a_2	Fraction of radiation scattered at 150° for a field area of 400cm^2, measured at a distance of 1 m	0.0006 m^2	0.0019 m^2	3.
H	Dose-equivalent rate at specified location when source is "on".	1.2 μSv/h 0.12 mrem/h	1.9 μSv/h 0.19 mrem/h	

1. The Health Physics and Radiological Health Handbook, Revised Edition
2. Johns & Cunningham, The Physics of Radiology
3. National Council on Radiation Protection and Measurements, Report No. 49

Beta Source

Outside the maze there will be no worker dose resulting from beta exposure since the steel partitions are sufficient to completely stop the beta particles. According to The Health Physics and Radiological Health Handbook, the range of ^{90}Y betas is 2mm in steel.

7. The facility includes a sprinkler system capable of extinguishing a fire without the necessity of firefighters entering the room. I have enclosed specifications of the system (Encl. 4).

8. A new section 3.6, has been added to AOP-11-01 (Encl. 1) to describe laboratory security and keys.

9. Language describing the requirement and the content of operating procedures has been added to AOP-11-01 (Encl. 1) in section 3.5.

10. Our beta source will be the JL Shepherd Model 492.

11. Survey meters will be calibrated annually by an authorized laboratory. At some future date, Keithley may begin calibrating their own survey meters, but only after procedures are generated according to the Regulatory Guide 10.8

12. Additional language has been added to AOP-11-01 (Encl. 1) in section 5.6 to address inspection and maintenance of safety equipment.

13. No person at Keithley RMD will irradiate flammable or corrosive materials, as echoed in AOP-11-01 (Encl. 1) section 3.8.4.

I hope this information is sufficient to allow you to complete our application. If you have any questions, please call me at (216)498-2577.

Sincerely,

Robert J. Kobistek, MS
Radiation Safety Officer

Encl.

Encl. 1
Document Change Log

Changed By	Description of Change	Change Date
R.J.K.	Modified to incorporate additional information requested by NRC	

1. Purpose

This AOP is intended to set forth policies and procedures governing the safe use and handling of radioactive materials and radiation-generating equipment at RMD.

2. Scope

The policies, practices, and procedures described herein apply to all Keithley personnel, visitors, officers, and managers. Strict compliance with this document is mandatory under penalty of disciplinary action and/or termination.

2.1. Governing Regulations

2.1.1. Federal Regulations

US Code of Federal Regulations, Title 10

2.1.2. State Regulations

State of Ohio Department of Health Radiation Protection Rules

3. Policies

3.1. Access to Radiation Calibration Laboratory

The Radiation Calibration Laboratory is physically segregated from the manufacturing area by a wall and fence for limited access and is considered a secured area. The secured area does not include the laboratory supervisor's office or the path from the fence doorway to the office, as marked by tape on the floor. Only authorized personnel may enter the designated, secured area.

3.1.1. Radiation Workers

Radiation workers, who have undergone the required training (§5.3) and who have been issued personal dosimeters (§3.4) may enter the laboratory at any time provided they are wearing their dosimeter. If an employee has lost his dosimeter or left it at home, he must see the RSO for issuance of a temporary dosimeter before entering the lab.

3.1.2. Non-radiation Workers

Occasionally, a Keithley employee, to whom a dosimeter has not been issued, may require access to the Calibration Laboratory. The employee may be granted permission to access the facility by the RSO. The employee must demonstrate a valid need to enter the lab, after which the RSO will issue a temporary film badge or direct-reading dosimeter. The dosimeter must be worn at all times while the employee is in the lab. The dosimeter must be returned to the RSO after business in the lab is finished. The RSO will keep a log per §3.4.6.

3.1.3. Visitors

Provision is made for access to the lab facilities by visitors, such as X-ray equipment service engineers, consultants, contractors, sales reps, or visiting customers. All visitors must wear a personal dosimeter when in the lab. The dosimeter may be the property of the visitor, as is the case with X-ray service engineers and some consultants. If the visitor does not have his own dosimeter, he must be issued a temporary film badge or direct-reading dosimeter

by the RSO. The dosimeter must be worn at all times while the employee is in the lab. The dosimeter must be returned to the RSO after business in the lab is finished. The RSO will keep a log per §3.4.6.

3.1.4. Janitorial Personnel

Janitorial personnel need not wear dosimeters provided they perform their cleaning services at a time in which all X-ray generating equipment is turned off. Janitorial personnel may not enter any of the shielded areas containing radioactive isotopes. Prior to their first access to the Radiation Calibration Laboratory, the RSO will meet with the janitorial personnel and advise them of off-limit areas and radiation safety.

3.2. Other Areas Where Radiation is Used

Use of radiation producing equipment and/or non-licensed material in other areas of the building must be carried out with the knowledge and control of the RSO. Some examples of this type of use of radiation include small cabinet X-ray machines, check sources and other exempt quantities.

3.2.1. Notification of the RSO

The RSO must be made aware of all ionizing radiation-producing equipment and sources on the premises.

