

## 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, 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.

Licensee		3. License number	50-29058-01
1. Golden Valley Electric Association Attn: Production Department		4. Expiration date	December 31, 1997
2. P.O. Box 71249 Fairbanks, AK 99707		5. Docket or Reference No.	030-33010
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 sources	A. Not to exceed 50 millicuries per source and 200 millicuries total	
9. Authorized use			
A. For possession in Kay-Ray/Sensall, Inc. Model 7062-BP source housings for measurement of coal density in pipelines.			

## CONDITIONS

10. Licensed material shall be used only at the Healy Power Plant at 2.5 Mile Usibelli Spur Road, Healy, Alaska 99743-0297.
11. A. Licensed material shall be used by, or under the supervision of individuals who have successfully completed the manufacturer's training program for gauge users and who have been designated by the Radiation Safety Officer, Paul Morgan. The licensee shall maintain records of individuals designated as users.
- B. The Radiation Safety Officer for this license is Paul Morgan.
12. Sealed sources containing licensed material shall not be opened or sources removed from source housings by the licensee.

130048

**MATERIALS LICENSE**  
SUPPLEMENTARY SHEET

License number 50-29058-01

Docket or Reference number 030-33010

CONDITIONS

(continued)

13. A. Each gauge shall be tested for leakage of radioactive material at intervals not to exceed 3 years. However, in the absence of a certificate from a transferor indicating that a test has been made within six months prior to the transfer, a gauge (or a replacement sealed source for the gauge) received from another person shall not be put into use until tested.
- B. The 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, the source shall be removed from service and decontaminated, repaired, or disposed of in accordance with Commission regulations. A report shall be filed within 5 days of the date the leak test result is known with the U. S. Nuclear Regulatory Commission, Radioactive Materials Safety Branch, 1450 Maria Lane, Walnut Creek, California 94596. The report shall specify the source involved, the test results, and corrective action taken. Records of leak test results shall be kept in units of microcuries and shall be maintained for inspection by the Commission. Records may be disposed of following Commission inspection.
- C. The licensee is authorized to collect leak test samples for analysis by Kay-Ray/Sensall, Inc. or tests for leakage and/or contamination shall be performed by persons specifically licensed by the Commission or an Agreement State to perform such services.
14. Each gauge shall be tested for the proper operation of the on-off mechanism and indicator, if any, at no longer than three-year intervals.
15. Installation, initial radiation survey, relocation, removal from service, maintenance, and repair of devices containing sealed sources shall be performed by Kay-Ray Sensall, Inc. or by persons specifically licensed by the Commission or an Agreement State to perform such services. Installation, replacement, and disposal of sealed sources shall be performed only by persons specifically licensed by the Commission or an Agreement State to perform such services.
16. The licensee shall conduct a physical inventory every six (6) months to account for all devices received and possessed under the license. The records of the inventories shall be maintained for three (3) years from the date of the inventory for inspection by the Commission, and shall include the quantities and kinds of byproduct material, manufacturer's name and model numbers, location of the devices and the date of the inventory.

MATERIALS LICENSE  
SUPPLEMENTARY SHEET

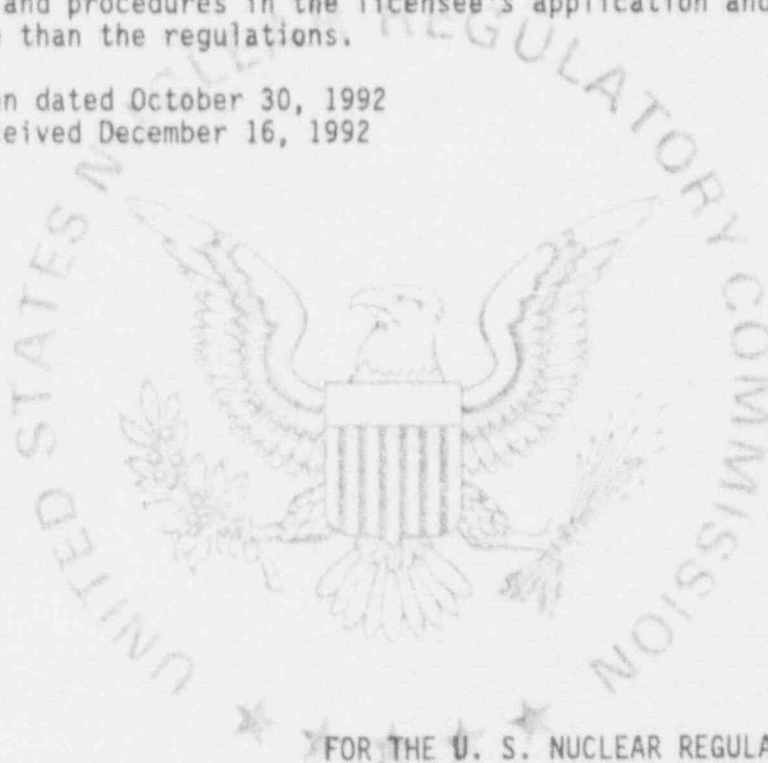
License number	50-29058-01
Docket or Reference number	030-33010

CONDITIONS

(continued)

17. 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 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 dated October 30, 1992
- B. Letter received December 16, 1992



DEC 18 1992

Date \_\_\_\_\_

By: Beth A. Prange  
Beth A. Prange  
Sr. Health Physicist (Licensing)  
Radioactive Materials Safety Branch  
Region V

DEC 18 1992

Docket No. : 030-33010  
License No.: 50-29058-01  
Control No.: 571708

Golden Valley Electric Association  
Attn: Production Department  
P.O. Box 71249  
Fairbanks, AK 99707

Attention: Paul Morgan  
Radiation Safety Officer

Enclosed is the NRC license which you requested.

Please review the enclosed document carefully and be sure that you understand all conditions. If there are any errors or questions, please notify us so that we can provide appropriate corrections and answers.

Any future correspondence relating to your license should specifically reference your license and docket numbers to expedite your inquiry.

Sincerely,

Beth A. Prange  
Sr. Health Physicist (Licensing)  
Radioactive Materials Safety Branch

Enclosure: Attachment A  
License No. 50-29058-01



Distribution

bcc w/original concurrence, copy of license and original correspondence:

License docket folder

bcc w/copy of license and correspondence:

Inspection folder

bcc w/copy of license:

Reading file

bcc w/correspondence and 2 copies of license:

Shirley Crutchfield, LFMB, MNBB 4503

License only:

State of AK

KPrendergast

/ /

JMontgomery

/ /

DSkov

/ /

<sup>BP</sup>  
BPrange  
12/18/92

REQUEST COPY	REQUEST COPY	REQUEST COPY	REQUEST COPY
YES <input type="checkbox"/> NO <input type="checkbox"/>	YES <input type="checkbox"/> NO <input type="checkbox"/>	YES <input type="checkbox"/> NO <input type="checkbox"/>	YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>

12/16/92

16:39

GVEA-HEALY POWER PLANT HEALY AK

002



GOLDEN VALLEY ELECTRIC ASSOCIATION INC.

Box 287, Healy, Alaska 99743, Phone 907-683-2254

U.S. Nuclear Regulatory Commission  
Attention: Beth Prange  
Region V  
Material Radiation Protection Section  
1450 Maria Lane, Suite 210  
Walnut Creek, CA 94596

Dear Beth,

Thank you for your phone call of December 16th, 1992. Enclosed is the map you requested of the Healy Plant location relative to local land marks. I am currently trying to confirm with Stock Equipment Company the radiation limits and will advise you immediately I get a response.

Golden Valley Electric Association commits to not using the subject devices until the on site training has been completed and further agrees to retain documentation of this training for at least five years.

Yours truly,

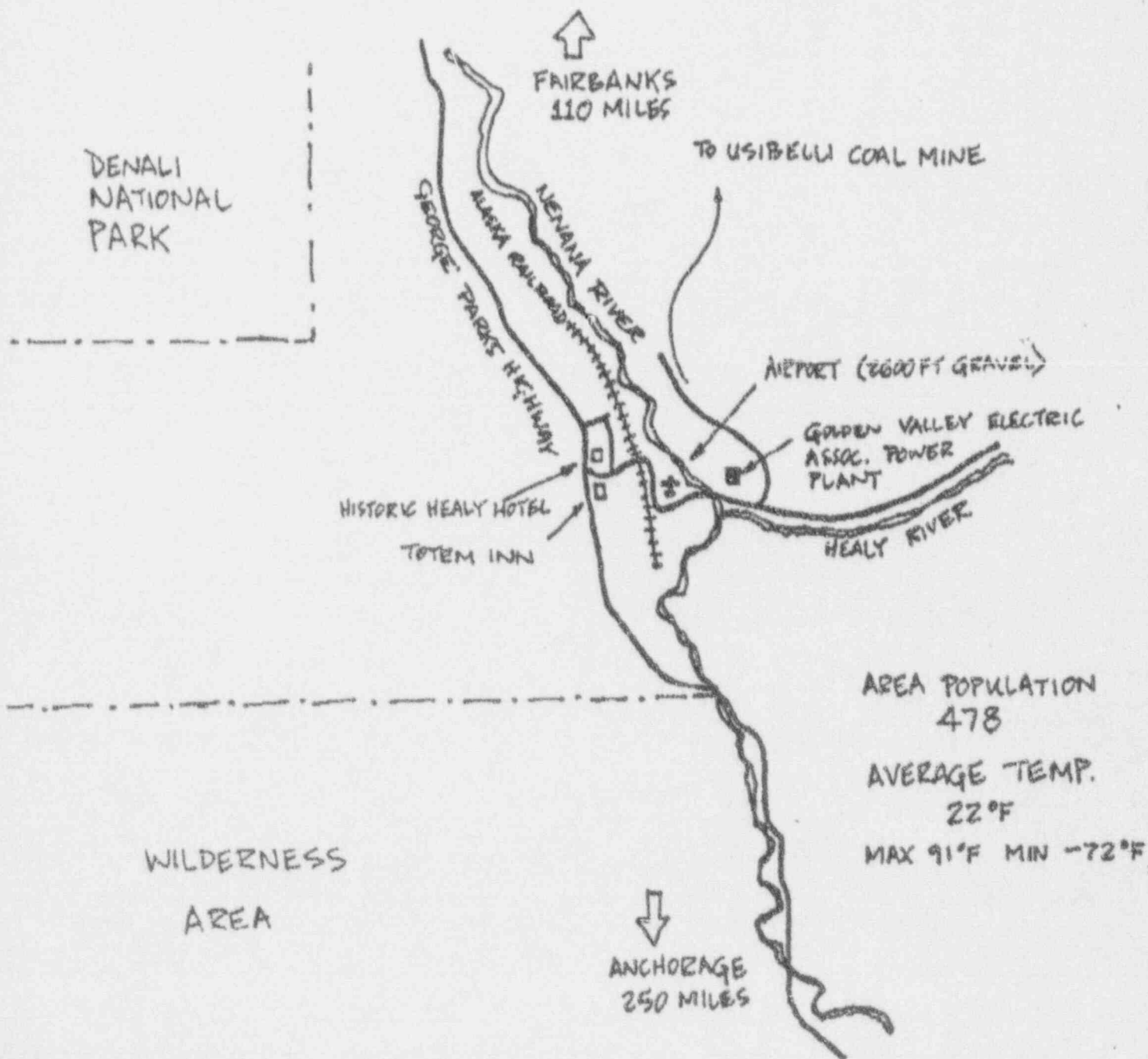
Paul C. Morgan  
Healy Maintenance Superintendent  
Golden Valley Electric Association

571708



GOLDEN VALLEY ELECTRIC ASSOCIATION INC.

Box 287, Healy, Alaska 99743, Phone 907-683-2264



571708

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 Req'd: \_\_\_\_\_  
.....

LICENSE FEE TRANSMITTAL

A. REGION

1. APPLICATION ATTACHED

Applicant/Licensee: GOLDEN VALLEY ELECTRIC ASSOCIATION  
Received Date: 921106  
Docket No: 3033010  
Control No.: 571708  
License No.:  
Action Type: New Licensee

2. FEE ATTACHED

Amount: 540.00  
Check No.: 41712

3. COMMENTS

Signed  
Date

*John Garcia*  
11-16-92

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

1. Fee Category and Amount:

3P \$540

2. Correct Fee Paid. Application may be processed for:

Amendment  
Renewal  
License

✓

3. OTHER

Signed  
Date

*Crutchfield*  
11-18-92

11-17-92 11:39





**GOLDEN VALLEY  
ELECTRIC ASSOCIATION, INC.**

*"Owned by those we serve"*

**PURCHASE ORDER**

NO: 65718

PAGE:

DATE: November 4, 1992

BILL TO: P.O. Box 71249  
Fairbanks, AK 99707-1249

SHIP TO: 758 Illinois Street  
Fairbanks, AK 99701

PHONE: (907) 452-1151

FAX: (907) 451-5681

CONFIRMING: BY

**IMPORTANT:** PURCHASE ORDER NUMBER MUST  
BE INDICATED ON EACH SHIPPING CONTAINER,  
PACKING LIST, INVOICE, OR CORRESPONDENCE.  
PACKING LIST MUST ACCOMPANY EACH SHIPMENT.

**SHIPPING INSTRUCTIONS:**

TO: Nuclear Regulatory Commission  
Region 5  
Material Radiation Protection Section  
1450 Maria Lane, Suite 210  
Walnut Creek CA 94596

ATTENTION: Marnella Rodrigues

VENDOR ACCT. #

PHONE: 301-492-4200

TERMS:

FAX:

FOB:

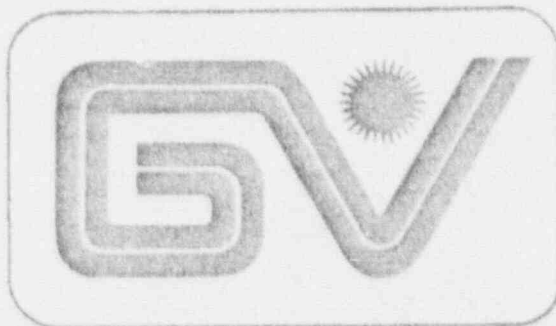
MARK SHIPMENT: GOLDEN VALLEY ELECTRIC ASSOCIATION

ITEM	QUANTITY	U/M	DESCRIPTION	UNIT PRICE	TOTAL PRICE
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1	1	ea	Application for Materials License, NRC Form 313		\$540.00
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per attached

Check Enclosed



GVEA  
USE  
ONLY

2-40/502.10 4.00

REQUISITION #

6630-92

REQUESTOR

Realy Power Plant

**INSTRUCTIONS TO VENDOR**

1. This purchase order subject to terms and conditions noted on face and reverse side.
2. Purchase order no. must appear on material and documents.
3. Packing list required with each shipment.
4. Invoice by item number. Duplicate invoice required.
5. No substitutions may be made without prior approval of Golden Valley Electric Association, Inc.
6. Direct all inquiries to Purchasing Department at above address.
7. Acknowledgement and ship date required if not shipped within 5 days of receipt of this purchase order.
8. Payment terms are Net 30 days unless otherwise indicated.

Vendor's Copy

**GOLDEN VALLEY ELECTRIC ASSOC., INC.**

*An Equal Opportunity Employer*

THOMAS K. HARTNELL, PURCHASING AGENT

THIS PURCHASE ORDER IS EXEMPT FROM NORTH STAR BOROUGH AND  
FAIRBANKS SALES TAX UNDER ALASKA STATUTE'S SECTION 10.25.57

New  
29058

NRC FORM 313  
(9-88)  
10 CFR 30, 32, 33,  
34, 35 and 40

U.S. NUCLEAR REGULATORY COMMISSION  
APPROVED BY DMS  
3180-0120  
Expires 6-30-90

# APPLICATION FOR MATERIAL LICENSE

030-33010

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

## APPLICATIONS FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

U.S. NUCLEAR REGULATORY COMMISSION  
DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR 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 HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

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

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

U.S. NUCLEAR REGULATORY COMMISSION, REGION II  
NUCLEAR MATERIALS SAFETY SECTION  
101 MARIETTA STREET, SUITE 2800  
ATLANTA, GA 30323

## IF YOU ARE LOCATED IN:

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

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

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

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

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

U.S. NUCLEAR REGULATORY COMMISSION, REGION V  
NUCLEAR MATERIALS SAFETY SECTION  
1450 MARIA LANE, SUITE 210  
WALNUT CREEK, CA 94506

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

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

- ☒ A. NEW LICENSE  
☐ B. AMENDMENT TO LICENSE NUMBER \_\_\_\_\_  
☐ C. RENEWAL OF LICENSE NUMBER \_\_\_\_\_

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

Golden Valley Electric Assoc.  
Attn: Production Dept.  
P.O. Box 71249  
Fairbanks, AK. 99707

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

Healy Power Plant  
2.5 mile Usibelli Spur Road  
Healy, AK 99743-0297

## 4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION:

Paul Morgan

## TELEPHONE NUMBER:

(907) 683-2254

SUBMIT ITEMS 5 THROUGH 11 ON 8 1/2 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 mcs 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 170.21):

FEE CATEGORY 3P AMOUNT ENCLOSED \$ 540.00

## 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:

 Paul Morgan

Maintenance Superintendent 10/30/92

## FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	COMMENTS
Appl.	Nov. 1	3P	
AMOUNT RECEIVED	CHECK NUMBER		
\$540	41712		

## APPROVED BY:

## DATE:



11-18-92

NRC FORM 313 (9-88)

ESTIMATED BURDEN: PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 7.5 HRS.  
FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE OFFICE OF INFORMATION AND REGULATORY AFFAIRS, OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

571708

Application for Material License by Golden Valley Electric Association  
Additional information, Items 5 though 13, NRC form 313  
30 October, 1992

Item 5 - MATERIAL TO BE POSSESSED

This application covers four identical sources and housings as follows:

Isotope: Cesium 137, 50 mCi each maximum

Manufacturer: Kay-Ray/Sensall Inc.,  
1400 Business Center Drive  
Mount Prospect, IL 60056

NRC Lic# IL01010-01

Model Number: Source 7700-50  
Housing 7062-BP

Item 6 - PURPOSE LICENSED MATERIAL WILL BE USED FOR

42772  
The sources will be used in gauges to measure the level of coal in a pipe. There are two 24" diameter coal feed pipes running from the coal storage bunkers in the Healy Power Plant. The devices are mounted at the top and bottom of each pipe so that high and low levels can be monitored. If a low level is reached a vibrator on the bunker automatically starts to move more coal into the pipe. The lowest devices are positioned well above head height. See attached drawing number D5733-D for the arrangement.

Item 7 - INDIVIDUAL RESPONSIBLE FOR RADIATION SAFETY PROGRAM

The "Responsible Individual" for Radiation Safety at Healy Power Plant is Paul Morgan, Maintenance Superintendent. Mr. Morgan has no training in radiation safety although will receive training on the operation and use of these devices, along with most other Healy Plant personnel, from the contractor who installs them, at the time of installation.