3.2.2. Radiation Safety

The RSO will take the necessary steps to assure safety. This may include posting signs, setting up temporary barriers, and/or restricting access to the area.

3.2.3. Personal Dosimeters

Radiation detection devices must be worn by personnel operating radiation-producing equipment located outside the Calibration Laboratory. If the RSO deems it necessary, he may designate the area as restricted to trained radiation workers, in which case all personnel in the vicinity must wear radiation detection devices.

3.3. Operation of Radiation-Producing Equipment

Possession of a personal dosimeter entitles the bearer to enter the Calibration Laboratory area, but does not imply permission to operate radiation-producing equipment. Only employees who have been properly trained and have written permission of the RSO may operate the equipment.

3.4. Personal Dosimeters and Records

3.4.1. Issuance of personal dosimeters

Dosimeters are issued by the RSO to Keithley employed personnel and other persons who have demonstrated a valid need to regularly enter the Calibration Laboratory to perform company business. Prior to issuance of dosimeters, the individual must attend a radiation safety training session, per §5.3.

3.4.2. When must an employee wear his/her dosimeter.

Personal dosimeters must be worn at all times in which the employee is in the Calibration Laboratory and when the employee is in an outside facility in which dosimeters are required by the facility.

3.4.3. When must an employee not wear his/her dosimeter.

The employee may not wear his/her dosimeter when he/she is receiving a radiation exposure that is not related to work for Keithley, such as medical X-rays or doses received during employment by another company. Dosimeters are to remain on the RMD premises when the employee leaves, except in those cases in which the employee is traveling to an outside radiation facility on Keithley business.

3.4.4. Lost or misplaced dosimeters

In the event that the employee misplaces or loses his/her dosimeter, he/she must report the loss to the RSO before entry to the Calibration Laboratory is permitted. The RSO will issue a temporary dosimeter to be used until the assigned dosimeter is located or replaced.

3.4.5. Dosimetry records

Personal dosimeters are to be read and maintained by ICN or equivalent dosimetry service. Records of doses are kept in a file by the RSO. An employee's dosimetry record may be reviewed by that employee at any time. Annually, the RSO will supply each employee with a written report of his/her annual dose.

3.4.6. Visitor dosimeters

The RSO will maintain film badges and/or direct-reading dosimeters for the use of personnel to whom permanent badges have not been issued. The RSO will also keep a log of the names and companies of dosimeter users along with a record of doses measured by the dosimeters.

3.5. Operating procedures

- Procedures must be generated to guide workers in safe operation of radiation-producing equipment. Each operator will have a copy of the operating and emergency procedures available during the use of the irradiators.

For each piece of radiation generating equipment, there must be a formal, written procedure in place that discusses the following:

- A requirement that the equipment be secured when unattended.
- A description of the actions to be taken to ensure that no one is in a range when the beam is turned on.
- A requirement that safety devices be checked for proper operation and that malfunctions or defects be corrected promptly. These records are to be retained for a minimum of two years.

3.6. Security

3.6.1. Entrance to the Calibration Laboratory

The gate entrance to the Calibration Laboratory shall be equipped with a key lock. It shall be locked during non-business hours. Only laboratory personnel, the supervisor, and the plant manager shall possess keys.

3.6.2. Entrances to the source ranges

The door to the cesium / cobalt range shall have a lockable door. The lab supervisor shall have a key. A second key for use by laboratory personnel will be stored in a secure enclosure inside the Laboratory gate. The door to the source range shall be locked and keys removed whenever the Laboratory is left unattended.

3.6.3. Source control panels

The control panels for the cesium / cobalt range and the beta range are equipped with key interlocks. Keys for use by laboratory personnel will be stored in a secure enclosure inside the Laboratory gate. The source control panels shall be locked whenever the Laboratory is left unattended

3.7. Purchase and receipt of radioactive materials and/or ionizing radiation-producing equipment

3.7.1. Purchase of radioactive materials and/or ionizing radiation producing equipment

The RSO must be notified by the responsible party prior to the purchase, leasing, renting, or borrowing of any radioactive material (including exempt quantities) or X-ray equipment. The responsible individual, the purchasing department, and the RSO will then work together to coordinate regulatory requirements with additional facilities (if necessary) and delivery of the source.

3.7.2. Receipt of radioactive materials

The RSO must be notified by the receiving department of the receipt of any parcel bearing a radioactive materials label.

3.8. Other rules and policies

3.8.1. Food or beverage may not be consumed in any area containing radioactive material. Smoking and application of cosmetics are also prohibited in these areas.

3.8.2. Anyone who purposely irradiates a personal dosimeter will be subject to disciplinary action.

3.8.3. No employee may intentionally defeat the safety interlocks on X-ray machines and radioactive sources.

3.8.4. No irradiator at Keithley RMD may be used to irradiate flammable or corrosive materials.

4. Responsibilities

4.1. Radiation Safety Officer

The RSO is ultimately responsible for administering this Radiation Safety Program. He is responsible for maintaining records, seeing that the equipment is safe and well maintained, training employees, complying with regulations, and all other tasks related to this Program.

4.2. Radiation Workers

The Radiation Workers are responsible for complying with the policies set forth in this Program. Any employee found not complying with this Program may face disciplinary action.

4.3. Manufacturing Manager and Division General Manager

RMD management will provide authority and support to the RSO for carrying out this policy.

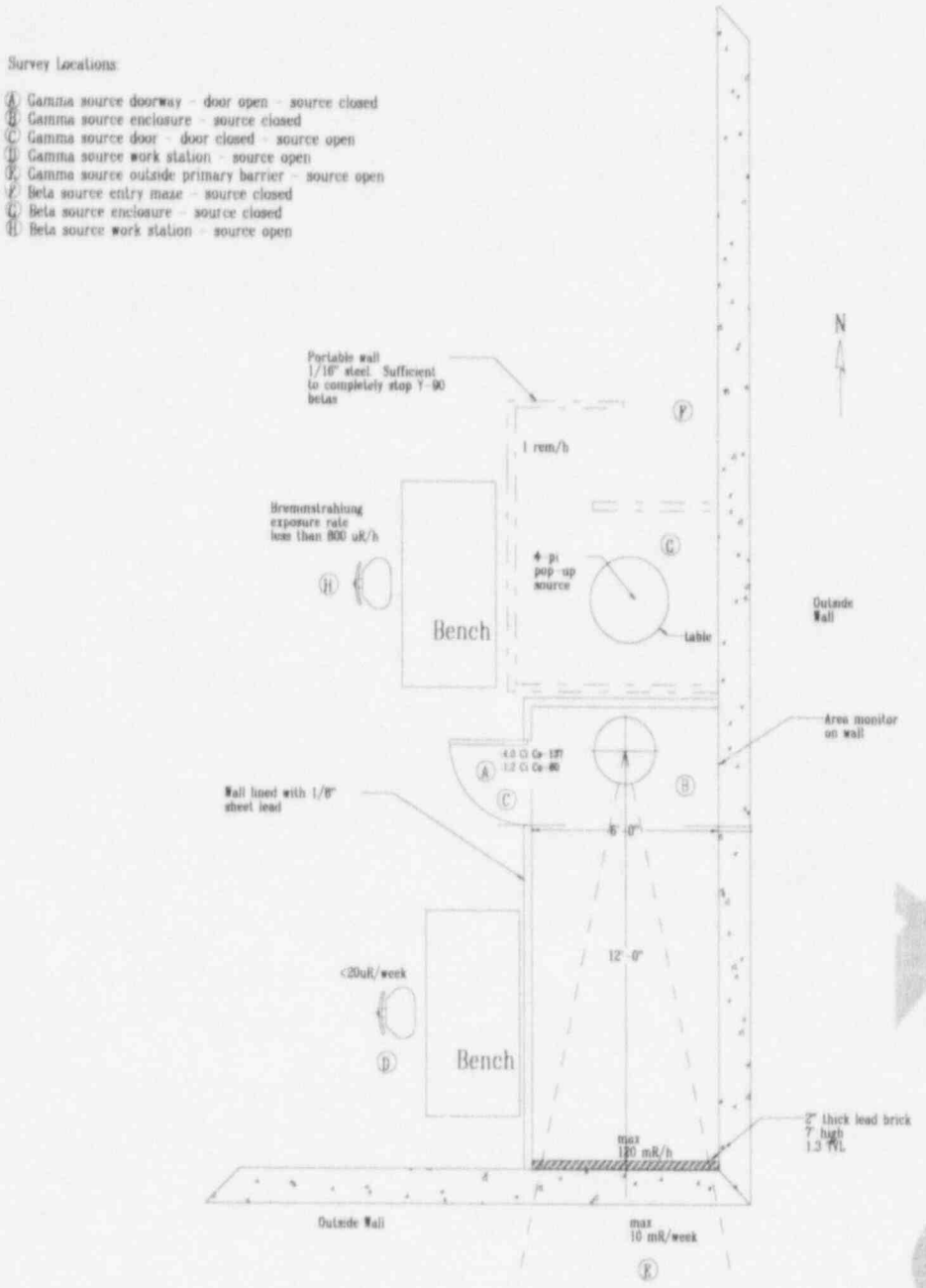
5. Procedures

5.1. Administration of Personnel Dosimeters

Film or TLD badges will be used for the purposes of personnel dosimetry. The badges will be serviced by a commercial dosimetry service. Dosimeters will be submitted monthly. Dosimetry records will be maintained by the RSO and made available for personnel review. A rack will be located near the entrance of the Calibration Laboratory for storage of the dosimeters when not being worn.

5.2. Surveys

Radiation surveys will be performed quarterly. An ionization chamber survey meter is used to survey the gamma sources and X-ray machines, and a pancake-type GM tube is used for surveying the beta source. Survey locations are indicated in Figure 1. Survey records are maintained by the RSO for a minimum of 3 years.