412  
Per the attached copy of NRC Certificate of Registration number NR-512-D-129-B dated April 9, 1986, page 5, these devices can be safely operated by persons not having training in radiological protection.

Item 7 continued

Leak-detection will be performed by a licensed contractor and not by Golden Valley Electric Association (GVEA) personnel. The contractor will be:

Kay-Ray/Sensall Inc.,  
1400 Business Center Drive  
Mount Prospect, IL 60056

NRC Lic# IL 01010-01

Item 8 - TRAINING PROVIDED TO OTHER USERS

Healy Power Plant is a 24 hour operation. GVEA's will have at least one person of the three on each shift, all available maintenance personnel, and the "Responsible Individual" attend the training given by the installer of the devices before the devices are commissioned. GVEA may also video tape the training so that individuals can review the material later.

Note that the devices do not require operation by an individual. They are remote and automatic. Once installed it is anticipated that the only work performed on them will be the leak-detection tests. Radium source devices are currently being removed and have required no attention or calibration in 25 years beyond replacement of the indicator light bulbs.

Item 9 - FACILITIES AND EQUIPMENT

See the attached drawing number D5733-D, showing the general arrangement with the Stock Equipment Company Gravimetric Coal Feeder receiving coal from the bunker above via the 24" diameter downspout pipe. This machinery allows coal to be fed at a steady rate down to the Foster Wheeler MB19 Coal Pulverizer. The Secoal Nuclear devices refer to the cesium source gauges. These devices allow the coal level in the 24" pipe to be determined. Upon a low level being reached a circuit is automatically engaged to activate the coal bunker vibrators and cause more coal to flow to the pipe from the bunker. The bunker is subject to bridging of coal over the top of the pipe. This system detects when that has happened and causes the bunker to be vibrated until the bridge fails and coal flow resumes.

The gauges will be exposed to minimal vibration as they are not attached to the bunker, which does vibrate. The temperature will be in the 50 to 90 degrees F range,



Item 9 - continued

typically in the mid 70's, cooling systems will not be required as the housings are rated to 400 degrees F. There is not a corrosive atmosphere.

Information on maintenance of the gauges is included in the attached Instruction Manual. The Healy Plant uses a computerized maintenance management system that produces work orders at specific intervals, usually to perform preventive maintenance activities. A work order will be issued by that system on a 180 day interval to inspect source related signage for legibility and visibility, to check proper shutter operation, and to check that the sources are still subject to a low temperature corrosive free atmosphere and appear to be undamaged.

The emergency procedure will be listed on a sign at the sources. It will include instructions to notify the Responsible Person, Paul Morgan, who will then notify the NRC if a situation involving accidental damage of a gauge occurs.

Item 10 - RADIATION SAFETY PROGRAM

All services including installation, initial radiation survey, maintenance of the sources, housings or detectors, leak-testing, and device relocation, will be undertaken by a licensed contractor, therefore GVEA intends to keep no personnel monitoring equipment or radiation detection equipment on site. The contractor will be:

Kay-Ray Sensall Inc.,  
1400 Business Center Drive  
Mount Prospect, IL 60056

NRC Lic# IL 01010-01

GVEA requests a three year leak-test interval as, per NRC Certificate of Registration Number NR-517 D129B, dated April 9, 1986, these devices are approved for that interval.

Leak testing will be performed by the above named contractor, who will complete all aspects of the test and provide GVEA with the results. A three year interval work order will be issued by the Healy Power Plant computerized maintenance management system to remind the Healy personnel to initiate the paperwork for these tests.

Healy Power Plant has a formal tagging permit procedure (lock-out procedure). This procedure is under review at this time. Currently it is being upgraded from a general procedure to specific listings controlling how individual items of equipment are made safe to work around.

Item 10 - continued

GVEA will produce a tagging permit procedure for working around the gauges, including signage above and below at the access points to alert workers that a tagging permit is required, as part of the revised tagging permit procedure, prior to the time the cesium gauges are commissioned. There are, in any case, few times when the downspout pipes could be accessed as normally up to 500 tons of coal sit above the pipes. In 25 years since construction no one has ever been down inside them.

Paul Morgan, the "Responsible Individual", is preparing the upgrade to the tagging permit procedure and will be responsible for ensuring that these procedures are followed.

Item 11 - WASTE MANAGEMENT

Disposal will be by transfer to a licensee specifically authorized to possess the licensed material, per section 20.301 of 10 CFR Part 20.

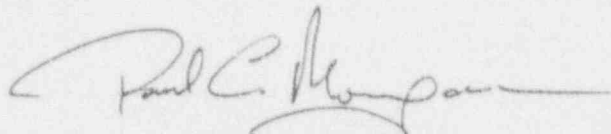
Item 12 - LICENSE FEES

GVEA understands, from a telephone call with Rita at NRC Region 5 offices, that the fee category is probably 3P and the fee is \$540.

Item 13 - Certification

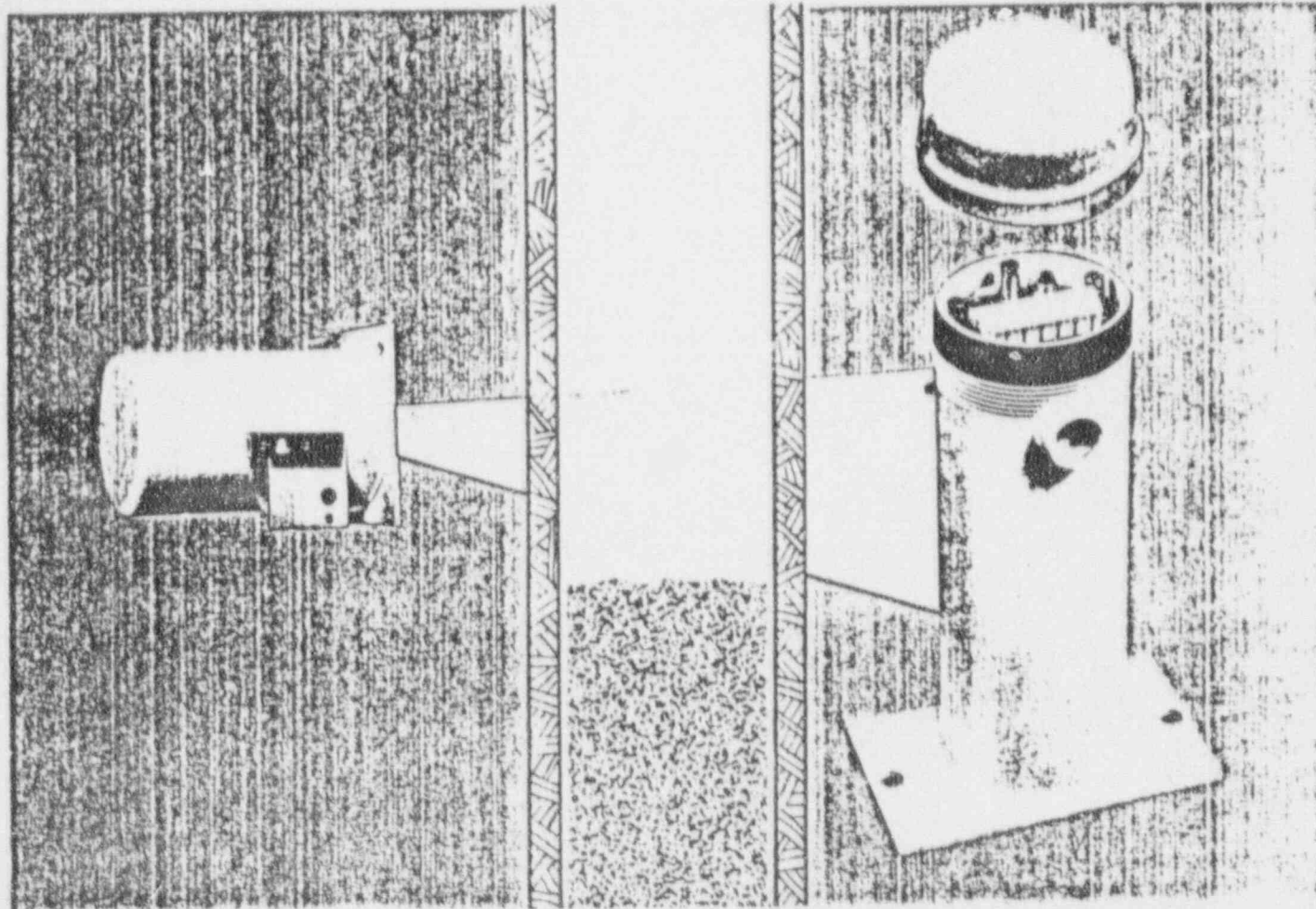
Below signed is the GVEA representative authorized to sign official documents.

I the undersigned certify that this application contains information that is true and correct to the best of my knowledge and belief.



Paul C. Morgan  
Maintenance Superintendent  
Healy Power Plant  
Golden Valley Electric Association  
an Alaskan Corporation.

# KAY-RAY® Model 4800X Level Measurement System



## MODEL 4800X with ULTRA-RELIABLE GAMM-O-SWITCH® DETECTOR

Kay-Ray/Sensall, Inc. introduces the Model 4800X non-contacting single point level measurement system for applications where ultra-reliable level measurement is required. The level of any liquid, slurry, or solid material can be accurately and confidently measured regardless of vessel size and shape or process material characteristics. Measurement is not affected by process material temperature, pressure or pH extremes and vapors, dust or other material characteristics.

### *features*

- Push button activated automatic self-calibration
- Continuous self-diagnostics with separate process level alarm and system fail alarm relays.
- Rugged system with source housing and GAMM-O-SWITCH® detector mounted outside existing vessel—no intrusion.
- Measurement unaffected by dust, pH, or pressure and temperature extremes within vessel.
- Measures level in a line all the way across the vessel—not just at one side.
- Industrial grade microcomputer and electronic components used in GAMM-O-SWITCH® detector

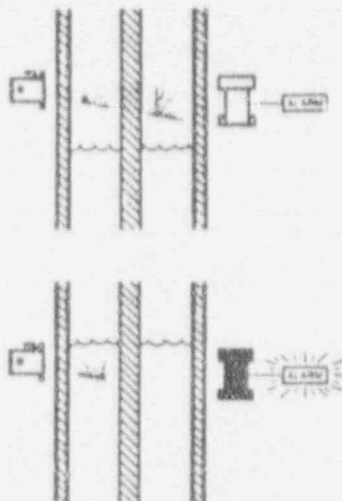
### *benefits*

- Operators can be assured of reliable level indication across the vessel regardless of the temperature, pressure, dust, pH, and abrasiveness of the process material.
- Operators will be immediately advised of ANY failure of the 4800X level system.
- No specialized training required to operate or maintain.
- Operators do not need to be concerned about damage to the 4800X due to conditions within vessel.

# MODEL 4800X ultra-reliable level system

The Model 4800X non-contacting level measurement system is Kay-Ray's fourth generation system for monitoring and controlling the level of liquids, slurries, or solids under difficult/critical process conditions.

This system utilizes Kay-Ray's family of rugged source housings and the Model GLS GAMM-O-SWITCH® detector. As shown in the accompanying figures, a Kay-Ray source housing is mounted on one side of the vessel whose level is to be measured; the GAMM-O-SWITCH® detector is mounted on the opposite side. The level is indicated when the gamma beam between the source housing and GAMM-O-SWITCH® detector is attenuated by the material within the vessel.



## RELIABILITY

Measuring the level of liquids, slurries, and solids from outside the containment vessel greatly enhances the reliability of level information. Corrosives, abrasives, high temperature-high pressure conditions have no physical contact with or influence on the Kay-Ray source housings or GAMM-O-SWITCH® detectors.

The GAMM-O-SWITCH® detector itself utilizes an industrial grade microcomputer and watch dog timer circuitry to provide separate process and system condition alarms. If any component fails, plant operators will be immediately apprised of the situation; false alarms due to detector failures are eliminated.

## SIMPLICITY

Installation, calibration, and maintenance of the Model 4800X level system are easier than any other system of its type. The source housing requires no maintenance as it has only one moving part and no electrical circuitry. The GAMM-O-SWITCH® detector is automatically self-calibrated by pressing one button; maintenance simply involves replacement of one plug-in module.

## RUGGEDNESS

All source housings are required to meet the demanding vibration and shock tests of the U.S. Department of Transportation. The GAMM-O-SWITCH® detector utilizes all industrial grade electronics and is housed in a heavy steel enclosure.

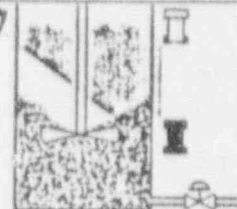
## APPLICATIONS

Kay-Ray's 4800X ultra-reliable level system is applied to solve a wide range of level measurement problems across many industries. The following examples illustrate some of these solutions. Note the different arrangements of the source housings and GAMM-O-SWITCH® detectors to obtain the desired level information.

### FOOD

Syrups, concentrates, pastes, milk products, starches, malts, hops, and other sanitary C.I.P. grade level measurements.

High and Low Solids Level



### HYDROCARBON PROCESSING

Regenerator catalysts, preflash towers, asphalt oxidizer columns, acid/hydrocarbons, and other heavy foaming or high temperature level measurements.

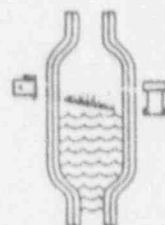
Low Liquid Level



### CHEMICAL PROCESSING

Pressurized reactors, fluidized beds, lock hoppers, acid/product interfaces, and other corrosive, high temperature/high pressure level measurements.

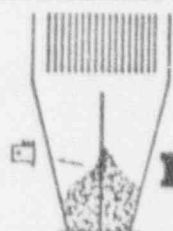
High Liquid Level



### POWER

Fly ash hoppers, plugged chutes, coal/limestone storage silos, coal feeder down spouts, and other abrasive solids level and flow measurements.

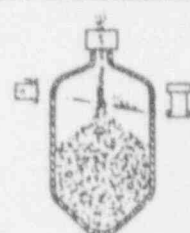
High Solids Level



### PULP AND PAPER

Digester, chip chute, chip bin, stock chest, stock tower, alkali tower, and other corrosive liquids and solids level measurements.

High Solids Level



### CEMENT/MINING

Crusher, pneumatic pump, precipitator hopper, raw storage silos and other abrasive solids level measurements.

High and Low Solids Level

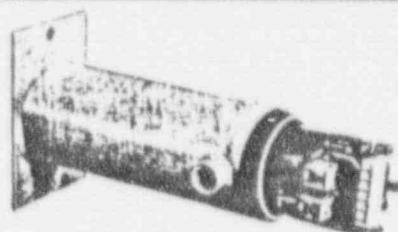




# FEATURES

## GAMM-O-SWITCH® Detector

The Model GLS GAMM-O-SWITCH® detector utilizes state-of-the-art industrial grade microprocessor technology and efficient Geiger-Mueller tubes. All of these components are packaged into one plug-in module and housed within a heavy walled steel container. The Model GLS GAMM-O-SWITCH® detector can directly replace Model 520 and 523 GAMM-O-SWITCH® and Model 7305, 7326, and 7353 detectors.



## Process/Diagnostic Alarms

PROCESS CONDITION	RED LED	GREEN LED	PROCESS ALARM RELAY	DIAGNOSTIC ALARM RELAY
Normal	Off	On	Energized	Energized
Alarm	On	Off	Deenergized	Energized
SYSTEM CONDITION				
Detector open/shorted	Flashing	Off	Deenergized	Deenergized
Detector saturated	Flashing	On	Deenergized	Deenergized
GLS failure	Off	Off	Deenergized	Deenergized
Uncalibrated	Off	Flashing	Energized	Deenergized
Calibrating	On	On	Energized	Energized

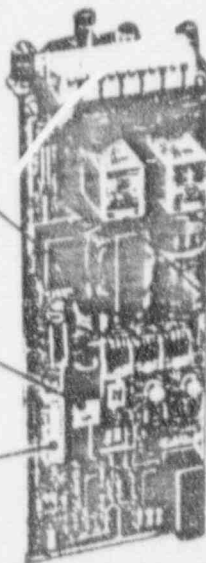
## Internal Components

### Microprocessor Technology

115VAC or 230VAC power input selection

Industrial grade microcomputer chip and support electronics

DIP switch for feature selection

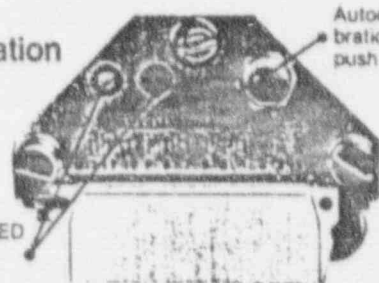


10 Amp dual Form C Process alarm relay

10 Amp single Form C system failure alarm relay

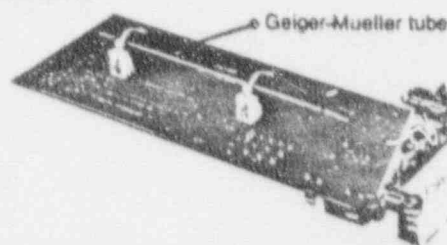
### Automatic Self-Calibration

Red and Green LED system condition indicators



Automatic self-calibration activating push button

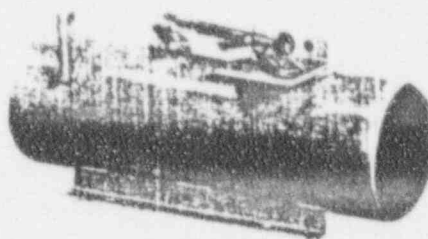
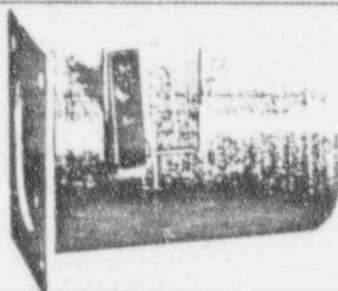
### Efficient Gamma Beam Detection



Geiger-Mueller tube

## Source Housing

Kay-Ray has a family of source housings available to match the needs of a wide range of applications. Source housings are available to meet any of the U.S. (N.R.C.) and international regulations. Either Cesium 137 or Cobalt 60 can be supplied to meet the necessary measurement requirements.



## INSTALLATION AND MAINTENANCE

Installation of the Model 4800X level system can normally be accomplished without vessel wall modifications or process downtime. The source housing and GAMM-O-SWITCH® detector are mounted with brackets directly on the vessel or on adjacent structures.

The source housings have no electronics or continuously moving parts, and no regular maintenance is required.

Calibration of the system is automatically accomplished by pushing a button mounted on the Model GLS GAMM-O-SWITCH® detector. The modular construction of the Model GLS allows rapid replacement or inspections.

The Red and Green LED indicators display the operating condition of the system.