Keithley RMD X-ray, Gamma-ray Lab
6045 Cochran Rd. Solon, Ohio

Figure 1

General Manager Approval Required Prior to Use	**Approval:**	**Date:**

5.3. Leak Test

Leak tests are to be performed at six-month intervals according to the procedures recommended by the manufacturer and listed in the operator's manual. The survey meter used to measure the wipes must be calibrated annually and must be capable of detecting 0.005 μCi (185 Bq) of the radionuclide being tested. The RSO will verify the minimum detectability annually using check sources.

5.4. Inventory

All sources will be inventoried at quarterly intervals.

5.5. Training

All radiation workers are required to participate in a four-hour training program prior to their receiving clearance to work in the Calibration Laboratory. In addition, two-hour refresher courses will be held annually. Training records will be maintained in the employee training files and the radiation safety files. Training sessions will consist of six parts:

1. Introductory comments
2. Viewing of instructional video cassette
3. Discussion
4. Hands-on demonstration of types of radiation, shielding, and distance using survey meter and sources. Session to include instructions on operation of survey meters.
5. Tour of the Lab and safe use of radiation-generating equipment.
6. Exam

Topics to be covered include:

- Atomic structure and radioactivity
- Natural and man-made radiation
- Biological effects of radiation
- Radiation risks
- Radiation protection standards
- Radiation detection instruments
- Exposure contamination control
- Laboratory safety
- Emergency response/procedures
- Safe operation of radiation-generating equipment, including internal operating procedures.
- A discussion of the on-the-job training to be given following the training program.

The annual refresher course will include.

- Viewing of instructional video tape
- Discussion of changes in operating and emergency procedures
- Changes in regulations and license conditions
- Reports on accidents
- Results of inspections
- Emergency practice drills

- Exam

5.6. QA of Interlocks and Safety Equipment

- Door interlocks and area monitor will be tested daily.
- Operation of the source position indicator will be tested weekly.
- Emergency source return mechanisms will be tested weekly.
- The mechanical integrity of the source transport mechanism will be inspected quarterly.
- Irradiator maintenance will be carried out according to manufacturer's recommendations

5.7. Emergency Procedures

5.7.1. Accidental Exposure to Radiation

An employee who believes he has accidentally received direct exposure to a radioactive source or X-ray tube must contact the RSO as soon as possible thereafter. The RSO will gather information regarding length of exposure, distance to source, etc., so he may calculate the approximate dose received by the employee. The employee's dosimeter will be sent out for an immediate reading. The RSO will take whatever action is necessary depending on the estimated dose, and badge reading.

5.7.2. Area Monitor Alarms

Personnel must always observe area monitor warning lights before entering radiation areas. Employees may not enter a radiation area if the area monitor displays a high radiation condition. If an area monitor shows high radiation but the source control panel indicates the source is closed, the door to the source room should be kept closed, and the RSO should be notified immediately.

5.8. Reviews and Audits

This Radiation Safety Policy, its content and effectiveness shall be reviewed annually. The RSO is primarily responsible for organizing the annual review.

5.8.1. Content of Audit

The following items will be reviewed during the annual audit:

- Content of this document
- Compliance of RSO and radiation workers with the Radiation Safety Program
- Compliance of RSO and radiation workers with regulations
- Personnel dosimetry records
- Results of NRC and/or State audits
- Worker training program – relevance, effectiveness, and implementation

5.8.2. Management responsibility

The Division General Manager and any other manager to whom the RSO must report shall be given copies of all correspondence with the NRC including the original license application, the license, amendments, inspection findings, and any relevant regulation changes. Management will utilize this information on a continuous basis, as well as during the annual audit, to evaluate the performance of the Radiation Safety Program and the RSO.

5.8.3. RSO Performance Evaluation

The performance of the RSO will be evaluated as part of his/her annual employee performance evaluation, conducted according to guidelines established by the Human Resources Department. If, in addition to radiation safety duties, the RSO also performs another function (e.g. Calibration Lab Physicist / Supervisor), a separate section will exist in the evaluation document for the RSO function. The RSO will be evaluated on his/her performance of the duties listed in §4.1, as well as his/her proficiency at attaining agreed-upon personal goals. The RSO portion of the performance evaluation will be conducted by the Division General Manager, to whom the RSO has direct report.

5.8.4. Audit review

During the annual audit, a review shall be made of audits conducted by the RSO during the year. The annual review shall determine whether the RSO has audited authorized users for regulatory compliance and adherence to the content of RMD's license.

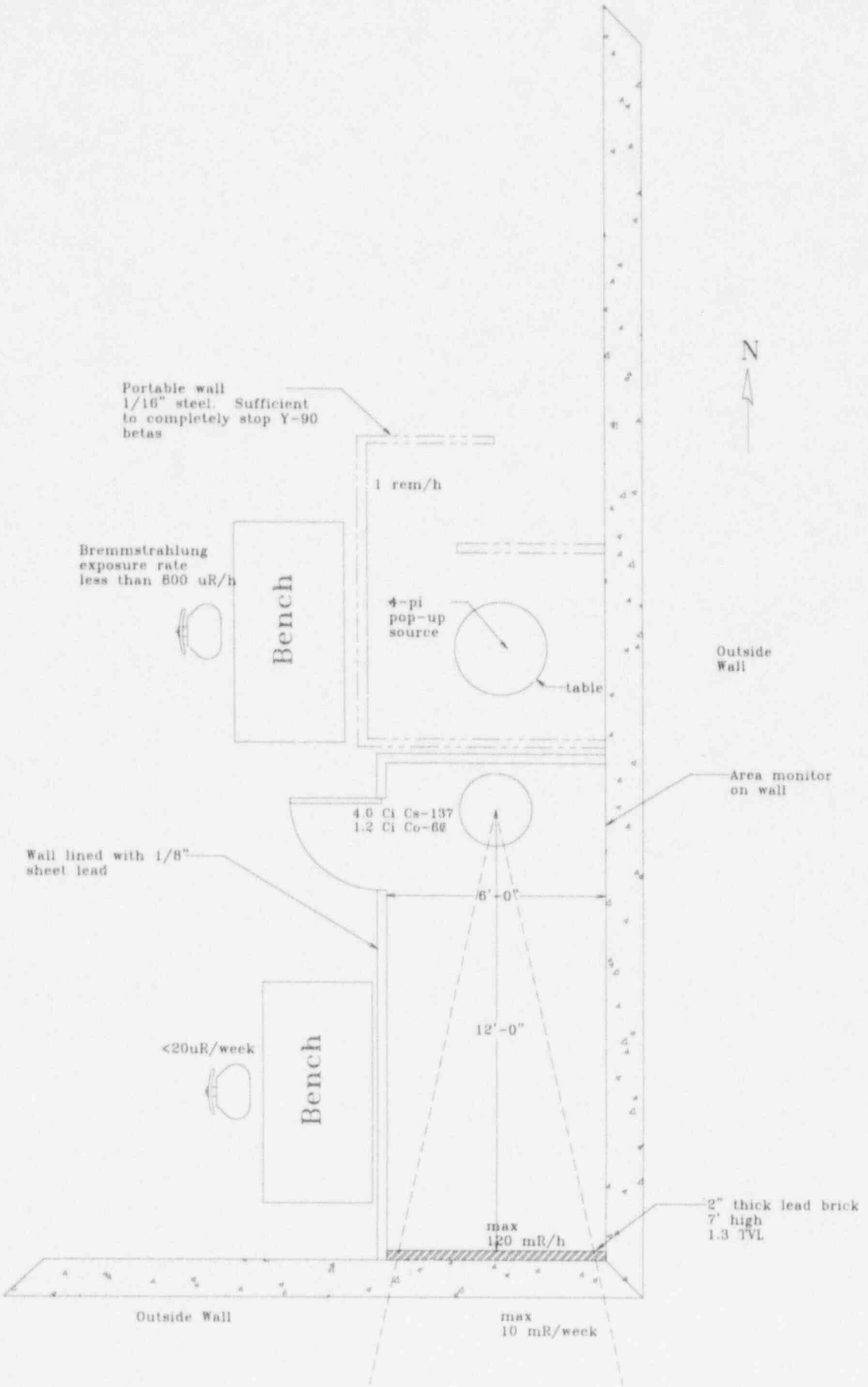
6. Electronic Files Listing

The table below lists all of the electronic master files which pertain to this AOP revision.

Name	Date	Description	Comments
AOP1101A.DOC	9/20/96	This Document	Initial Release
AOP1101B.DOC		This Document	Revision B

[1] Storage directory: ..\ADM_DATA\AOP\MASTER

Encl. 2



Keithley RMD X-ray, Gamma-ray Lab

6045 Cochran Rd. Solon, Ohio 1/4"=1'

Encl. 3

INSTALLATION & OPERATION MANUAL FOR MODEL 81 DUAL SOURCE GAMMA CALIBRATOR

Model _____
S.N. _____

NOTICE: IF AT ANY TIME THIS DEVICE MALFUNCTIONS, REMOVE THE SYSTEM FROM OPERATION IMMEDIATELY AND CALL J.L. SHEPHERD & ASSOCIATES FOR INSTRUCTIONS ON CORRECTIVE PROCEDURES.

I. MODEL 81 RADIATION SAFETY

The Model 81 Calibrator emits an intense beam of radiation through the area subtended by the beamport whenever either source is in the "EXPOSED" position. A much lower level of scattered radiation extends in a penumbra surrounding the primary beam. The user should set up exclusion lines for personnel using this calibrator, as well as limit room access. Ordinarily, this information is included as part of the facility operation rules and is required as part of the user's license to possess this calibrator.

A. Leak Test Procedure

1. Locate sources in "OFF" position.

2. Wipe the upper end of the source rod(s) where it exits from the top of the shielded container with a piece of absorbent material. Wiping the areas where the operating tower meets the top of the shield is acceptable.

3. These wipes should be measured on an instrument capable of detecting 0.005 μCi of Cs-137, Co-60 or Sr-90, depending upon isotope loading of your device.