Power can be 115VAC or 230VAC; a backup rechargeable battery with a 24 hour holdup time used to preserve calibration data in case of a power failure or brown out. The Model GLS has a built-in recharger to keep the battery charged.

## SAFETY

The gamma beam used by the source housings cannot cause residual effects in either the measured product or the handling equipment. The Model 4800X level system meets all applicable U.S. and international regulatory standards, including those of the FDA.

## System Specifications

The Model 4800X ultra-reliable level system usually consists of two components—the Kay-Ray Model GLS GAMM-O-SWITCH® detector and one of Kay-Ray's family of source housings.

### GAMM-O-SWITCH DETECTOR

*Repeatability:*  $\pm \frac{1}{4}$  inch (6mm)

*Response Time:* 1-20 seconds—DIP switch selectable

*Calibration:* automatic-push button activated

*Ambient Temperature:*  $-20^{\circ}$  to  $160^{\circ}\text{F}$  ( $-29^{\circ}$  to  $71^{\circ}\text{C}$ )

*Level Alarm:* 10 Amp 115VAC dual Form C contacts,  
fail safe high or fail safe low—  
DIP switch selected

*Diagnostic Alarm:* 10 Amp 115VAC single Form C  
contacts; alarms on all possible  
failure modes

*Source Decay Compensation:* Cesium 137 or Cobalt 60  
—DIP switch selectable

*Approvals:* CSA Class I, Div. 1, Groups C & D;  
Class II, Div. 1, Groups E, F, & G;  
Class III, CENELEC EExd IIC T6

*Finish:* Chemically resistant epoxy paint

*Power Requirements:* 115VAC or 230VAC  $\pm 10\%$   
50/60 Hz 12VA

*Weight:* 18 lbs. (8.5kg)

### SOURCE HOUSINGS

*Source Material:* Cesium 137 or Cobalt 60

*Collimation:*  $10^{\circ}$  conical or  $40^{\circ} \times 7^{\circ}$  wedge shaped

*Construction:* Lead-filled steel housing with lever  
actuated shutter

*Shutter Activation:* Manual, remote manual, electric,  
or pneumatic

*Ambient Temperature:*  $-50^{\circ}$  to  $400^{\circ}\text{F}$  ( $-45^{\circ}$  to  $204^{\circ}\text{C}$ )

*Classification:* Meets all U.S. (N.R.C.) and international  
source housing standards

*Finish:* Chemically resistant epoxy paint

*Weight:* 24 lbs. (11kg), 95 lbs. (43kg), 190 lbs. (86kg)  
or 450 lbs. (204kg)

**ROSEMOUNT**

Measurement  
Control  
Analytical  
Valves

Kay-Ray/Sensall, Inc.  
1400 Business Center Drive  
Mt. Prospect, IL 60056  
Tel (708) 803-5100  
Telex F2970165  
Fax (708) 803-5466

# **KAY-RAY® Model 4800X Single Point Level System**

## **Instruction Manual**

**December 1989**

**Kay-Ray/Sensall Order Number \_\_\_\_\_**

- ☐ **General License (See Chapter 7)**
- ☐ **Specific License (See Chapter 8)**

## Disclaimer of Warranties and Limitation of Liabilities

The staff of Kay-Ray/Sensall, Inc., has taken due care in preparing this manual; however, nothing contained herein modifies or alters in any way the standard terms and conditions of the Kay-Ray/Sensall purchase agreement by which this equipment was acquired, nor increases in any way Kay-Ray/Sensall's liability to the customer. In no event shall Kay-Ray/Sensall, Inc., be liable for incidental or consequential damages in connection with or arising from the use of this manual or any programs contained herein.

## Important Notice

This measurement device utilizes a radioactive source. Refer to and understand the local regulations pertaining to the use of radioactive material in this application.

Installation, dismantling, relocation, maintenance, repair, and testing involving the radioactive material, its shielding, or containment shall be performed by persons specifically licensed by the U.S. Nuclear Regulatory Commission or agreement state.



*NOTE: Handling of the gamma portion of this system can only be done by properly licensed personnel. If a licensed individual is unavailable, consult Kay-Ray/Sensall, Inc., directly at (708) 803-5100. Kay-Ray/Sensall has a complete Field Service staff of trained and licensed technicians available for installation and start-up assistance. Field Service rates are available upon request. Training classes are available from Kay-Ray/Sensall which provide background needed to meet the NRC requirements for licensing personnel.*

The shipping regulations of the Nuclear Regulatory Commission and the Department of Transportation are continuously being updated. Therefore, BEFORE you return a radioactive source to Kay-Ray/Sensall, please call our Service Department at (708) 803-5100. You will need to obtain a return authorization number before you can ship the source housing to Kay-Ray/Sensall. A qualified Service Representative will tell you how to pack and label the source for safe handling and transportation. Kay-Ray/Sensall reserves the right to refuse shipment if the above procedure is not followed.

Kay-Ray® and Gamm-O-Switch® are registered trademarks of Kay-Ray/Sensall, Inc.



## Model 4800X Instruction Manual Revision History

Revision Number	Date	Comments
0	12-01-89	Initial Release
1	7-30-90	

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# 1.

## Principles of Operation

### 1.1 Introduction

The Model 4800X Point Level is a rugged, non-contacting gamma level detector used to meet the needs of difficult or critical process conditions. The Model 4800X determines the level of a material by measuring the mass of material between the source and detector. A gamma beam much like the X-rays used in medical diagnostic work is used to accomplish this. The gamma beam is directed in a controlled way through a cross section of the vessel; a gamma detector on the opposite side of the vessel detects the change in intensity of this beam as the material in the vessel passes the measurement level.

The system operates by sensing the presence of either a high strength or a low strength gamma field. (A low field could be no radiation at all.) When a high gamma field is sensed at the detector, the system assumes that the product level is low, thus allowing a direct path for radiation to travel from the source to the detector. Conversely, when little or no radiation is sensed by the detector, the system assumes that the radiation path is blocked by material in the vessel and the proper high level switching action is initiated.

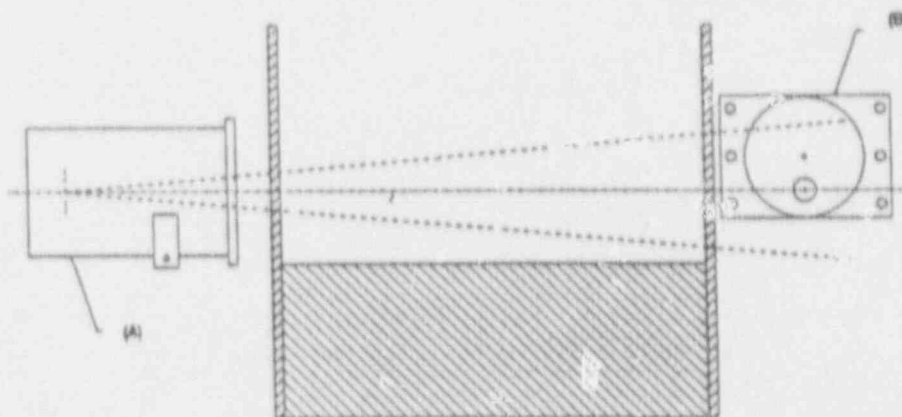


Figure 1.1A - Single Point Mounting

Figure 1.1A shows the typical mounting arrangement of a gamma level detector. The 4800X is comprised of two major elements:

- Source housing
- Detector/electronics (Gamm-O-Switch<sup>®</sup>)

The lead filled steel source housing (A) is attached to the vessel using the mounting brackets provided. The source housing contains a properly sized gamma source and a means to control the emission and direction of the gamma beam. The gamma beam is directed in a fan or conical shaped pattern through a cross section of the vessel. The detector/electronics (B) is mounted on the other side of the source housing.

The 4800X can be used as either a single point system as illustrated in Figure 1.1A, a dual point system as shown in Figure 1.1B, or a dual beam system as shown in Figure 1.1C.

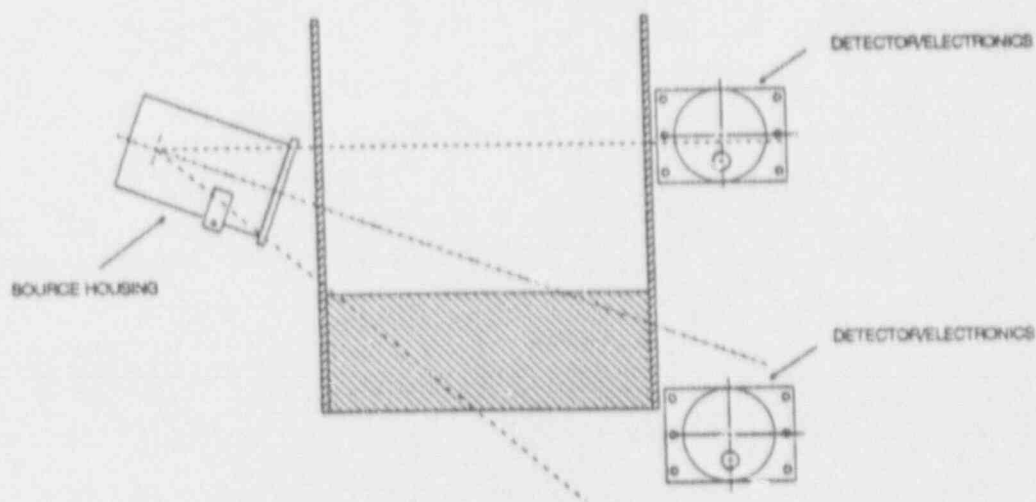


Figure 1.1B - Dual Point Mounting

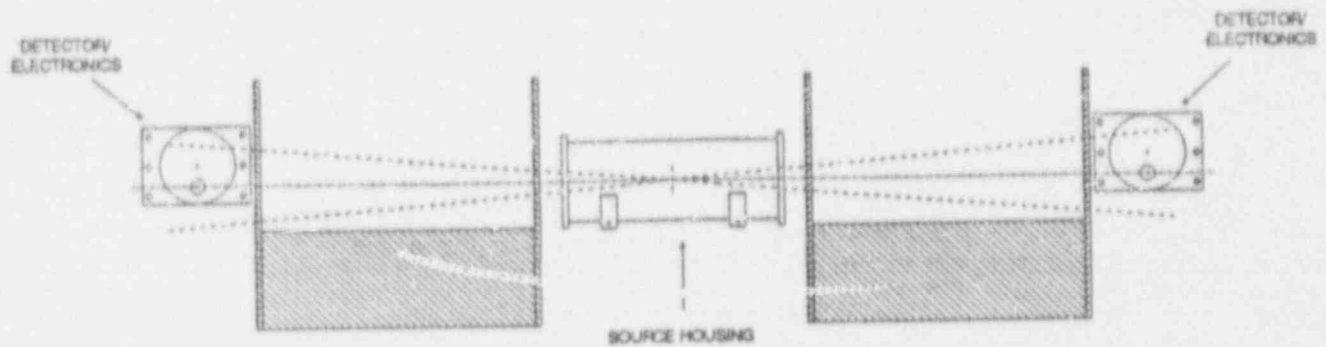


Figure 1.1C - Dual Beam Mounting

Figures 1.2A and 1.2B show the relationship of material level to the gamma beam intensity measured by the gamma detector. These changes in intensity are referenced to the gamma beam intensity at the detector with an empty vessel. As the material passes through the measurement level, more of the beam is blocked from reaching the detector and the output of the detector decreases. This detector output is provided to the integral electronics.

Corrosives, abrasives, high temperature or high pressure conditions have no physical influence on the 4800X.

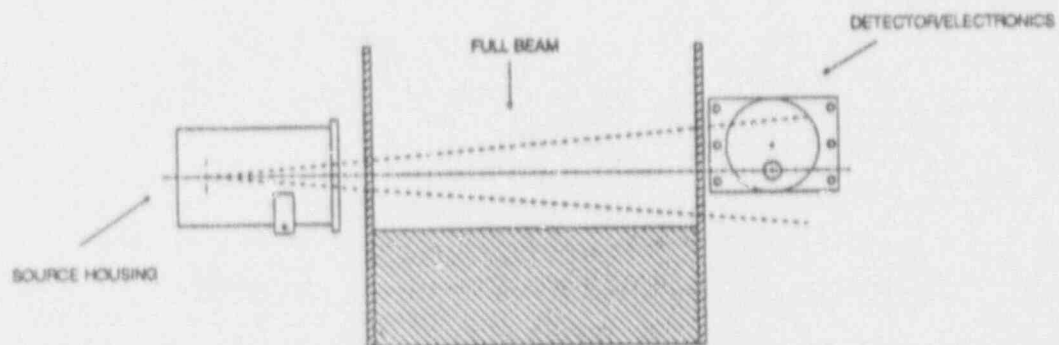
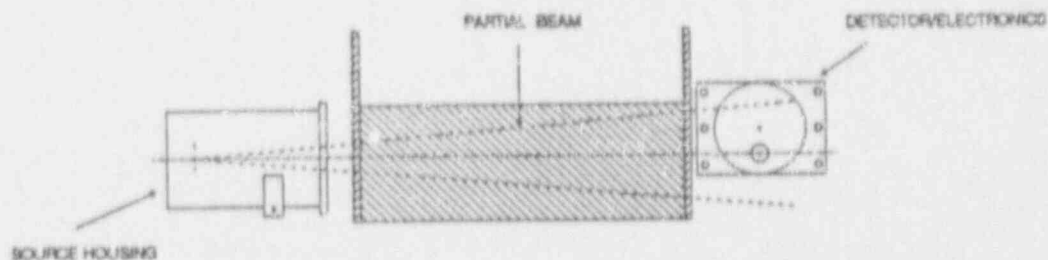


Figure 1.2A - Gamma Beam Intensity - Empty Vessel



**Figure 1.2B - Gamma Beam Intensity - Full Vessel**

## 1.2 Safety

Each 4800X installation must recognize the local regulations covering the use of gamma-based measurement systems. In the United States, the 4800X is recognized as a safe measurement system. As such, for specific applications, the Nuclear Regulatory Commission (NRC) has therefore granted the 4800X coverage under a general license. The requirements for the general license are as follows:

- The system must be a single port level installation.
- Each proposed installation under a general license must be reviewed for safety by a Kay-Ray-/Sensall sales engineer. The customer must provide all necessary drawings, sketches, dimensions, data and other documents necessary for a proper evaluation of the installation.
- Source housings must be model 7062B for activities up to 100 mCi or model 7063P for activities up to 500 mCi. Source activities greater than 500 mCi may not be distributed under a general license.
- The system must be mounted on a bin, bunker, silo, hopper, or similar vessel where a fixed measurement geometry is achievable.
- The source housing must be mounted in such a way that a person cannot place any part of his body in the gamma beam; a guard can be installed to achieve this goal. If the source is mounted on a vessel into which access is possible, an interlock system must be used.



## 2.

## System Description

### 2.1 Features

---

- Push button activated automatic self-calibration.
- Continuous self-diagnostics with separate process level alarm and system fail alarm relays.
- Rugged system with source housing, and Gamm-O-Switch® detector mounted outside existing vessel.
- Measurement unaffected by dust, pH, or pressure and temperature extremes within vessel.
- Measures level in a line all the way across the vessel. . . not just at one side.
- Industrial grade microcomputer and electronic components used in Gamm-O-Switch® detector.
- Non-Intrusive
- Battery Backup

### 2.2 Source Housing

---

The source housing contains a properly sized gamma source. A two position shutter mechanism controls the emission of a gamma beam. When the shutter is closed and locked, the source is shielded, allowing for safe storage, shipping, and installation. With the shutter open, a gamma beam is emitted. For single point applications this beam follows a 10° conical path. For dual point applications, a wedge shaped beam, 40° x 7° is usually provided. The exceptions to this are:

- 8" diameter source housings with sources greater than 2000 mCi use 25° x 7°
- 10" diameter source housings with sources less than or equal to 2000 mCi use 30° x 7°
- 10" diameter source housings with sources greater than 2000 mCi use 25° x 7°

Source housings are available in four diameters: 4 inch (100 mm), 6 inch (150 mm), 8 inch (200 mm), and 10 inch (250 mm). The correct size is directly related to the source size and the required limits of surface radiation. Two of the sizes, 4 inch and 6

inch, are available in stainless steel. Model numbers for the source housings used with wedge shaped beams are: 4"-7062B, 6"-7063, 6"-7063S, 8"-7064 and 10"-7067. Model numbers for the source housings used with conical shaped beams are: 4"-7062BP, 6"-7063P, 6"-7063PS, 8"-7064P, and 10"-7067P. In addition, there is one dual beam source housing, Model 7080, which can be placed between two hoppers and used to direct a gamma beam in two directions through both hoppers.

Cesium 137 (Cs 137) is the isotope (gamma source) usually used with the Model 4800X. It has a half life of 30 years, which means that 50% of its activity will decay over a 30 year period. The isotope Cobalt 60 is periodically used in applications where the vessel walls are extremely thick. Cobalt has a half life of 6 years. The isotope is placed in a double-walled stainless steel capsule which is welded and nitrogen leak tested. This capsule is secured in the center of the lead shield in the housing.

Even though the chance of leakage of gamma material is very remote, the United States Nuclear Regulatory Commission (NRC) does require that the source housing be leak tested at regular intervals, not to exceed 3 years. For further information, see Chapter 7, General Licensing Requirements, or Chapter 8, Specific Licensing Requirements, whichever is appropriate.



**NOTE:** Handling of the gamma portion of this system can only be done by properly licensed personnel. If a licensed individual is unavailable, consult Kay-Ray/Sensall, Inc., directly at (708) 803-5100. Kay-Ray/Sensall has complete Field Service staff of trained and licensed technicians available for installation and startup assistance. Field Service rates are available upon request. Training classes are available from Kay-Ray/Sensall which provide background needed to meet the NRC requirements for licensing personnel.

## 2.3 Detector/Electronics

The detector/electronics unit consists of a Geiger-Mueller (GM) tube and an associated microprocessor based electronics enclosed in an explosion proof housing.

### 2.3.1 Detector

The GM tube excitation voltage supply, -700 VDC, is applied to the inside wall and center conductor of the GM tube. When the gamma photon strikes the gas in the detector, it creates ion pairs. The -700 VDC forces the charged ions to collect on the inside wall and center conductor producing a small current pulse. The pulse rate is directly proportional to the number of photons striking the GM tube.

Output indicators are provided by the Process Alarm Relay, the Diagnostic Alarm Relay and the status LEDs. The Process Alarm Relay indicates if the level of the

Output indicators are provided by the Process Alarm Relay, the Diagnostic Alarm Relay and the status LEDs. The Process Alarm Relay indicates if the level of the material in the vessel has passed the measurement point. The Diagnostic Alarm Relay provides a means for remotely indicating a system failure condition. The local LEDs serve to pinpoint the nature of the failure.