4. If contamination above this level is detected, remove the device from service immediately and notify the manufacturer.

NOTE: The 0.005 μCi level is that generally prescribed by Regulatory Authorities; individual institutions may require more stringent standards.

II. INSTALLATION

The Model 81 is shipped completely assembled in wood shipping crate. The control panel and the base for the unit are shipped in separate boxes. Installation procedures are as follows:

1. Remove the based from the shipping box and place into position. The base has 4 each angle floor mounting brackets welded in place. After the base has been located, transfer hold pattern from mounting holes in brackets to floor and install floor anchors. Bolt base to anchors.

2. Remove the Model 81 from the shipping box. It may be lifted by eyebolts on sides, but extreme care must be taken not to damage tower assembly during lifting and transport. Place Model 81 on stand and bolt in place using bolts provided. NOTE: The Model 81 is shipped with a solid beam port plug in place.

3. Attach an air supply rated 60 psig or greater (bottled air or N2 is suggested) to the inlet port of the oiler-filter-regulator mounted on the side of the tower which has 1/4 NPT female fitting. The regulator on the unit is factory set to the proper operating pressure, but may require slight adjustment in the field. See adjustment section of manual. Next, fill the oiler section of the oiler-filter-regulator with SAE 10 weight non-detergent oil as indicated in the instructions for this unit in the manual. Adjust the bleed screw on the oiler ca. 1/2 turn from full closed. During operation a slight mist should appear in the sight glass. The oiler should be replenished one time per year. Adjust as required.

4. Attach the cables with amphenol connectors from the control panel to the mating connectors on the tower. Attach interlock systems to the 2 each 2 pin interlock connectors on the back of the control panel (mating connectors supplied). NOTE: Both interlock circuits must have continuity or the source will not raise. Attach external warning light (such as JLS&A Model WL-2) to the external warning light amphenol on the rear of the panel. This circuit is rated 50 watts

J L SHEPHERD and Associates

1010 Arroyo St., San Fernando, CA 91340
(818) 898-2361

Irradiation & Calibration Equipment • Lead Shielding • Nuclear Applications

OPERATING MANUAL FOR MODEL 492M CALIBRATOR

Model 492

S.N. 15009

NOTICE: IF ANY ANY TIME THIS CALIBRATOR MALFUNCTIONS, REMOVE THE UNIT FROM OPERATION IMMEDIATELY AND CALL J.L. SHEPHERD AND ASSOCIATES FOR INSTRUCTIONS ON CORRECTIVE PROCEDURES.

RADIATION SAFETY

1. The calibrator emits an intense beam of radiation in the area in front of the calibrator when the shutter is in the "OPEN" position. A much lower level of scattered radiation extends in a penumbra surrounding the primary beam. THE OPERATOR SHOULD NEVER STAND IN THE DIRECT BEAM WHILE OPERATING THE UNIT. The operator should also avoid standing in the penumbra adjacent to the primary beam. The unit must be operated at all times from a position behind the calibrator on the side opposite the beam. The user should set up exclusion lines for personnel using this calibrator as well as limited room access. This information is ordinarily included as part of the facility operation regulations and is required as part of the user's license to possess the calibrator.

   CAUTION: The window of the Sr-90 source faces the direction of the beam as in-set approximately .06" from the face of the primary shield. The source window is .003" stainless steel covered by an aluminum filter for a total of 100mg/cm filtration. Extreme care should be taken not to puncture the filter/window. If the window/filter is punctured, the source will probably leak. THE MANUFACTURER IS NOT RESPONSIBLE FOR DAMAGE TO THE SOURCES OCCASIONED BY PUNCTURING THE WINDOW. IF THE WINDOW IS PUNCTURED (BY THE USER), ALL WARRANTIES ARE VOID. THE SOURCE WINDOW/FILTER SHOULD NEVER BY TOUCHED BY ANY OBJECT EXCEPT A SOFT Q-TIP WHEN PERFORMING A LEAK TEST.

RADIATION SAFETY CONTINUED

2. At intervals not exceeding six (6) months, leak test should be made on the calibrator by taking wipes on the face of the source with the shutter open using a "U" shaped rod with wipe (typically a Q-tip) attached to the end of the rod. The operator should stand behind the calibrator. These wipes should be measured on an instrument capable of measuring 0.005 uCi of Sr-90. Use of the calibrator should be stopped immediately if contamination is detected and the manufacturer should be notified. NOTE: The 0.005 uc level is that generally prescribed by regulatory authorities: individual institutions may require more stringent standards.

INSTALLATION

Model 492 Calibrators are normally shipped in two parts: (a) The source shield and (b) the stand. To install: Bolt the source shield to stand in the location where calibrator is to be used. Plug cord into a 115 volt (single phase) socket. Remove the shipping fixture - 2/each 7" x 7-1/2" steel plates fastened around the shield and shutter mechanism with 4/each 1/2" bolts.

OPERATION

1. Remove the padlock which locks the shutter in the "OFF" position during shipment using the key provided. NOTE: This padlock may be used to lock the shutter in the "OFF" position at any time that the calibrator is not being used.