Condition	Status LED's		Process Alarm Relay	Diagnostic Alarm Relay
	Red LED	Green LED		
Normal	Off	On	Energized	Energized
Level Alarm	On	Off	De-energized	Energized
Detector Failure	Flashing	Off	De-energized	De-energized
Saturated Detector	Flashing	On	De-energized	De-energized
Power/CPU Failure	Off	Off	De-energized	De-energized
Calibrating	On	On	Energized	Energized
Uncalibrated	Off	Flashing	Energized	De-energized

### 2.3.2 Electronics

System calibration is simple. Just empty the vessel, or lower the material level to elevation below the point that is being monitored and press the calibration button. The microcomputer will do the rest.

Certain options are dip-switch selectable: response time, high level or low level alarm, 50 or 75 percent trip point, fixed or pushbutton calibration, and radiation source selection (Cesium or Cobalt). These options and the procedure used to select them are defined in Chapter 4, Initial Setup.

# 3.

## Installation

### 3.1 General

---

To function as designed, the source housing and detector/electronics must be properly applied. This chapter describes the recommended procedures for standard applications. Should these procedures prove inadequate for a particular application, consult Kay-Ray/Sensall for specific recommendations.

Every application of the 4800X System has exacting requirements both with respect to the application as well as radiation safety. To meet the needs of the process, the equipment must be installed properly. To assure safe operation and to meet governmental requirements, the installation must be preplanned according to the recommendations of the supplier. At the time of actual installation, either the supplier or other properly licensed personnel are required to be in attendance to verify the safety of the system.

The system is shipped in accordance with all United States Nuclear Regulatory Commission and Department of Transportation Regulations. The source housing is shipped with the source shutter block locked in the closed position. The lock must remain in place until installation has been completed and the system is ready for start-up and calibration. Keys for unlocking the shutter block padlock are sent separately to the customer.

### 3.2 Mechanical Installation

---

#### 3.2.1 Source Housing Installation

The source housing should be mounted on the vessel wall opposite the detector unless specifically designed for a non-standard (chord) mounting. The position of the source housing is determined by the desired measurement level and application, single point or dual point. Be sure to allow adequate clearance for installation and maintenance of the extra source housing structure, and if required, beam shields and/or actuator cables.

The gamma beam from the dual point source housing is highly directional, thus it is necessary that the source be directed at the detector with the beam oriented in the same plane as both detectors.



**CAUTION:** The unit is shipped with the shutter handle locked in the "store" or "closed" position, and the lock should not be removed until the system is completely installed and ready for operation. Care should be taken when mounting the source housing, to ensure that the gamma beam is properly oriented and that access to the shutter handle is not restricted.



### 3.2.1.1 Source Housing Mounting for Single Point

To place the source housing on the vessel, first measure from the base of the vessel up to the desired measurement point and mark the vessel at that location. Next, position the Model 7660 mounting brackets (or other suitable mounting means) on the vessel wall as illustrated in Figure 3.1A. Remember that the size and type of the source housing effects the center line of the gamma beam. Be sure to line up the mounting brackets accordingly.

Once the brackets are located correctly, attach them to the side of the vessel. They can be attached by welding or bolting to the surface. Next, attach the source housing to the brackets. (See Figures 3.2A through 3.2C for source housing dimensions.)

SOURCE HOUSING			
SIZE (DIA)	MODEL #	A	B
4" (100mm)	7062BP	4" (100mm)	3 1/4" (81.3mm)
6" (150mm)	7063P 7063PS	6" (150mm)	4 1/4" (106.3)
8" (200mm)	7064P	7 1/2" (181mm)	5 1/4" (131.3)

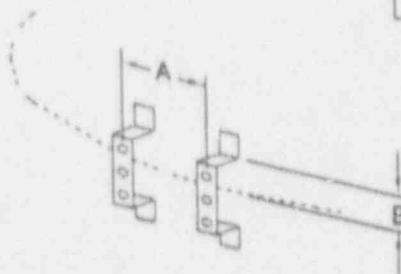


Figure 3.1A - Mounting of Single Point Source Housing

### 3.2.1.2 Source Housing Mounting for Dual Point

To place the source housing on the vessel, first measure from the base of the vessel up to the higher of the two desired measurement points. Then mark the vessel at that location. Next, position the Model 7654 mounting brackets (or other suitable mounting means) on the vessel as illustrated in Figure 3.1B. Remember that the size and type of the source housing determines the pattern of the gamma beam. Be sure to line up the mounting brackets accordingly.

Once the brackets are located correctly, attach them to the side of the vessel. The brackets can be attached by welding or bolting to the surface. Next, attach the source housing to the brackets. (See Figures 3.2A through 3.2C for source housing dimensions.)



**NOTE:** The largest source housing available, the 10" diameter 7067P, must be supported from the base due to the heavy weight of the housing. In setting up your support structure, be sure to center the housing accordingly.

SOURCE HOUSING			
SIZE (DIA)	MODEL #	A	B
4" (100mm)	7062BP	4" (100mm)	3" (75mm)
6" (150mm)	7063 7063S	6" (152mm)	4" (100 mm)
8" (200mm)	7064	7 1/2" (191mm)	5" (125 mm)

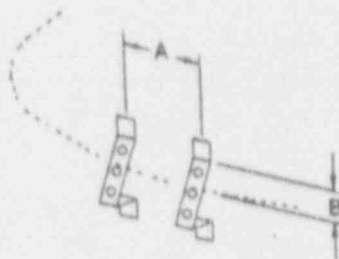


Figure 3.1B - Mounting of Dual Point Source Housing

### 3.2.1.3 Source Housing Mounting for Dual Beam

Because the Dual Beam Source Housing, Model 7080, is located between two vessels, the support for the housing is usually a free standing column. To place the housing correctly, simply provide a support base positioned  $2\frac{3}{4}$ " (69.8mm) before the desired measurement level. The support base must have 4 holes,  $\frac{7}{16}$ " (11.1 mm) diameter, to match the 7080 housing base. See Figure 3.2C.

#### *Radiation Beam Shields: Installation*

Radiation beam shields are required with the Kay-Ray/Sensall Model 7080 source head to meet the provisions of the General License under which the equipment is sold.

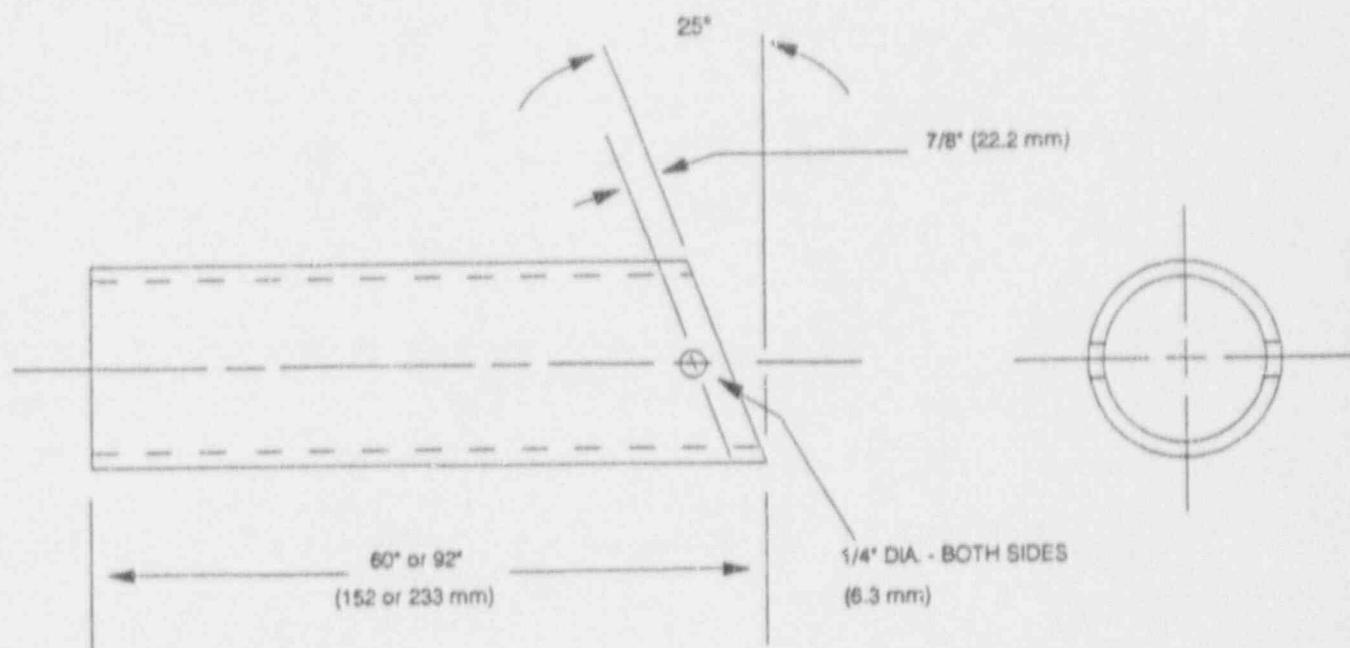
These shields are provided by the factory in two lengths, 5' 0" (1.5 m) and 7' 8" (2.3 m). (Figure 3.4A)

These shields may require trimming to length by the customer at his job site after the source is mounted. The shields are shipped mitered at 25° on one end and drilled to accept the supplied mounting brackets and hardware. Since the shield tubing acts somewhat like a choke on the radiation beam, it is important that the radiation source, shield, and detector are all in alignment with each other.

The shield should be mounted so that it is physically attached only at the hopper end. The source end should overlap the source housing approximately one inch to allow for thermal expansion/contraction of hoppers. (See Figure 3.4B)

To install radiation beam shields, follow these steps:

1. Rough in location of beam shield mounting holes on hopper ( $\frac{3}{8}$ " (9 mm) diameter holes). Provide means for holding shield mounting brackets in place.
2. Cut the square end of the shield to the desired length.
3. Pre-assemble the brackets to the mitered end.
4. Slide the square end of the tube over the source housing and attach the hopper end.



MATERIAL: 5" O.D. .052 Wall Extruded

Aluminum Tubing 6063-T6

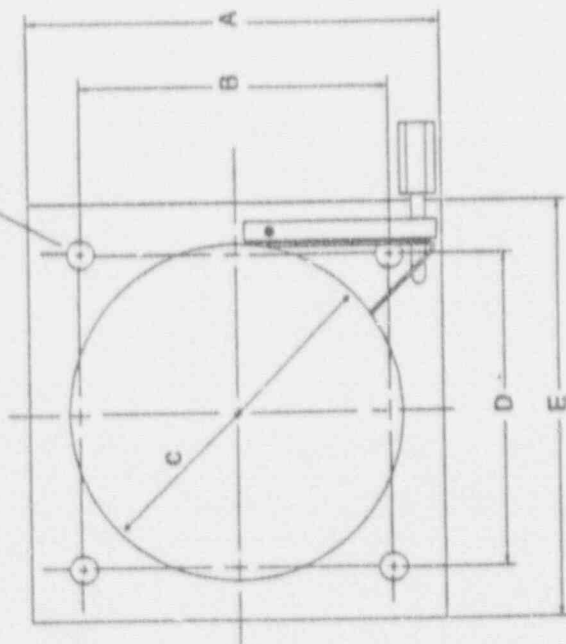
FINISH: Natural

Piece to be free of excessive saw burrs.

Figure 3.2 - Beam Shield for 7080 Source Housing



9/16 (14 3) DIA  
MOUNTING HOLES



DIMENSIONS (inches)										
SOURCE HOUSING MODEL #	A	B	C	D	E	F	G	H	I	J
4 7062SP	5	4	4	4	4	4	4	4	4	4
6 7063P	6	6	6	6	6	6	6	6	6	6
8 7063PS	8	8	8	8	8	8	8	8	8	8
10 7064P	10	10	10	10	10	10	10	10	10	10
12 7064P	12	12	12	12	12	12	12	12	12	12
14 7064P	14	14	14	14	14	14	14	14	14	14
16 7064P	16	16	16	16	16	16	16	16	16	16
18 7064P	18	18	18	18	18	18	18	18	18	18
20 7064P	20	20	20	20	20	20	20	20	20	20
22 7064P	22	22	22	22	22	22	22	22	22	22
24 7064P	24	24	24	24	24	24	24	24	24	24
26 7064P	26	26	26	26	26	26	26	26	26	26
28 7064P	28	28	28	28	28	28	28	28	28	28
30 7064P	30	30	30	30	30	30	30	30	30	30
32 7064P	32	32	32	32	32	32	32	32	32	32
34 7064P	34	34	34	34	34	34	34	34	34	34
36 7064P	36	36	36	36	36	36	36	36	36	36
38 7064P	38	38	38	38	38	38	38	38	38	38
40 7064P	40	40	40	40	40	40	40	40	40	40
42 7064P	42	42	42	42	42	42	42	42	42	42
44 7064P	44	44	44	44	44	44	44	44	44	44
46 7064P	46	46	46	46	46	46	46	46	46	46
48 7064P	48	48	48	48	48	48	48	48	48	48
50 7064P	50	50	50	50	50	50	50	50	50	50
52 7064P	52	52	52	52	52	52	52	52	52	52
54 7064P	54	54	54	54	54	54	54	54	54	54
56 7064P	56	56	56	56	56	56	56	56	56	56
58 7064P	58	58	58	58	58	58	58	58	58	58
60 7064P	60	60	60	60	60	60	60	60	60	60
62 7064P	62	62	62	62	62	62	62	62	62	62
64 7064P	64	64	64	64	64	64	64	64	64	64
66 7064P	66	66	66	66	66	66	66	66	66	66
68 7064P	68	68	68	68	68	68	68	68	68	68
70 7064P	70	70	70	70	70	70	70	70	70	70
72 7064P	72	72	72	72	72	72	72	72	72	72
74 7064P	74	74	74	74	74	74	74	74	74	74
76 7064P	76	76	76	76	76	76	76	76	76	76
78 7064P	78	78	78	78	78	78	78	78	78	78
80 7064P	80	80	80	80	80	80	80	80	80	80
82 7064P	82	82	82	82	82	82	82	82	82	82
84 7064P	84	84	84	84	84	84	84	84	84	84
86 7064P	86	86	86	86	86	86	86	86	86	86
88 7064P	88	88	88	88	88	88	88	88	88	88
90 7064P	90	90	90	90	90	90	90	90	90	90
92 7064P	92	92	92	92	92	92	92	92	92	92
94 7064P	94	94	94	94	94	94	94	94	94	94
96 7064P	96	96	96	96	96	96	96	96	96	96
98 7064P	98	98	98	98	98	98	98	98	98	98
100 7064P	100	100	100	100	100	100	100	100	100	100

DIMENSIONS (mm)										
SOURCE HOUSING MODEL #	A	B	C	D	E	F	G	H	I	J
4 7062SP	127	102	117	102	127	102	117	102	117	102
6 7063P	203	152	190	152	203	190	203	190	203	190
8 7063PS	203	152	190	152	203	190	203	190	203	190
10 7064P	228	181	219	181	228	214	228	214	228	214
12 7064P	254	203	241	203	254	241	254	241	254	241
14 7064P	279	225	267	225	279	264	279	264	279	264
16 7064P	305	248	290	248	305	290	305	290	305	290
18 7064P	330	270	313	270	330	313	330	313	330	313
20 7064P	355	292	335	292	355	335	355	335	355	335
22 7064P	381	314	357	314	381	357	381	357	381	357
24 7064P	406	337	380	337	406	380	406	380	406	380
26 7064P	432	359	402	359	432	402	432	402	432	402
28 7064P	457	381	425	381	457	425	457	425	457	425
30 7064P	483	403	447	403	483	447	483	447	483	447
32 7064P	508	425	470	425	508	470	508	470	508	470
34 7064P	533	447	492	447	533	492	533	492	533	492
36 7064P	559	469	515	469	559	515	559	515	559	515
38 7064P	584	491	537	491	584	537	584	537	584	537
40 7064P	610	514	560	514	610	560	610	560	610	560
42 7064P	635	536	582	536	635	582	635	582	635	582
44 7064P	660	558	605	558	660	605	660	605	660	605
46 7064P	686	580	627	580	686	627	686	627	686	627
48 7064P	711	602	650	602	711	650	711	650	711	650
50 7064P	737	625	672	625	737	672	737	672	737	672
52 7064P	762	647	695	647	762	695	762	695	762	695
54 7064P	787	669	717	669	787	717	787	717	787	717
56 7064P	813	691	740	691	813	740	813	740	813	740
58 7064P	838	714	762	714	838	762	838	762	838	762
60 7064P	863	736	785	736	863	785	863	785	863	785
62 7064P	889	758	807	758	889	807	889	807	889	807
64 7064P	914	780	830	780	914	830	914	830	914	830
66 7064P	939	802	852	802	939	852	939	852	939	852
68 7064P	965	824	875	824	965	875	965	875	965	875
70 7064P	990	846	897	846	990	897	990	897	990	897
72 7064P	1016	868	920	868	1016	920	1016	920	1016	920
74 7064P	1041	890	942	890	1041	942	1041	942	1041	942
76 7064P	1067	912	965	912	1067	965	1067	965	1067	965
78 7064P	1092	934	987	934	1092	987	1092	987	1092	987
80 7064P	1118	956	1010	956	1118	1010	1118	1010	1118	1010
82 7064P	1143	978	1032	978	1143	1032	1143	1032	1143	1032
84 7064P	1169	1000	1055	1000	1169	1055	1169	1055	1169	1055
86 7064P	1194	1022	1077	1022	1194	1077	1194	1077	1194	1077
88 7064P	1220	1044	1100	1044	1220	1100	1220	1100	1220	1100
90 7064P	1245	1066	1122	1066	1245	1122	1245	1122	1245	1122
92 7064P	1271	1088	1145	1088	1271	1145	1271	1145	1271	1145
94 7064P	1296	1110	1167	1110	1296	1167	1296	1167	1296	1167
96 7064P	1322	1132	1190	1132	1322	1190	1322	1190	1322	1190
98 7064P	1347	1154	1212	1154	1347	1212	1347	1212	1347	1212
100 7064P	1373	1176	1235	1176	1373	1235	1373	1235	1373	1235

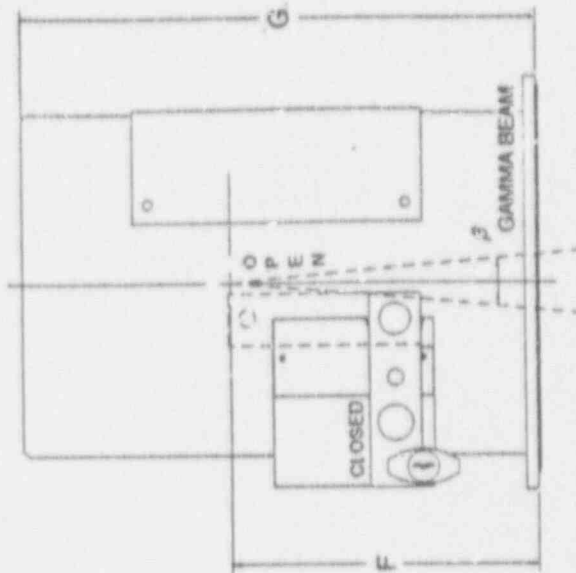
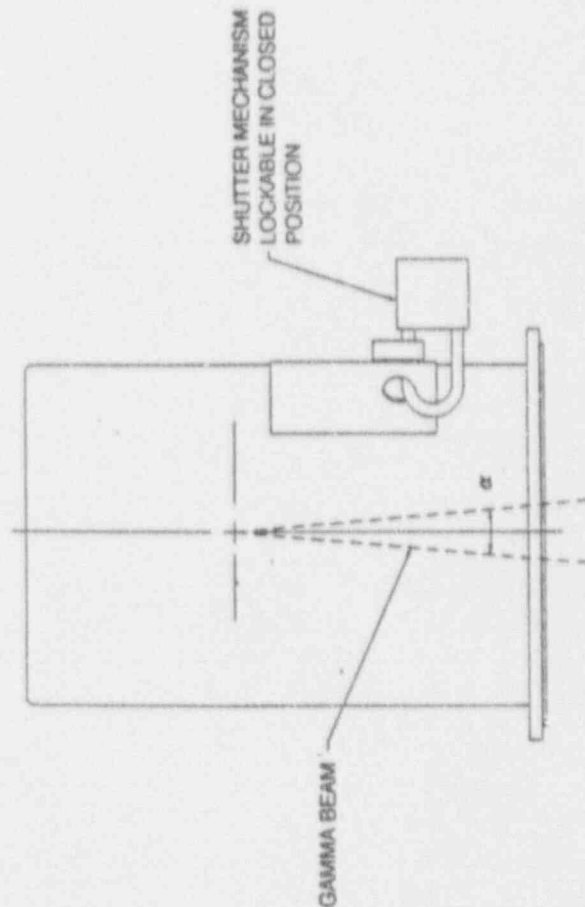
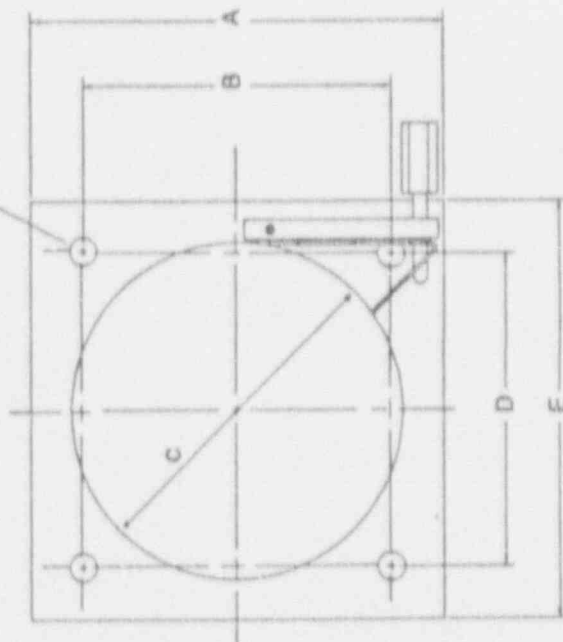


Figure 3.3A - Dimensions for Single Point Source Housings

9/16 [14.3] DIA  
MOUNTING HOLES



DIMENSIONS [inches]												
SOURCE HOUSING NOMA SIZE	MODEL #	A	B	C	D	E	F	G	H	I	J	K
4	7062B	5	4	4 $\frac{1}{2}$	4	5	4	5 $\frac{1}{2}$	4	5	4	7
6	7063	6	5	5 $\frac{1}{2}$	5	6	5	6 $\frac{1}{2}$	5	6	5	7
8	7063S	8	6	6 $\frac{1}{2}$	6	7	6	7 $\frac{1}{2}$	6	7	6	7
10	7064	10	8	8 $\frac{1}{2}$	8	9	8	9 $\frac{1}{2}$	8	9	8	7
12	7067	12	10	10 $\frac{1}{2}$	10	11	10	11 $\frac{1}{2}$	10	11	10	7

DIMENSIONS [mm]

SOURCE HOUSING NOMA SIZE	MODEL #	A	B	C	D	E	F	G	H	I	J	K
4	7062B	127	102	117	102	127	102	141	102	127	102	7
6	7063	152	127	141	127	152	127	168	127	152	127	7
8	7063S	203	152	168	152	203	152	229	152	203	152	7
10	7064	254	181	216	181	254	181	280	181	254	181	7
12	7067	305	254	267	254	305	254	343	254	305	254	7

\*For sources greater than 2000 mCi this is 25°.

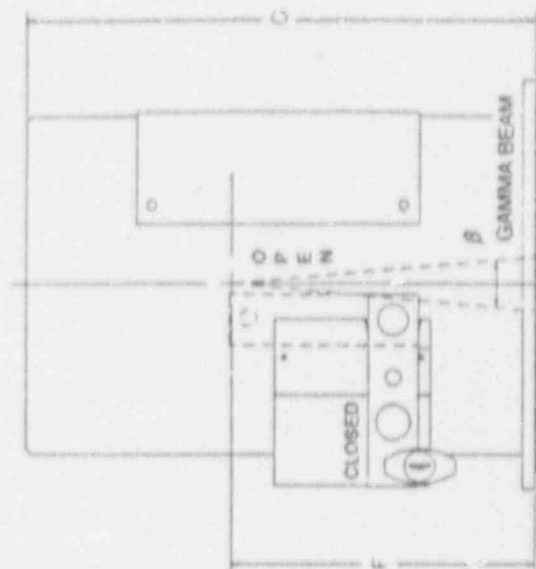
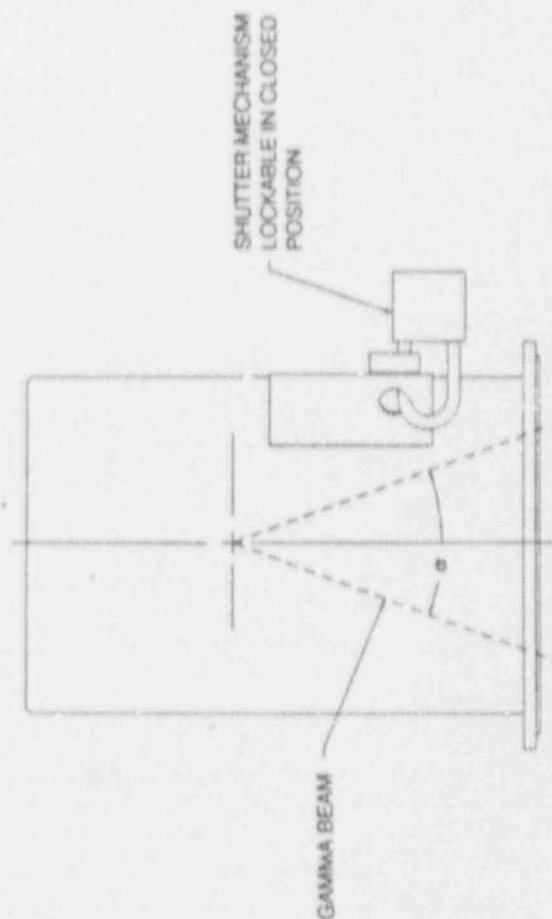


Figure 3.3B - Dimensions for Dual Point Source Housings

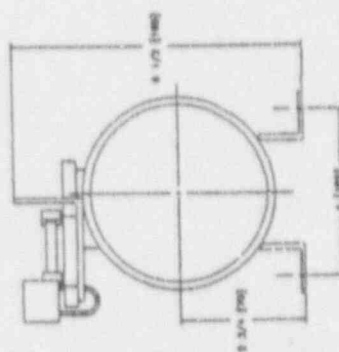
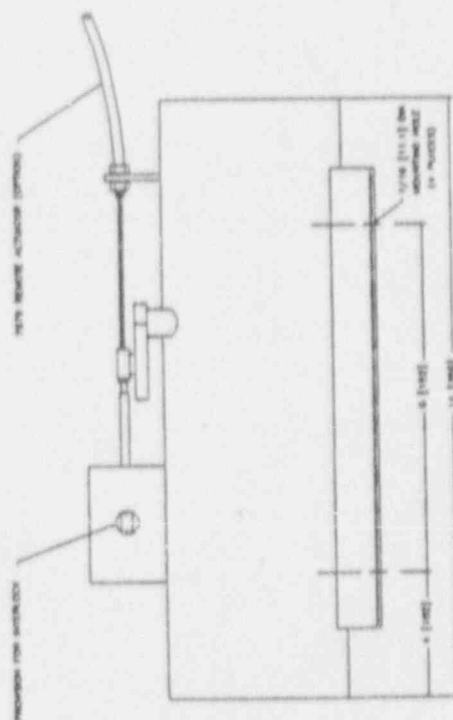
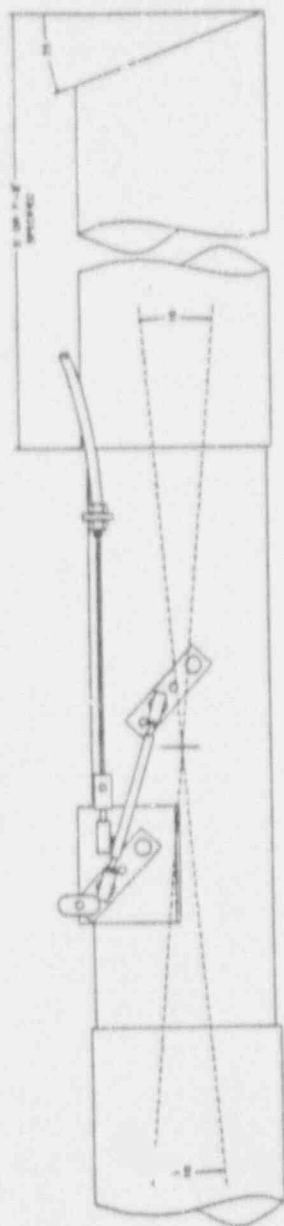


Figure 3.3C - Dimensions for Remote Actuator

### 3.2.2 Remote Actuator Installation

In certain applications such as areas of high temperature or confined spaces, it is important to have remote control of the source housing's on/off shutter to ensure safe operation. To accomplish this, the 7679B remote actuator and control cable can be installed.

Figures 3.3A and 3.3B illustrate the remote actuator connections. This device should be mounted in a way that allows a minimum two foot bend radius of the control cable and provides for clamping of the cable to fixed structures.

If traverse motion is to be encountered anywhere along the cable, appropriate clamping and protection against abrasion must be provided to assure optimum performance.

Reverse bends should be avoided as this effects frictional resistance and cable play.

The cable must not be routed and clamped against hot surfaces. Its temperature must not exceed 200° F (93° C).

If required due to container construction, weight of the source unit, temperature, etc., the source housing and detector can be mounted on a structure next to but not touching the walls. If necessary, special ground supports may be required. In any instance it is absolutely necessary that all system components be rigidly mounted.

#### 3.2.2.1 Cable To Source Housing Attachment



**CAUTION:** Single and dual point source housing cable attachments and adjustments must be made while maintaining the source housing in the locked position and the actuator in the OFF position. The following simple steps along with Figure 3.3A describes the attachment of the remote actuator cable to the source housing.

1. Remove swivel (A), one (1) jam nut (B) and washer from the cable end.
2. Attach the free swivel to the handle using a "C" clip.
3. Spin the remaining jam nut (B) and washer rearward to the limit of the threaded cable section.
4. Position the cable end through the hole in the cable bracket (C) and reinstall the jam nut (B) and washer.



**NOTE:** Do not tighten the cable mount against the bracket at this time as this will help in the cable travel adjustment.

5. Insert the core wire (E) through the free swivel (A). While pulling tight, tighten the jam screw (F). (Making sure source handle remains closed.)
6. Tighten the jam nuts (B).

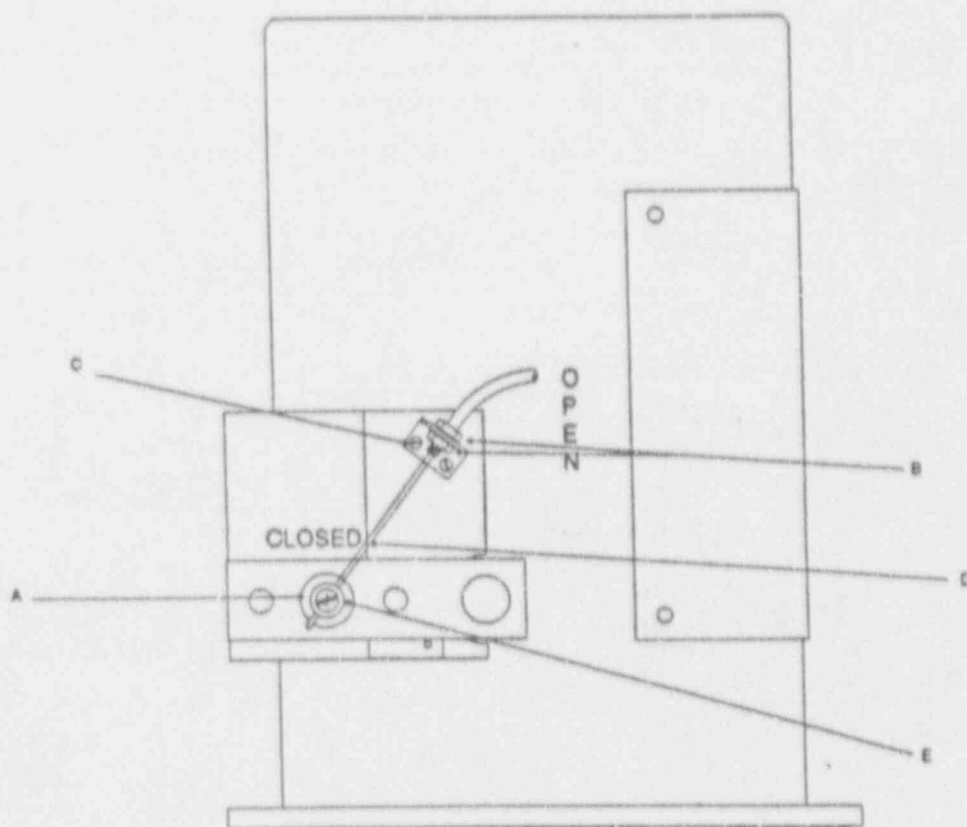


Figure 3.4A - Remote Actuator Connection to 7062B



### 3.2.2.2 Cable to Dual Beam Source Housing

The following simple steps, along with Figure 3.3B describe the attachment of the remote actuator cable to the dual beam source housing.

1. Assemble the threaded insert (B) to the free swivel (A) and tighten.
2. Remove the front jam nut (C) from the cable (D). Spin the remaining jam nut (C) rearward to the limit of the threaded cable section.
3. Insert the threaded cable section through the hole in the bulk head (G). Reassemble the jam nut (C) to the threaded cable section.



**NOTE:** Do not tighten the jam nut against the bulk head at this time as this is the linkage travel adjustment.

4. Attach the core wire by inserting it into the free swivel hole (A). Insert the core wire to the full depth of the hole in the free swivel, tighten the set screw in the free swivel securely against the core wire.
5. Tighten the jam nut (C) against the bulk head (G) to achieve linkage adjustment.
6. Check the operation of the source and actuator assembly.



**CAUTION:** Never attempt to open or close the source with the handles at the source as this will result in damage to the cable and the actuator mechanism.

Remove the lock from the source and move the handle on the remote actuator to the extreme opposite side of the "CLOSED" position. This action should open the shutter block handle 90° from the OFF position. If this has not been accomplished, return the remote actuator handle to the "CLOSED" position and remove any excess slack from the core wire by reducing the cable length by 1/2" (12 mm) at the bulk head. Recheck the operation.



### 3.2.2.3 Actuator and Source Handle Adjustment

With the actuator cable firmly attached to the source housing, it is now time to attach it to the actuator. Once this is finished, adjust the cable to attain the desired movement of the handle.

1. Insure that the actuator handle is in the fully closed position, and that all final cable routing and clamping operations have been performed.
2. Remove the padlock from the source head.
3. Open the remote shutter (as far as possible). Now the source housing handle should be open (approx. 90° angle from closed position). If not, loosen the core wire jam screw (F) and tighten or loosen the core wire (E).



**CAUTION:** *Never attempt to open or close the source housing with the handle at the source housing, as this will result in damage to the cable and actuator mechanism.*



**NOTE:** *Periodically inspect and lubricate all exposed pivot points, as required. The actuator cable is prelubricated and requires no additional maintenance.*

### 3.2.3 Detector Installation

#### 3.2.3.1 Installation of Detector - Single Point or Upper Level of Dual Point

To install the detector used in a single point system, or as an upper level detector in a dual point system, first measure up from the base of the vessel to the measurement level desired. This level must be the same as was used to position the source housing. Mark the vessel to indicate this level.

Line up the detector so that the center of the GM Tube is at the same elevation as the measurement level desired. As illustrated in Figure 3.5, the center of the GM Tube is located  $\frac{5}{16}$ " (16 mm) below the center line of the entire detector/electronics assembly.

Attach the detector using the bolt holes provided or by welding it directly to the vessel.



**NOTE:** *The detector used with the 4800X system is an extremely sensitive device designed to operate in small gamma fields. For this reason, any application of this system must be carefully planned. Particularly when more than one system is involved, detectors must not be located in proximity to or in the beam path of other source housings. Failure to consider detector location in relation to other systems*

may result in undesirable interference and crosstalk between units. Applications assistance is available from Kay-Ray/Sensall. Kay-Ray/Sensall applications engineering should be consulted whenever the installation of multiple systems is required.

### 3.2.3.2 Installation of Detector - Lower Level of Dual Point Systems

The first step in installing the lower level detector is to measure and mark on the vessel the desired measurement level. To ensure that a proper alignment is provided, these detectors must be installed to meet the following criteria:

The maximum level range (upper level - lower level).

Maximum Level Range = (Vessel Diameter) x tan (Beam Angle) - 4 inches (100 mm)

The beam angles for the source housings are:

Model #	Source Size	Beam Angle	tan (Beam Angle)
7062BP	All	40°	.893
7063P	All	40°	.893
7063PS	All	40°	.893
7064P	Up to and including 2000 mCi	40°	.893
	Greater than 2000 mCi	25°	.466
7067P	Up to and including 2000 mCi	30°	.577
	Greater than 2000 mCi	25°	.466

Attach the detector using the bolt holes provided or by welding it directly to the vessel.





### 3.3 Electrical Installation

Only the detector/electronics requires electrical power. The source housing does not require any outside sources of power.

All electrical connections are made on the connector that attaches to the electronics assembly. (Refer to Figure 3.6.) Both the normally open and normally closed relay contacts are available on the connector. For fail-safe alarm purposes, usually the normally closed (NC) contacts are used.