2. To expose the source, grasp the black operating knob (while standing behind calibrator, opposite beam) and move the shutter until it touches the end of the frame (Stop). The source is now exposed.

3. To return the shutter to the "OFF" position, push the operating knob and shutter, in front of the shield, until it strikes the end of the shutter frame. The source is now fully shielded.

SAFETY FEATURES

The Sr-90 source is fixed in the primary shield of the calibrator. It is exposed by moving the shutter by means of an operating rod with knob. The shutter is contained in a heavy steel framework.

Encl. 4

GRINNELL FIRE PROTECTION
10100 BRECKSVILLE ROAD
BRECKSVILLE, OHIO 44147

HYDRAULIC CALCULATIONS

FOR

KEITHLY INSTRUMENTS
6045 COCHRAN ROAD
SOLON, OHIO

FILE NUMBER:66-387330
DATE:6/21/96

ACCEPTED
JUL 1 1996
SOLON FIRE PREVENTION BUREAU
BY GN

-DESIGN DATA-

OCCUPANCY CLASSIFICATION:	ORDINARY HAZARD GROUP II
DENSITY:	.20 gpm/sq. ft.
AREA OF APPLICATION:	1500 sq. ft.
COVERAGE PER SPRINKLER:	400 sq. ft.
TOTAL SPRINKLER WATER REQUIRED:	416.60 gpm
TOTAL WATER REQUIRED (incl/ hose):	666.60 gpm
FLOW & PRESSURE @ CITY MAIN:	666.60 gpm @ 59.50 psi
SPRINKLER ORIFICE SIZE:	.70 inch

NAME OF CONTRACTOR: GRINNELL FIRE PROTECTION

DRAWING BY: MICHAEL RUDA

CHECKED BY: RICHARD GRUNWALD OHIO CERTIFICATION # G-018

AUTHORITY HAVING JURISTICTION: SOLON FIRE PREVENTION BUREAU

CONTRACTOR CERTIFICATION NUMBER: 2547

CALCULATIONS BY HASS COMPUTER PROGRAM (LICENSE # 422C1329X)
HRS SYSTEMS, INC.
ATLANTA, GA

NOV 07 1996

Thomas K. Stefanakos, MSNE
Keithley Instruments, Inc.
Radiation Measurements Division
28775 Aurora Road
Cleveland, OH 44139

Dear Mr. Stefanakos:

We have received your application on September 30, 1996, requesting a new license. As defined in ANSI Standard N433.1, a Category I irradiator is an irradiator in which the sealed source is completely contained in a dry container constructed of solid materials and is shielded at all times, and human access to the sealed source and the volume undergoing irradiation is not physically possible in its designed configuration. 10 CFR 36.2 defines a panoramic dry-source-storage irradiator as an irradiator in which the irradiations occur in air in areas potentially accessible to personnel and in which the sources are stored in shields made of solid materials. The term includes beam-type dry-source-storage irradiators in which only a narrow beam of radiation is produced for performing irradiations. Therefore, it appears that the irradiator/calibrators requested by your license application meet the definition of a panoramic dry-source-storage irradiator.

Draft Regulatory Guide DG-0003, January 1994, entitled Guide for the Preparation of Applications for Licenses for Non-Self-Contained Irradiators was used to prepare the following questions. A copy of DG-0003 is enclosed. You are encouraged to read the guide and provide all of the requested information in order to expedite the review process.

We find that to complete the review process, we need the following additional information about your radiation safety program:

1. 10 CFR 20.1101 requires that each licensee review their radiation protection program content and implementation at least annually. Therefore, please submit a description of your program for performing the required annual review. The annual audit procedures should include the following:

   a. A description of how senior management will become aware of NRC regulations, the provisions of the license, and the compliance status of the institution's licensed program. Senior management should be involved in reviewing the radiation protection program annually.

   b. A review of the Radiation Safety Officer's performance. Specific minimum qualifications should be established for an individual who will review the RSO's performance. Confirm that the results will be reported to senior management.

c. A review of the audits that the RSO has conducted during the year. The review should determine that the RSO has audited authorized users' compliance with regulatory and NRC license requirements. The RSO's audits should include such topics as: evaluation of users' radiation safety procedures through observation and discussion, and performance of independent work area surveys, etc. In addition, the review should examine the effectiveness and promptness for correcting deficiencies found by the RSO.

2. Item 8, subitem 3. "Training" of your application states, in part, that training "will be conducted by someone with the appropriate qualifications." Please either submit a proposal describing your definition of "appropriate qualifications" or provide a statement that training will be conducted only by the two individuals listed in Item 8.3. If you wish to add trainers in the future, you may submit their names and qualifications for our review.