To minimize moisture or condensation inside the detector housing, properly seal the cap and conduit fitting. Silicone rubber or caulk should be used around the conduit fittings.

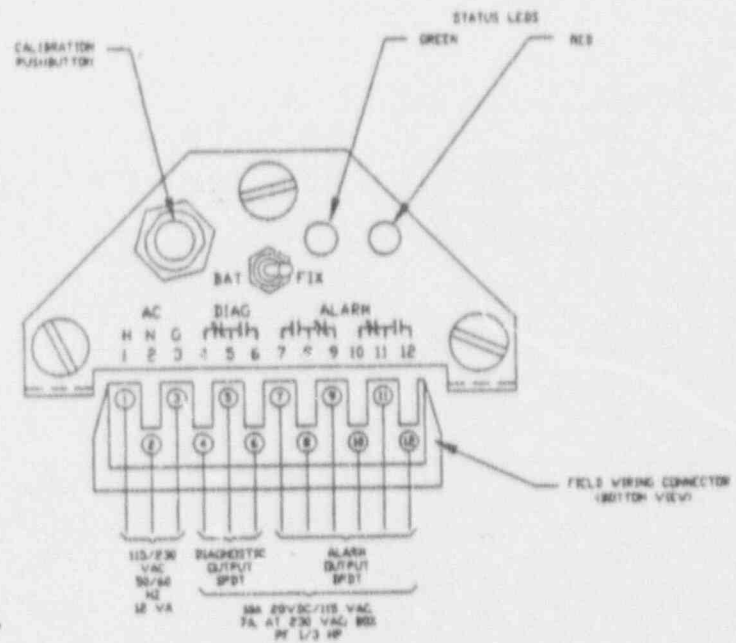


Figure 3.6 - Electrical Installation

# 4.

## Configuration

Configuration of the various options is usually done at the factory, but configuration is easily done by changing the settings of the on-board switches. Refer to Figure 4.1 for the location of the switches.

### 4.1 Line Power Selection

SW4 configures the transformer windings for 115 or 230 VAC. The selected line voltage is indicated on the slide mechanism. The  $\frac{1}{4}$  A fuse provided is adequate protection for 115 VAC and 230 VAC operation.

### 4.2 Response Time Selection

C1 and C2 control the system response time proportional to the radiation levels present at the detector. Three valid response ranges are available. Unreliable operation will result if both C1 and C2 are switched off. The following table illustrates the typical response times for various radiation fields and C1 and C2 combinations.

DETECTOR RADIATION LEVEL	C1 ON C2 ON	C1 OFF C2 ON	C1 ON C2 OFF
0.1mR/hr	6 sec	12 sec	18 sec
0.2mR/hr	3 sec	6 sec	9 sec
0.5mR/hr	1.25 sec	2.5 sec	3.75 sec
1.0mR/hr	.75 sec	1.5 sec	2.25 sec
2.0mR/hr	—	1 sec	2 sec
4.0mR/hr	—	—	1 sec

Combinations with dashed response times do not work reliably and are not recommended.



**NOTE:** A 4 mR/hr is the maximum field that can be used with the system.

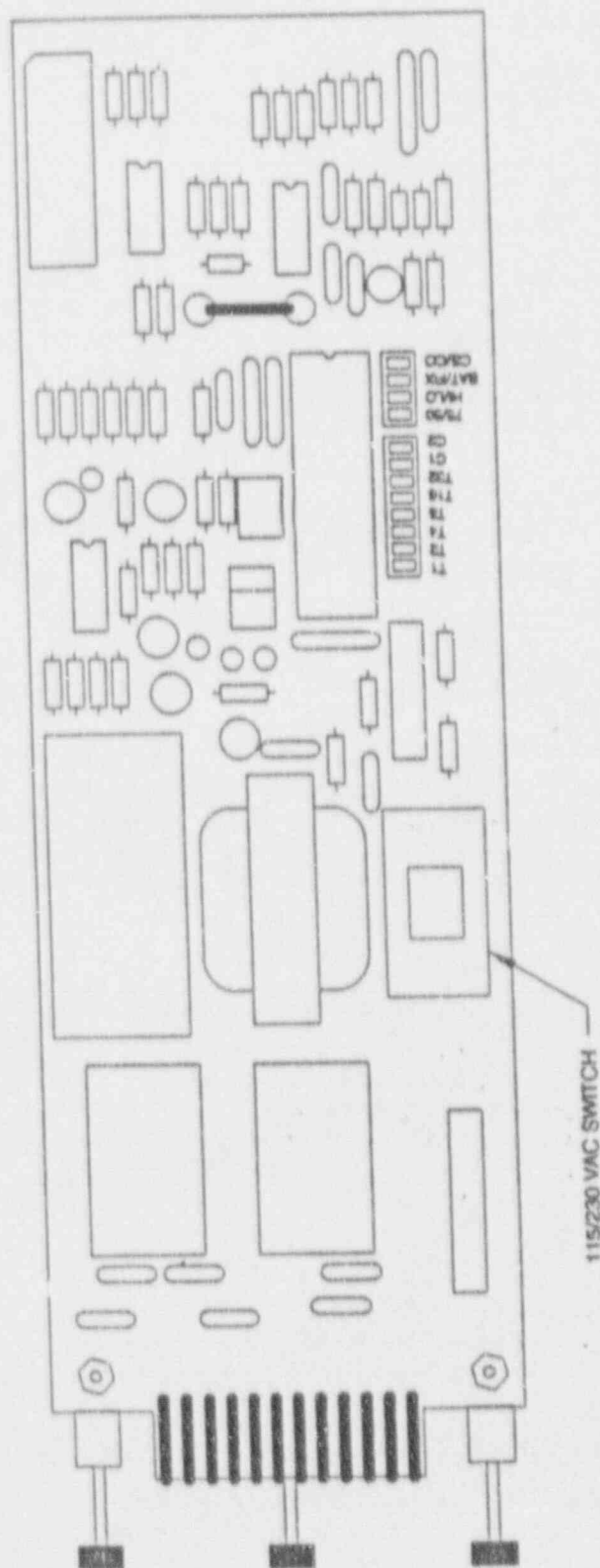


Figure 4.1 - Switch Location

#### 4.3 Trip Point Selection

The trip point is usually set for a 75 percent radiation change yielding the most reliable operation in most conditions. The 50 percent trip point is needed when background fields are relatively high or when the material's density is relatively low. Leaving the 75/50 switch off selects the 75 percent trip point. Placing the 75/50 switch on selects the 50 percent trip point.

#### 4.4 High/Low Alarm Selection

To select high level alarming, place the HI/LO switch in the "off" position. To select low level alarming, place the HI/LO switch in the "on" position. Fail-safe operation is assured by always energizing the output relays in the normal operating condition and de-energizing them in the alarm state (normally open relays).

#### 4.5 Push button Calibration Mode Selection

*(provides a minimum of  
24 hr battery backup)*

The push button calibration mode is selected by placing the BAT/FIX switch in the "off" position. In this mode the battery will maintain calibration data for a minimum of 24 hours during a power failure. The battery fully recharges in 15 hours once power is restored. If there is a need for backup battery power greater than 24 hours, then fixed calibration must be selected by placing the BAT/FIX switch in the "on" position.

#### 4.6 Fixed Calibration Mode Selection

*(use if anticipate power  
outages greater than 24 hours)*

Normally the pushbutton calibration mode is used with the system. However, there may be occasions such as the need for more than 24 hours of backup, where the use of the fixed calibration mode is more appropriate. The fixed calibration mode is selected by placing the BAT/FIX switch in the "on" position. The six time select switches, T1 through T32, must be set to the response time given in the following table.

The actual response time equals the accumulated values of switches in the "off" position. Any response time from 1 to 63 seconds can be selected with a combination of the switch settings.

Switch	Response	
	Off	Time Value On
T1	1	0
T2	2	0
T4	4	0
T8	8	0
T16	16	0
T32	32	0

As an example, to select a response time of 10 seconds, set T2 and T8 to the "off" position and all others to the "on" position.

#### 4.7 Gamma Source Selection

Normally source housings are provided with Cesium 137. For special applications, or upon customer requirements, Cobalt 60 will be supplied. To select Cesium 137 place the CS/CO switch in the "off" position. To select Cobalt 60 place the CS/CO switch in the "on" position.



# 5.

## Calibration

The system may be calibrated using the pushbutton method or the fixed mode method as described in sections 4.5 and 4.6. The push button method is the easiest and most reliable for most situations. The fixed mode allows fine tuning adjustment for tricky applications such as when there is a need to switch on less than a 50 percent radiation change.

### 5.1 Push Button Calibration Method

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When power is applied for the first time (including recycling power line switch) make sure the front panel FIX/BAT switch is on FIX mode. Then proceed with the push button calibration method.

Section 4.2 described response time selection. To get the fastest response time place C1 and C2 in the "on" position. The slowest response time is with C1 "on" and C2 "off". Check the switches to make sure you get the desired speed of response. Three simple steps will calibrate the system.

1. Empty the vessel being monitored.
2. Open the source housing shutter mechanism.
3. Press the calibration push button.

During calibration both the red and the green LEDs will be illuminated. At the end of the calibration cycle the red LED will be extinguished. The system response time can be determined by timing the calibration cycle and then dividing the time by 16. The response time can be increased or decreased by changing the settings for C1 and C2, and then repeating the calibration cycle.

Note that switches T1 through T32 have no effect in the push button calibration mode. It doesn't matter what position they are in.

A flashing green LED at the end of the calibration cycle indicates either a low radiation field or an electronics problem. Verify that the vessel is empty and the source head shutter is open. Then check the gamma field at the detector with a radiation survey meter. The lowest recommended operating field is .1 mr/hr. Calibration time for this field is 3 minutes and 30 seconds to 10 minutes depending on the settings of C1 and C2.

## 5.2 Using the Gamm-O-Switch® to Measure Radiation

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If a survey meter is not available, then the Gamm-O-Switch® can be used to determine the radiation field strength data needed for calibration section. Make sure that the front panel is in the FIXED position. First, switches C1 and C2 must be placed in the "On" position. (The other switch settings do not matter.) Then follow these two simple steps.

A. Press the pushbutton and time the period from releasing the pushbutton until only 1 LED is illuminated. Record the period (T) in seconds.

B. Calculate the radiation field (F) using the formula

$$F = 9.6/T$$

This technique can be used to measure fields as low as 0.025 mR/hr or as high as 16 mR/hr.

## 5.3 Fixed Mode Calibration Method

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Make sure that the front panel switch is at the FIXED position. To set up fixed mode calibration it will be necessary to have a radiation survey meter available or use the method described in section 3.4. The first method describes calibration with an empty vessel. The second method describes calibration on a full vessel. The third method describes calibration with less than a 50% radiation change.

### 5.3.1 Calibration Under Normal Conditions (Empty Vessel)

A. Empty the vessel being monitored.

B. Open the source housing shutter mechanism.

C. Measure the radiation field at the detector. Let F equal this value.

D. Select a speed of response from the table below and set C1 and C2 accordingly. Get the value for N from Table 5.1 - Response Time.

E. Calculate the response time (R) from the equation:

$$R = N/F$$

F. Determine the settings for switches T1 through T32 such that their combined value equals R. The values for T1 through T32 are given in Table 5.2 - Option Setting.

Table 5.1 - Response Time

Speed	C1	C2	N
Slow	On	Off	3
Normal	Off	On	2
Fast	On	On	1

Table 5.2 - Option Setting

Switch	On	Off
T1	0	1
T2	0	2
T4	0	4
T8	0	8
T16	0	16
T32	0	32

*Example:*

Suppose you measure 0.4 mR/hr at the detector and you want to set the system for a normal response time. Then:

$$F = .4$$

$$N = 2$$

$$R = 2/.4 = 5$$

The values of T1 and T4 add up to 5 so set T1 and T4 "off" and set T2, T3, T5, and T6 "on".

### 5.3.2 Calibration on a Full Vessel

A. Open the source housing shutter mechanism.

B. Measure the radiation field at the detector. Let F equal this value.

C. Select a speed of response from the table below and set C1 and C2 accordingly. Get the value for N from Table 5.1 - Response Time.

D. Calculate the response time (R) from the equation:

$$R = N/(6 \times F)$$

An assumption is made that the empty vessel radiation field will be greater than 3 times F and less than 12F. If the field is less than 3F then the alarm will not trip and you will have to follow the calibration procedure in section 5.2.3 for radiation changes of less than 50%. If the field is greater than 12F the diagnostic alarm will trip and you will have to recalibrate using an estimated empty vessel field and the normal calibration method of section 5.2.1.

E. Determine the settings for switches T1 through T32 such that their combined value equals R. The values for T1 through T32 are given in Table 5.2 - Option Setting.

F. Set the 75/50 switch to the "On" position.

*Example:*

Suppose you measure .1 mR/hr at the detector and you want to set the system for a fast response. Then:

$$F = .1$$

$$N = 1$$

$$R = 1/(6)(.1) = 6.6$$

The closest settable time to R would be 3 seconds which is obtained by setting T1, T2, and T4 "off" and T8, T16, and T32 "on". The system would operate satisfactorily if the empty vessel radiation field is between .3 and .12 mR/hr.

5.3.3 Calibration for Radiation  
Field Changes  
Less Than 50%

- A. Empty the vessel being monitored.
- B. Open the source housing shutter mechanism.
- C. Measure the radiation field at the detector and record it as F1.
- D. Fill the vessel being monitored.
- E. Measure the radiation field at the detector and record it as F2.
- F. Calculate the ratio (M) of the two fields.

$$M = F2/F1$$

- G. If M is greater than 0.8, stop. The system will not work in this application.
- H. Set the 75/35 switch to the "On" position.
- I. Set C1 "On" and C2 "Off".
- J. Calculate the response time (R) from the following equation and round to the nearest integer.

$$R = 3/(F1 + F2)$$

- K. Verify that the system will work by calculating that:

$$F2 < (1.5/R) < F1$$

If the inequalities are not satisfied, then the radiation field will have to be reduced to get more resolution in the response time calculation.

- L. Determine the settings for switches T1 through T32 such that their combined value equals R. The values for T1 through T32 are given in Table 5.2 - Option Setting.

*Example 1:*

Assume:	F1 = 0.35 mR/hr = empty vessel radiation
	F2 = 0.25 mR/hr = full vessel radiation field
Checking:	M = 0.25/0.35 = 0.71 (satisfies G)
Calculating:	R = 3/(0.25 + 0.35) = 5



Checking:  $0.25 < 1.5/5 = 0.3 < 0.35$  (satisfies K)

Set T1 and T4 "On" and T2, T8, T16, and T32 "Off".

*Example 2:*

Assume:  $F1 = 1.0 \text{ mR/hr}$   
 $F2 = 0.75 \text{ mR/hr}$

Checking:  $M = 0.75/1.0 = 0.75$  (satisfies G)

Calculating:  $R = 3/(0.75 + 1.0) = 1.7 = 2.0$  rounded

Checking:  $.75 < (1.5/2.0) < 1.0$   
 $.75 < .75 < 1.0$

The radiation field must be reduced to increase resolution of R.  
Hence the inequality is not satisfied

#### 5.4 Checking Operation

Once the 4800X system has been properly installed and calibrated, operator attention is not necessary. The system will continue to operate satisfactorily unless a change in measurement geometry (wall buildup, vessel structural changes, etc.) causes the need for recalibration.

The operation of the system may be checked at any time by manually changing the product level above or below the point where alarm switching should occur. If manual control of the product level is not possible, a level change may be simulated by changing the gamma field at the detector. Remember that the system operates by sensing the presence of either a high strength or a low strength gamma field. (A low field could be no radiation at all.) When a high gamma field is sensed at the detector, the system assumes that the product level is low, thus allowing a direct path for radiation to travel from the source to the detector. Conversely, when little or no radiation is sensed by the detector, the system assumes that the radiation path is blocked by material in the vessel and the proper high level switching action is initiated.

Two methods can be used to simulate product level changes:

1. If product in the vessel is low (below the detector) a high level can be simulated by simply closing the source shutter. When the source housing shutter handle is placed in the store or "closed" position, the radiation is removed and the proper switching action for a high level should take place.
2. If product in the vessel is high (above the detector), a low level can be simulated by placing a very small test source on the detector housing. When the radiation from

the test source is sensed by the detector, the system assumes that it is coming through the vessel from the source housing. The proper switching action for a low level condition should, therefore, take place.

Remember that switching actions will vary depending on the fail-safe mode incorporated. A fail-safe high unit will be in an alarm state when the product level is high and the radiation path is blocked. A fail-safe low unit will be in an alarm state only when the product level is low and the radiation path is not blocked.

# 6.

## Trouble-Shooting

The 4800X system includes a diagnostic alarm relay for use as a remote failure indicator. The contacts can be wired to an indicator lamp or to an audible alarm. The relay has SPDT (single pull double throw) contacts rated for 10 amp resistive loads. It is energized for all normal operating conditions and is de-energized for all system failure conditions. To diagnose a failure, first remove the detector cover to observe the LEDs. Then follow the steps presented below.

### 6.1 Both LEDs Off (Power/CPU Failure)

1. Check AC power to the unit by removing the I/O connector and measuring the voltage between terminals 1 and 2.
2. Check the onboard fuse (V 4 A) and replace it if necessary.
3. Replace the detector/electronics module and recalibrate.

### 6.2 Red Flashing, Green Off (Detector Failure)

1. Either the detector tube or the high voltage supply failed. Replace the detector/electronics module and recalibrate.

### 6.3 Red Flashing, Green On (Saturated Detector)

1. Check if the radiation level is too high by closing the source housing shutter mechanism. If the indicators change to anything else, then the radiation level is too high. Recalibrating will eliminate this problem.
2. If, after recalibrating, the red LED is flashing and the green LED remains on, replace the detector/electronics module and recalibrate.

### 6.4 Red Flashing, Green Flashing

1. Power was off longer than the holdup time of the battery. Recalibrate to clear the alarm. The battery will recharge in 16 hours.

### 6.5 Red Off, Green Flashing

1. Power was off longer than the holdup time of the battery. Recalibrate to clear the alarm. The battery will recharge in 16 hours.

# 7.

## General Licensing Requirements



**CAUTION:** Each 4800X installation must recognize the local regulations covering the use of gamma-based instrumentation. In the USA the 4800X is recognized as a safe standard measurement system. The Nuclear Regulatory Commission (NRC) has therefore granted the 4800X coverage under a general license.

### 7.1 Definitions

Below is a list of key words and phrases with their definitions as used in this chapter.

#### *Byproduct Material*

The radioactive material (such as Cesium-137 or Cobalt-60) that emits the radiation used in Kay-Ray/Sensall equipment. It is so called because it is a byproduct of nuclear power plants.

#### *Source Capsule*

The double-walled, welded, stainless steel capsule that contains the byproduct material.

#### *Device*

The term used by regulatory agencies to describe a variety of mechanisms used for gauging that generate radiation or house radioactive material.

#### *Source Housing*

A device that contains a source capsule and has a mechanism (shutter) for turning the radiation beam on and off.

#### *Gauge*

A term used to describe nuclear measuring apparatus. As used here, it includes the source housing, the radiation sensor or detector, and associated parts such as brackets, mounting plates, pipe saddles, and "A" frames. It does not include the electronics unit unless the electronics is in close proximity to the source housing and detector. In some Kay-Ray/Sensall gauges the electronics is an integral part of the detector.

#### *Leak Test*

A test used to detect the leakage of byproduct material from a source capsule. In this test the outer surfaces of the source housing are wiped with a cotton-tipped swab, and the swab is analyzed to detect any traces of byproduct material that may have adhered to it.

#### *Activity*

The strength of a source capsule measured in Curies (Ci) or millicuries (mCi).

## 7.2 The NRC and Agreement States

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The U.S. Nuclear Regulatory Commission (NRC) regulates the use of radioactive material in all states that are not "agreement" states. An agreement state is one that has entered into an agreement with the NRC for the exercise of regulatory authority over the use of radioactive materials within its borders.

The agreement states are: Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Idaho, Illinois, Iowa, Kansas, Kentucky, Louisiana, Maryland, Mississippi, Nebraska, Nevada, New Hampshire, New Mexico, New York, North Carolina, North Dakota, Oregon, Rhode Island, South Carolina, Tennessee, Texas, Utah, and Washington.



*NOTE: In the following discussion, NRC rules and regulations are quoted, but if yours is an agreement state, you should be aware that it has its own set of regulations. In most cases agreement state regulations are the same as those of the NRC, but in some cases they may be more restrictive. We urge you to obtain a copy of your agreement state's regulations and read them carefully.*

## 7.3 Customer Responsibilities

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A source housing containing a radioactive source capsule is part of the equipment you purchased. You are allowed to possess and use this device by virtue of a general license issued by the NRC or your agreement state. This license allows you to acquire, receive, possess, use, and transfer the source housing in accordance with the provisions of Title 10, Chapter 1, Code of Federal Regulations, Part 31 (10 CFR 31) or an equivalent agreement state regulation. This regulation clearly defines your responsibilities as a user of byproduct material.

Attached to your source housing is a stainless steel label that briefly states your responsibilities. In the following discussion the wording of this label will be given along with a brief explanation of each point.

1. *Receipt, possession, use, and transfer of this device are subject to a general license or equivalent, and regulations of the U.S. Nuclear Regulatory Commission or an agreement state.*

The relationship between the NRC and agreement states has already been covered. Again, if yours is an agreement state, we urge you to obtain a copy of your state's regulations regarding radioactive materials - the regulations could vary from those of the NRC.

2. *Abandonment or disposal prohibited unless transferred to persons specifically licensed by the U.S. Nuclear Regulatory Commission or an agreement state.*



You are not allowed to abandon your source housing. If you no longer want the device, you must transfer it to a person or company that is specifically licensed to possess Kay-Ray/Sensall source housings. For all practical purposes you must transfer the device to Kay-Ray/Sensall or a commercial disposal company. In either event, call Kay-Ray/Sensall's service department for instructions. Unless you are specifically licensed to do so, you are not allowed to remove a source housing from service or prepare it for shipment.

3. *Operation prohibited if there is indication of failure of or damage to the shielding, source containment, or on-off mechanism.*

You are not allowed to use the source housing if there is any indication that the outer steel parts or inner lead shielding is damaged. Also, you are not allowed to use the device if the shutter mechanism is inoperable or damaged in any way.

4. *Installation, dismantling, relocation, maintenance, repair, and testing involving the radioactive material, its shielding, or containment shall be performed by persons specifically licensed by the U.S. Nuclear Regulatory Commission or agreement state.*

Unless you are specifically licensed to do so, you are not allowed to install, dismantle, move, maintain, repair, or test your source housing. For all practical purposes the only thing you are allowed to do is move the shutter operator handle to the open (on) or closed (off) position. We recommend that you operate the shutter mechanism frequently to prevent it from becoming "frozen" in either the open or closed position. Kay-Ray/Sensall, of course, is licensed to perform all of the activities listed in point 4 and can help train site personnel to meet state and federal licensing requirements.

5. *Device shall be tested for radioactive leakage and proper functioning of on-off mechanism and indicator at installation, source replacement, and thereafter at no longer than three-year intervals.*

When your source housing is installed, and at three-year intervals thereafter, it must be leak tested. It must also be leak tested in the unlikely event that the source capsule is replaced. The shutter mechanism must also be tested for proper operation at these times. Kay-Ray/Sensall is licensed to perform leak tests, analyze wipe swabs, and test the shutter mechanism.

6. *Loss, theft, or transfer of this device and failure of or damage to the shielding, the source containment, or the on-off mechanism must be reported to the U.S. Nuclear Regulatory Commission or an agreement state.*

The following incidents must be reported to the NRC or your agreement state:

- a. The loss of your source housing.
- b. The theft of your source housing.
- c. The transfer of your source housing.
- d. Failure of or damage to the lead shielding.
- e. Failure of or damage to the steel portions of your housing or to the means with which the source capsule is held in position within the lead shielding.
- f. Failure of or damage to the shutter mechanism in your source housing.

7. *Notify our service department before you return any radioactive device to Kay-Ray/Sensall. We reserve the right to refuse shipment if this procedure is not followed.*

We want to be made aware of all source housings that you intend to return so that we can help you avoid improper packaging and documentation. As mentioned above, preparing a source housing for shipment can only be done by a licensed individual.

#### 7.3.0.1 *Additional Responsibilities*

1. You must make sure that your source housing is used only as intended by Kay-Ray/Sensall. For example, a source housing that is intended to be used on a continuous level system cannot be used on a density system.
2. Your source housing must be installed in accordance with the drawings, sketches, and other documentation provided by or approved by Kay-Ray/Sensall. If Kay-Ray/Sensall personnel install your gauge they will be responsible for a safe installation.
3. If your gauge is used on a vessel into which access is possible you must employ a system that prevents entry while the source housing shutter is open.
4. You must keep records of receipts, relocations, transfers, disposals, leak tests, shutter mechanism tests, and any servicing performed. If Kay-Ray/Sensall personnel perform any of these services you will be given the proper records.
5. The labels on your source housing must never be removed and must remain legible at all times.

6. Check the regulations of your state. You may have to register your gauge.

#### 7.4 Excerpts from Regulations

##### 7.4.1 General License

The following pages contain excerpts from 10 CFR 20, 10 CFR 30, and 10 CFR 31 that apply to general licensees. If yours is an agreement state it will have a similar set of regulations. We urge you to familiarize yourself with these documents. These regulations cover in detail all of the points mentioned above and give some additional requirements.

##### 31.5 *Measuring, Gauging or Controlling Devices*

- a) A general license is hereby issued to commercial and industrial firms and research, educational, and medical institutions, individuals in the conduct of their business, and Federal, State, or Local government agencies to acquire, receive, possess, use, or transfer, in accordance with the provisions of paragraphs (b), (c), and (d) of this section, byproduct material contained in devices designed and manufactured for the purpose of detecting, measuring, gauging, or controlling thickness, density, level, interface location, radiation, leakage, or qualitative or quantitative chemical composition, or for producing light or an ionized atmosphere.
- b) The general license in paragraph (a) of this section applies only to byproduct material contained in devices which have been manufactured or initially transferred and labeled in accordance with the specifications contained in a specific license issued pursuant to 10 CFR 32.51 of this chapter or in accordance with the specifications contained in a specific license issued by an Agreement State which authorizes distribution of the devices to persons generally licensed by the Agreement State.
- c) Any person who acquires, receives, possesses, uses, or transfers byproduct material in a device pursuant to the general license in paragraph (a) of this section:
  - 1. Shall assure that all labels affixed to the device at the time of receipt and bearing a statement that removal of the label is prohibited are maintained thereon and shall comply with all instructions and precautions provided by such labels;
  - 2. Shall assure that the device is tested for leakage of radioactive material and proper operation of the on-off mechanism and indicator, if any, at no longer than six-month\*\* intervals or at such other intervals as are specified in the label; however:

- i. Devices containing only krypton need not be tested for leakage of radioactive material, and
- ii. Devices containing only tritium or not more than 100 microcuries of other beta and/or gamma emitting material or 10 microcuries of alpha emitting material and devices held in storage in the original shipping container prior to initial installation need not be tested for any purpose;

\*\*Kay-Ray/Sensall's general license label allows a three-year interval.

- 3. Shall assure that the tests required by paragraph (c)(2) of this section and other testing, installation, servicing, and removal from installation involving the radioactive materials, its shielding, or containment, are performed:
  - i. In accordance with the instructions provided by the labels; or
  - ii. by a person holding a specific license pursuant to Parts 30 and 32 of this chapter or from an Agreement State to perform such activities;
- 4. Shall maintain records showing compliance with the requirements of paragraphs (c)(2) and (c)(3) of this section. The records must show the results of tests. The records also must show the dates of performance of, and the names of persons performing, testing, installing, servicing, and removing from the installation radioactive material and its shielding or containment. The licensee shall retain these records as follows:
  - i. Each record of a test for leakage of radioactive material required by paragraph (c)(2) of this section must be retained for three years after the next required leak test is performed or until the sealed source is transferred or disposed of.
  - ii. Each record of a test of the on-off mechanism and indicator required by paragraph (c)(2) of this section must be retained for three years after the next required test of the on-off mechanism and indicator is performed or until the sealed source is transferred or disposed of.
  - iii. Each record that is required by paragraph (c)(3) of this section must be retained for three years from the date of the recorded event or until the device is transferred or disposed of.
- 5. Upon the occurrence of a failure of or damage to, or any indication of a possible failure of or damage to, the shielding of the radioactive material or the on-off mechanism or indicator, or upon the detection of 0.005 microcurie or more re-



movable radioactive material, shall immediately suspend operation of the device until it has been repaired by the manufacturer or other person holding a specific license pursuant to Parts 30 and 32 of this chapter or from an Agreement State to repair such devices, or disposed of by transfer to a person authorized by a specific license to receive the byproduct material contained in the device and, within 30 days, furnish to the Director of the appropriate Nuclear Regulatory Commission Inspection and Enforcement Regional Office listed in Appendix D of Part 20 of this chapter, a report containing a brief description of the event and the remedial action taken;

6. Shall not abandon the device containing byproduct material;
7. Shall not export the device containing byproduct material except in accordance with Part 110 of this chapter;
8. Except as provided in paragraph (c)(9) of this section, shall transfer or dispose of the device containing byproduct material only by transfer to a person holding a specific license pursuant to Parts 30 and 32 of this chapter or from an Agreement State, to receive the device and within 30 days after transfer of a device to a specific licensee shall furnish to the Director of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, a report containing identification of the device by manufacturer's name and model number and the name and address of the person receiving the device. No report is required if the device is transferred to the specific licensee in order to obtain a replacement device;
9. Shall transfer the device to another general licensee only:
  - i. Where the device remains in use at a particular location. In such case the transferor shall give the transferee a copy of this section and any safety documents identified in the label of the device and within 30 days of the transfer, report to the Director of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington D.C. 20555, the manufacturer's name and model number of device transferred, the name and address of the transferee, and the name and/or position of an individual who may constitute a point of contact between the Commission and the transferee; or
  - ii. Where the device is held in storage in the original shipping container at its intended location of use prior to initial use by the general licensee.
10. Shall comply with the provisions of 20.402 and 20.403 of this chapter for reporting radiation incidents, theft, or loss of licensed material, but shall be exempt from the other requirements of Parts 19, 20, and 21 of this chapter.

d) The general license in paragraph (a) of this section does not authorize the manufacture or import of devices containing byproduct material.

30.34 *Terms and Conditions  
of Licenses*

a) Each license issued pursuant to the regulations in this part and the regulations in Parts 31-35 shall be subject to all the provisions of the Act, now or hereafter in effect, and to all valid rules, regulations, and orders of the Commission.

b) No license issued or granted pursuant to the regulations in this part and Parts 31-35, 39, nor any right under a license shall be transferred, assigned, or in any manner disposed of, either voluntarily or involuntarily, directly or indirectly, through transfer of control of any license to any person, unless the Commission shall, after securing full information, find that the transfer is in accordance with the provisions of the Act and shall give its consent in writing.

c) Each person licensed by the Commission pursuant to the regulations in this part and Parts 31-35, 39, shall confine his possession and use of the byproduct material to the locations and purposes authorized in the license. Except as otherwise provided in the license, a license issued pursuant to the regulations in this part and Parts 31-35, 39, of this chapter shall carry with it the right to receive, acquire, own, and possess, byproduct material. Preparation for shipment and transport of byproduct material shall be in accordance with the provisions of Part 71 of this chapter.

d) Each license issued pursuant to the regulations in this part and Parts 31-35, 39, shall be deemed to contain the provisions set forth in section 183b.-d., inclusive, of the Act, whether or not these provisions are expressly set forth in the license.

e) The Commission may incorporate, in any license issued pursuant to the regulations in this part and Parts 31-35, 39, at the time of issuance, or thereafter by appropriate rule, regulation, or order, such additional requirements and conditions with respect to the licensee's receipt, possession, use, and transfer of byproduct material as it deems appropriate or necessary in order to:

1. Promote the common defense and security;
2. Protect health or to minimize danger to life and property;
3. Protect restricted data;
4. Require such reports and the keeping of such records, and to provide for such inspections of activities under the license as may be necessary



or appropriate to effectuate the purposes of the Act and regulations thereunder.

#### 7.4.2 Records, Inspections, and Tests

##### 30.51 Records

- a) Each person who receives byproduct material pursuant to a license issued pursuant to the regulations in this part and Parts 31-35, 39, shall keep records showing the receipt, transfer, and disposal of such byproduct material.
- b) Records which are required by the regulations in this part and Parts 31-35, 39, or by license condition shall be maintained for the period specified by the appropriate regulation or license condition. If a retention period is not otherwise specified by regulation or license condition, such records shall be maintained until the Commission authorizes their disposition.
- c)
  - 1. Records of receipt of byproduct material which must be retained pursuant to paragraph (a) of this section shall be maintained as long as the licensee retains possession of the byproduct material and for two years following transfer or disposal of the byproduct material.
  - 2. Deleted.
  - 3. Records of transfer of byproduct material shall be maintained by the licensee who transferred the material for five years after such transfer.

##### 30.52 Inspections

- a) Each licensee shall afford to the Commission at all reasonable times opportunity to inspect byproduct material and the premises and facilities wherein byproduct material is used or stored.
- b) Each licensee shall make available to the Commission for inspection, upon reasonable notice, records kept by him pursuant to the regulations in this chapter.

##### 30.53 Tests

- a) Each licensee shall perform, or permit the Commission to perform, such tests as the Commission deems appropriate or necessary for the administration of the regulations in this part and Parts 31-35, and 39 of this chapter, including tests of:
  - 1. Byproduct material;
  - 2. Facilities wherein byproduct material is utilized or stored;

3. Radiation detection and monitoring instruments; and

4. Other equipment and devices used in connection with the utilization or storage of byproduct material.

#### 7.4.3 Enforcement

##### 30.61 *Modification and Revocation of Licenses.*

a) The terms and conditions of each license issued pursuant to the regulations in this part and Parts 31 through 35 of this chapter shall be subject to amendment, revision, or modification by reason of amendments to the Act, or by reason of rules, regulations, and orders issued in accordance with the term of the act.

b) Any license may be revoked, suspended, or modified, in whole or in part, for any material false statement in the application or any statement of fact required under section 182 of the Act, or because of conditions revealed by such application or statement of fact or any report, record, or inspection or other means which would warrant the Commission to refuse to grant a license on an original application, or for violation of, or failure to observe any of the terms and provisions of the Act or of any rule, regulation, or order of the Commission.

c) Except in cases of willfulness or those in which the public health, interest, or safety requires otherwise, no license shall be modified, suspended, or revoked unless, prior to the institution of proceedings therefor, facts or conduct which may warrant such action shall have been called to the attention of the licensee in writing and the licensee shall have been accorded an opportunity to demonstrate or achieve compliance with all lawful requirements.

##### 30.62 *Right to Cause the Withholding or Recall of Byproduct Material*

The Commission may cause the withholding or recall of byproduct material from any licensee who is not equipped to observe or fails to observe such safety standards to protect health as may be established by the Commission, or who uses such materials in violation of law or regulation of the Commission, or in a manner other than as disclosed in the application therefor or approved by the Commission.

##### 30.63 *Violations*

An injunction or other court order may be obtained prohibiting any violation of any provision of the Atomic Energy Act of 1954, as amended, or Title II of the Energy Reorganization Act of 1974, or any regulation or order issued thereunder. A court order may be obtained for the payment of a civil penalty imposed pursuant to section 234 of the Act for violation of section 53, 57, 62, 63, 81, 82, 101, 103, 104, 107, or 109 of the Act, or section 206 of the Energy Reorganization Act of 1974, or any rule,

regulation, or order issued thereunder, or any term, condition, or limitation of any license issued thereunder, or for any violation for which a license may be revoked under section 186 of the Act.

Any person who willfully violates any provision of the Act or any regulation or order issued thereunder may be guilty of a crime and, upon conviction, may be punished by fine or imprisonment or both, as provided by law.

20.402 *Reports of Theft or  
Loss of Licensed  
Material.*

- A) 1. Each licensee shall report to the Commission by telephone, immediately after it determines that a loss or theft of licensed material has occurred in such quantities and under such circumstances that it appears to the licensee that a substantial hazard may result to persons in unrestricted areas.

20.403 *Notification of Incidents*

- A) Immediate Notification. Each licensee shall immediately report any events involving byproduct, source, or special nuclear material possessed by the licensee that may have caused or threatens to cause:

1. Exposure of the whole body of any individual to 25 rems or more of radiation; exposure of the skin of the whole body of any individual of 150 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms of any individual to 375 rems or more of radiation; or
2. The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 5,000 times the limits specified for such materials in Appendix B, Table II of this part; or
3. A loss of one working week or more of the operation of any facilities affected; or
4. Damage to property in excess of \$200,000.

- B) Twenty-Four Hour Notification. Each licensee shall, within 24 hours of discovery of the event, report any event involving licensed material possessed by the licensee that may have caused or threatens to cause:

1. Exposure of the whole body of any individual to 5 rems or more of radiation; exposure of the skin of the whole body of any individual to 30 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms to 75 rems or more of radiation; or
2. The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 500 times the limits specified for such materials in Appendix B, Table II of this part; or

3. A loss of one day or more of the operation of any facilities affected; or

4. Damage to property in excess of \$2,000.

C) Any report filed with the Commission pursuant to this section shall be prepared so that names of individuals who have received exposure to radiation will be stated in a separate part of the report.