3. Please amend your application under Item 8, "Training" to state that in addition to the training described in Item 8, all irradiator/calibrator operators will be instructed in the following additional topics:

a. The operation of the irradiators. The objective is to help the person understand the operating procedures;

b. Your internal operating procedures that the operator will be performing. This is the most important part of the training because the safe operation of the irradiator depends on these procedures being followed correctly. The objective is that the operator is able to correctly perform the procedures that he or she will be expected to perform;

c. A discussion of the on-the-job training that will be given to trainees. The training should consist of a minimum of several complete irradiation procedures by the trainee under close supervision of a qualified operator; and

d. You should conduct safety reviews for irradiator operators at least annually. The reviews should include a discussion of changes in operating and emergency procedures, changes in .egulations and license conditions, reports on recent accidents, results of inspections of operator safety performance, results of facility inspection and maintenance checks and a drill to practice an emergency. This review should also include a brief written test. Please confirm that your annual retraining will cover the above topics.

4. Your application did not address how you will analyze leak test samples collected from your sealed sources. Please provide the following information:

   a. A description of the procedure for collecting the leak test sample;

   b. A description of the instrumentation used to measure activity on the leak test wipe sample and the lower limit of detectability for this instrumentation; or

   c. Appendix H of Regulatory Guide 10.8 (enclosed) may be helpful to you in preparing your response and provides a program that is acceptable to the NRC. If you elect to have another person perform the leak test, please submit the name of the person and the applicable NRC or Agreement State license number. If this person is not licensed, please submit a description of their procedure and instrumentation as requested above.

5. It appears that your proposed beta and gamma dosimeter calibration/irradiation ranges will be high radiation areas during source exposure. Therefore, describe access control for each range and how your facilities meet the provisions of 10 CFR 20.1601. Use diagrams and sketches to help describe the location and operation of interlocks and alarms.

6. For each range, please provide the calculations used to determine the radiation levels in restricted and unrestricted areas adjacent to the calibration ranges. For unrestricted areas, you must demonstrate that the radiation levels do not exceed 10 CFR Part 20. 1301 limits when the sources are in use. Please include an evaluation of all areas adjacent to the ranges including areas above and below the ranges as well as all exterior areas.

7. Describe the type and location of the heat and smoke detectors to be used to detect a fire in the RMD X-ray, Gamma-ray Lab. Describe the fire extinguishing system that is capable of extinguishing the fire without personnel entering the room.

8. Describe the lock and key system for controlling source movement and discuss how it prevents individuals from operating the calibrators without authorization. Describe how keys will be controlled.

9. You should establish and agree to follow written procedures governing the operation of the irradiators. You should have written operating procedures directed to and given to irradiator operators outlining their responsibilities to ensure your compliance with NRC's regulations, the terms and conditions of the license, and the commitments made in license applications and correspondence with NRC. You do

not need to submit a copy of your operating procedures, however, please confirm that you will establish procedures which will contain the following topics as a minimum:

a. A requirement that the irradiator room and console be secured when unattended.

b. A description of the actions to be taken to ensure that no one is in the range when the primary beam is turned on.

c. A requirement that safety devices be checked for proper operation (including identifying the safety features to be checked and by whom, how the checks are to be performed and the frequency), that malfunctions or defects be corrected promptly, and that the dates and results of the checks and a notation of the date on which each malfunction or defect was corrected be maintained for at least 2 years after each check and each correction of a malfunction or defect. Appendix H (enclosed) contains a list of topics that may be addressed in a set of operating procedures.

d. A confirmation that each operator will have a copy of the operating and emergency procedures available during use of the irradiators.

10. Please clarify if you will be obtaining the Beta Calibrator Model 492M or 492.

11. Please specify the frequency at which survey meters will be calibrated. The minimum is annually. If you wish to calibrate your own meters, you may stated that survey meters will be calibrated in accordance with the procedures contained in Regulatory Guide 10.8, Appendix B (copy attached).

12. Please describe your irradiator equipment and facility inspection and maintenance program. You should discuss the applicable safety checks listed in 10 CFR 36.61. Specify the frequency that these checks will be performed.

13. Confirm that you will not irradiate flammable or corrosive materials. For this purpose, flammable will mean any material with a flash point at a temperature below the temperature you expect irradiated products to reach during irradiation. However, in no case should any material with a flash point below 145 degrees Fahrenheit be irradiated. For this purpose, corrosive will mean any material with a pH less than 4.0 or greater than 10.0. You may propose different definitions if justification is provided.

I will continue my review of your application when I receive this information. Please reply in duplicate, within 20 days, and refer to Control Number 301903.

If you have any questions or require clarification on any of the information stated herein, please contact me at (630) 829-9822.

Sincerely,

Original Signed By
Evelyn R. Matson
Health Physicist
Nuclear Materials Licensing Branch

Enclosures:
1. Draft Regulatory Guide DG-0003, January 1994, entitled Guide for the Preparation of Applications for Licenses for Non-Self-Contained Irradiators
2. Regulatory Guide 10.8, Appendix H, Model Procedure for Leak-Test Sealed Sources
3. Regulatory Guide 10.8, Appendix B, Model Procedure for Calibrating Survey Instruments
4. Appendix H, Operating Procedures, from the Guide for the Preparation of Applications for Licenses for Medical Teletherapy Programs.

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DATE	10/6/96								

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