#### 7.5 NRC Regional Offices

##### *REGION I:*

Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont

Address: USNRC, Region I  
475 Allendale Road  
King of Prussia, PA 19406

Phone: (215) 337-5000  
(FTS) 346-5000

##### *REGION II:*

Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, Puerto Rico, South Carolina, Tennessee, Virginia, Virgin Islands, and West Virginia

Address: USNRC, Region II  
101 Marietta Street, NW  
Suite 2900  
Atlanta, GA 30323

Phone: (404) 331-4503  
(FTS) 242-4503

##### *REGION III:*

Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin

Address: USNRC, Region III  
799 Roosevelt Road  
Glen Ellyn, IL 60137

Phone: (312) 790-5500  
(FTS) 388-5500

##### *REGION IV:*

Arkansas, Colorado, Idaho, Kansas, Louisiana, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah, and Wyoming

Address: USNRC, Region IV  
611 Ryan Plaza Drive  
Suite 1000  
Arlington, TX 76011

Phone: (817) 860-8100  
(FTS) 728-8100

*Region IV Field Office:*

Address: USNRC, Region IV  
Uranium Recovery Field Office  
730 Simms Street  
P.O. Box 25325  
Denver, CO 80225

Phone: (303) 236-2805  
(FTS) 776-2805

*REGION V:*

Alaska, Arizona, California, Hawaii, Nevada, Oregon, Pacific Trust Territories, and Washington

Address: USNRC, Region V  
1450 Maria Lane  
Suite 210  
Walnut Creek, CA 94596

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



# 8.

## Specific Licensing Requirements

This guide has been prepared to aid you in the proper completion of radioactive material license applications for Agreement States. Most Agreement State applications follow this format, but you should be aware that there may be some differences. This guide is not a substitute for understanding your state's regulations. You should obtain a copy of the regulations and read them carefully.

8.1 Item 1(a)

Name and Street Address of Applicant

Self-explanatory.

8.2 Item 1(b)

Street Address(es) which radioactive material will be used

The address must be the actual location where the byproduct material will be possessed, stored, and/or used. The location should be clearly identified by street or road name, number, city, and state. A post office box number is not acceptable.

8.3 Item 2

Department to use radioactive material

Self-explanatory.

8.4 Item 3

Previous License Number(s)

If this is a renewal, state your present license number. If this is an application for a new license, state "None".

8.5 Item 4

Individual User(s)

List the names of the individuals who will supervise and/or use (operate) the source housing. An adequate number of trained users should be listed to provide for continuity of operation. Normally, at least one of the users should be physically present when the source housing is in operation.



If individual users have not yet been permanently assigned, such as when a gauge is purchased for new construction, a responsible individual should be named. As soon as the permanent users are designated, the license must be amended to reflect this change.

8.6 Item 5

Radiation Protection Officer

This would be the name of the person who will be responsible for record keeping, training of new users, and implementation of radiation safety procedures. This item must be completed in order for a license to be issued. If the RPO has not yet been permanently assigned, such as when a gauge is purchased for new construction, a plant superintendent, plant engineer, or other responsible individual should be named. As soon as the permanent RPO is designated, the license must be amended to reflect this change.

8.7 Item 6(a)

Radioactive Material

Enter one or more of the following, as appropriate for your gauge.

Cesium-137

Cobalt-60

8.8 Item 6(b)

Chemical and/or physical form and maximum number of millicuries or each chemical and/or physical form that you will possess at any one time.

The answer to this item will depend on the equipment purchased. If, for example, you purchased a Kay-Ray/Sensall Division (Kay-Ray/Sensall) 4800X Level system employing a Model 7063P Source Housing with a 200 millicurie, Cesium-137 source, you would enter:

*\*One sealed source, Kay-Ray Series 7700, 200 mCi, in a Kay-Ray Model 7063P source housing.\**

As another example, if you purchased three Kay-Ray/Sensall 4100F Coke Drum Level Systems, each employing a 500 millicurie, Americium-241 source in a Model 7100B Source Housing, you would enter:

*\*Three sealed sources, Kay-Ray Series 7701, 500 mCi each, in three Kay-Ray 7100B source housings.\**

Kay-Ray/Sensall uses only sealed sources. If you are not sure of the isotope, activity, or model number, contact our licensing department.

B.9 Item 7

Describe purpose for which radioactive material will be used

Again, the answer to this depends on the equipment purchased. Some typical entries would be:

*\*For level measurement of wood chips in a 10 ft. diameter hopper.\**

*\*For density measurement of coal slurry in an eight inch pipe.\**

*\*For mass flow measurement of coke on a 36" wide belt conveyor.\**

B.10 Item 8

Training and experience of each individual named in Item 4

For each person listed under individual user(s) and for the RPO, attach a resume describing any training in the use of radioactive materials. Be sure to state where the individuals were trained, the duration of their training, and whether the training was "on-the-job" or formal. Be sure to state if the training included any of the following: Principles and practices of radiation protection, radioactivity measurement, monitoring techniques and instruments, mathematics and calculations basic to the use and measurement of radioactivity, and the biological effects of radiation. If the individuals have not received any training in the use of radioactive materials, you may use the following suggested wording:

*\*At the time of system startup, a Kay-Ray/Sensall field service engineer will provide all the training necessary for the safe operation of the equipment. Radiation protection procedures will be outlined in Item 14 of this application. As the scope of this application does not include handling of the source housing, further formal training is not indicated.\**

8.11 Item 9

Experience with radiation

For each of the individuals listed under individual user(s), and the RPO, state their actual experience with radioactive materials. Be sure to give the isotopes handled, the maximum number curies, where the experience was gained, the duration of the experience, and the type of equipment on which the experience was gained. If the individuals have not had any experience with radiation, you may say:

*"Neither the individuals named as users, nor the radiation protection officer have had prior experience with radioactive materials."*

8.12 Item 10

Radiation detector. Instruments

Complete this item only if you have radiation detection instruments or intend to purchase one. We recommend that you have at least one G-M type beta/gamma survey meter. If you wish to purchase one from Kay-Ray/Sensall, we will provide you with a Ludium Model 3 Special beta/ gamma survey meter. This instrument will detect beta, gamma, and high energy x-radiation. It has ranges of 0 to .2, 0 to 2, 0 to 20 and 0 to 200 millirems per hour. This meter comes with an Eberline Model HP-270, energy compensated side-window type probe, having a wall thickness of 30 mg/cm. For neutron REM meters, contact Kay-Ray/Sensall sales.

8.13 Item 11

Method, frequency, and standards used in calibrating instruments listed above.

If you are equipped to calibrate your own radiation detection instruments, you can supply the required information. Most likely, however, you will want an independent laboratory to do your calibrations. In that case, just supply the name, address, and license number of the firm. Also state the calibration frequency (we recommend six months) for each instrument.

Kay-Ray/Sensall can provide a calibration service through an outside consultant. Our consultant performs this service for us on our premises. Our address is Kay-Ray/Sensall, Inc. 1400 Business Center Drive, Mount Prospect, IL 60056. Our license number is IL01010-01.

8.14 Item 12

Film badges, dosimeters, and bio-assay procedures used.

According to the current regulations, you must provide radiation dose measuring devices to anyone who receives or is likely to receive a dose of 312 millirems or more in any calendar quarter from the radioactive sources in your possession. Unless someone is working within three feet of the source housing for several hours a day, this is very unlikely to happen. If Kay-Ray/Sensall personnel install your system and perform the initial radiation survey, you will be advised of the need, if any, for dosimeters. We recommend the following wording:

*"Since Kay-Ray/Sensall source housings are designed to limit the radiation dose rate at 12 inches from any accessible surface to less than 5 millirems per hour, and since no individual will be working within \_\_\_ feet of the housing for more than \_\_\_ minutes each day, personnel dosimetry will not be needed." (You fill in the blanks.)*

Or you could say:

*"Kay-Ray/Sensall field service personnel will advise of any need for personnel dosimetry when the equipment is installed and the initial radiation survey is performed."*

If you feel that any individual should be monitored for exposure to radiation, we recommend the use of film badges. There are a number of firms that provide a film badge service. We at Kay-Ray/Sensall use:

TECHOPS LANDAUER, INC.  
2 Science Road  
Glenwood, IL 60425-1586  
(312) 755-7000

8.15 Item 13

Facilities and equipment

Submit this information on separate pages. You should submit a sketch, or better yet, a detailed engineering drawing of the vessel (bin, pipe, conveyor, etc.) on which your source housing and detector will be mounted. Show nearby walkways, ladders, platforms, catwalks, etc., where workers can gain access to the source housing and detector. For the vessel, you should show the wall thicknesses, insulation thicknesses, product density, and any internal vessel details that would affect the

intensity of the radiation beam at the detector. You want to supply enough information so that the license reviewer can make an estimate of the radiation to which nearby workers would be exposed.

B.16 Item 14

Radiation protection program

A. Leak Testing, Installation, Initial Surveying, Servicing, Maintaining, and Repairing.

Here you must submit the procedures for leak testing the source housing, installing the source housing and detector, performing the initial radiation survey, and servicing, maintaining, and repairing the source housing. You must supply the name, training, and experience of the person performing these activities. The individual must be specifically licensed by the NRC or an Agreement State to perform these activities on Kay-Ray/Sensall equipment.

Kay-Ray/Sensall field service engineers are licensed to perform all of the above activities. If you wish Kay-Ray/Sensall to perform these duties, we suggest the following wording:

*"Kay-Ray/Sensall field service personnel will perform a leak test on the source housing at the time of system installation. Kay-Ray/Sensall will also install or supervise the installation of the source housing and detector, perform the initial radiation survey, and perform any subsequent servicing, maintenance, and repair of the source housing."*

B. Control Measures.

In this section you must assure the license reviewer that your source housing will be used in a safe manner and that maintenance on the detector and maintenance on the vessel on which the source housing and detector are mounted will not be performed while the source shutter is in the "ON", "OPEN", or "MEASURE" position.

1. For density measurement systems, the following wording is suggested:

*"If maintenance is required on the process pipe within one foot of the source housing or detector, or if maintenance is required on the detector itself, the source housing shutter will be placed in the "OFF" ("CLOSED") position."*

2. Single point level systems, continuous level systems, interface level detection systems, and neutron moisture measurement systems on large vessels, bins, hoppers, etc., could present special problems: If your source housing and



detector are mounted on a vessel into which human access is possible, a system must be devised to prevent someone from entering the vessel while the source housing is in the "ON", "OPEN", or "STORE" position.

One way is by means of an "interlock" system in which a key that can only be released when the shutter is closed, is used to unlock the vessel access door. Another way is by means of a "lockout" system in which the vessel access door key is kept in the possession of a responsible person, such as the radiation safety officer or maintenance foreman. A third way (which may not be acceptable to the license reviewer) is to simply post a sign at the vessel entry door stating that access is not allowed unless the responsible individual is first notified.

Choose the system you wish to employ, then describe it in detail in Item 14. All Kay-Ray/Sensall source housings have been designed to accept the Kirk and Superior multi-key interlock systems. For details, contact one of our sales engineers. Possible wording for this section might be:

*"A Kirk two-position interlock system will be employed on the source housing and vessel access door. When the source housing is in the "ON" ("OPEN", "STORE") position, the key that opens the vessel access door will be held captive at the source housing. Only when the source housing shutter is moved to the "OFF" ("CLOSED", "STORE") position, will the key for the vessel access door be released."*

If you use the "lockout" system, you may say something like:

*"A lockout system will be used to prohibit access into the vessel on which the source housing is installed. The vessel access door will be padlocked at all times. A sign will be posted at the access door stating that there is a radiation hazard and the padlock key must be obtained from the Plant Safety Director. The Safety Director will be given written instructions to close and lock the source housing shutter before giving out the key to the access door padlock."*

You should submit copies of any signs or notices that you intend to post, and copies of any written procedures.

3. For mass flow measurement systems on belt and screw conveyors, we suggest this wording:

*"If maintenance is required on the belt (screw) within three feet of the "A" frame, or if maintenance is required on the "A" frame or detector, the source housing shutter will be placed in the "OFF" ("CLOSED") position. Two signs warning maintenance personnel of this requirement are included with the system by the manufacturer. These signs will be mounted on opposite sides of the "A" frame."*



### C. Emergency Procedures.

You should also write a brief procedure to be followed in the event of damage to your source housing caused by fire, explosion, or other accident. The following wording could be used:



*NOTE: Emergency procedures to be followed in the event of serious damage to a source housing caused by fire, explosion, or other accident.*

1. The individual closest to the accident must warn all persons in the immediate vicinity that an emergency exists. The plant Radiation Safety Officer or Plant Safety Director must be notified immediately.
2. If there are injuries, move the injured person away from the accident scene.
3. Administer life-saving first aid.
4. If needed, call for medical help.
5. Wait for the Radiation Safety Officer or Plant Safety Director to arrive.
6. Do not attempt to pick up or move the source housing.
7. The area around the damaged source housing must be secured. Rope off a circle around the housing. The radius of the circle should be at least those distances given in the table on page 8-9.
8. Notify your state Radiation Emergency Response Center.
9. Notify Kay-Ray/Sensall, Inc.

Source Housing Rope-off Radius (feet)

Activity (mCi)	Cs-137	Co-60	Am-241/Be
1	1	---	---
5	2	---	---
10	3	---	---
25	5	9	---
50	6	12	---
100	9	17	---
200	12	24	3
500	19	38	5
1000	27	54	7
2000	38	76	---
3000	47	93	---
5000	60	---	---
10000	85	---	---

8.17 Item 15

Source Disposal.

At the end of its useful life, your source housing can be returned to Kay-Ray/Sensall or you can contact a commercial radioactive waste disposal service.

Only individuals specifically licensed by the NRC or an Agreement State to work with Kay-Ray/Sensall equipment are allowed to remove a Kay-Ray/Sensall source housing from service and prepare it for shipment. Please contact our Service Department if you wish to dispose of your source housing. Contact us at:

Kay-Ray/Sensall, Inc.  
1400 Business Center Drive  
Mount Prospect, IL 60056

Phone: (708) 803-5100



**NOTE:** A return authorization number must be obtained from Kay-Ray/Sensall before the source housing can be returned.

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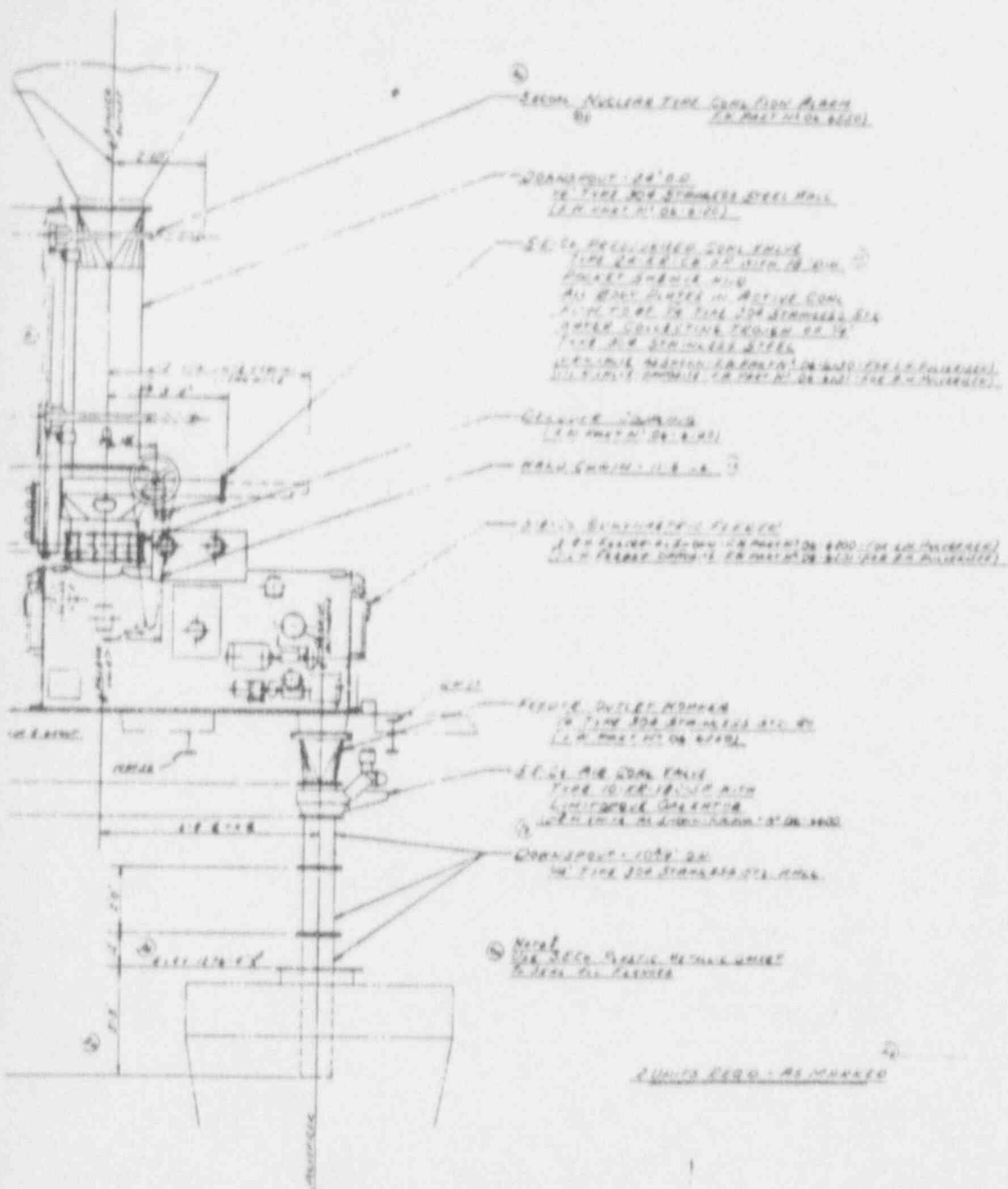
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ITEM	DESCRIPTION	QTY	UNIT	PRICE	TOTAL
1	DISCHARGE - 14"	1	EA	1.00	1.00
2	DISCHARGE - 14"	1	EA	1.00	1.00
3	DISCHARGE - 14"	1	EA	1.00	1.00
4	DISCHARGE - 14"	1	EA	1.00	1.00
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98	DISCHARGE - 14"	1	EA	1.00	1.00
99	DISCHARGE - 14"	1	EA	1.00	1.00
100	DISCHARGE - 14"	1	EA	1.00	1.00

ORDER TO PURCHASER EQUIPMENT FOR  
 GOLDEN VALLEY ELECTRIC ASSOCIATION INC.  
 HEAVY POWER PLANT - UNIT 1 - HEAVY POWER  
 STRAIGHT ENGINEERING CO. - CLEVELAND

SCALE: 1/4\"/>
 IN EACH VIEW

WYOOK EQUIPMENT CO. CLEVELAND OHIO

D5733-4

NOTE: PURCHASER TO CHECK HIS SUPPORT STEEL FOR LOADS IMPOSED BY THIS EQUIPMENT.

