

Received: 4/15/88 252142

NRC FORM 313 (10-87) 10 CFR 30, 32, 33, 34, 35 and 40

U.S. NUCLEAR REGULATORY COMMISSION APPROVED BY OMB 3160-0120 Expires: 6-30-90

APPLICATION FOR MATERIAL LICENSE

030-20541

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.

<p>APPLICATIONS FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:</p> <p>U.S. NUCLEAR REGULATORY COMMISSION DIVISION OF FUEL CYCLE AND MATERIAL SAFETY, NMSS WASHINGTON, DC 20566</p> <p>ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS, IF YOU ARE LOCATED IN:</p> <p>CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:</p> <p>U.S. NUCLEAR REGULATORY COMMISSION, REGION I NUCLEAR MATERIALS SAFETY SECTION B 475 ALLENDALE ROAD KING OF PRUSSIA, PA 19406</p> <p>ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:</p> <p>U.S. NUCLEAR REGULATORY COMMISSION, REGION II NUCLEAR MATERIALS SAFETY SECTION 101 MARIETTA STREET, SUITE 2800 ATLANTA, GA 30323</p>	<p>IF YOU ARE LOCATED IN:</p> <p>ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:</p> <p>U.S. NUCLEAR REGULATORY COMMISSION, REGION III MATERIALS LICENSING SECTION 799 ROOSEVELT ROAD GLEN ELLYN, IL 60138</p> <p>ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:</p> <p>U.S. NUCLEAR REGULATORY COMMISSION, REGION IV MATERIAL RADIATION PROTECTION SECTION 611 RYAN PLAZA DRIVE, SUITE 1000 ARLINGTON, TX 76011</p> <p>ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:</p> <p>U.S. NUCLEAR REGULATORY COMMISSION, REGION V NUCLEAR MATERIALS SAFETY SECTION 1450 MARIETTA AVE, SUITE 210 WALNUT CREEK, CA 94596</p>
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PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTION.

<p>1. THIS IS AN APPLICATION FOR (Check appropriate item)</p> <p><input type="checkbox"/> A. NEW LICENSE</p> <p><input checked="" type="checkbox"/> B. AMENDMENT TO LICENSE NUMBER <u>52-21350-01</u></p> <p><input checked="" type="checkbox"/> C. RENEWAL OF LICENSE NUMBER <u>52-21350-01</u></p>	<p>2. NAME AND MAILING ADDRESS OF APPLICANT (Include Zip Code)</p> <p>Alonso & Carus Iron Works, Inc. P.O. Box 566 Cataño, P.P. 00632</p>
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3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED.

Puerto Rico (1) Alonso & Carus (2) Temporary job sites

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION	TELEPHONE NUMBER
Wilfredo Rivera Febus - RPO or José A. Ruiz	(809)798-1065

SUBMIT ITEMS 6 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 mass number, b. chemical and/or physical form, and c. maximum amount which will be possessed at any one time.	6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.
7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE.	8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.
9. FACILITIES AND EQUIPMENT.	10. RADIATION SAFETY PROGRAM.
11. WASTE MANAGEMENT.	12. LICENSE FEES (See 10 CFR 170 and Section 170.31) FEE CATEGORY: AMOUNT ENCLOSED \$ 300

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 CONFORMANCE 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
	Laureano Carus	Chairman of the Board	4-11-88

B910190105 B81115
REQ2 LIC30
52-21350-01 PDR

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	COMMENTS	APPROVED BY
Ren	Apr-4-88	30		
AMOUNT RECEIVED	CHECK NUMBER			DATE
\$300/450	1558/1625			7/14/88

TRAINING

5.1 Initial Training

Each radiographer trainee shall attend a one week course, given by Alonso & Carús, specifically to fulfill the NRC's requirement for initial training.

Radiographer trainees will receive eight hours instruction given by the Radiation Protection Officer on written Operation and Emergency Procedures. This will include a review of Federal Regulations and the following:

1. General Introduction
2. The handling and use of radiographic equipment
3. Methods and occasions for conducting surveys, including acceptable exposure levels
4. Method for controlling access to restricted areas
5. Methods and occasions for locking and securing radiographic equipment
6. Personnel monitoring
7. Transportation requirements
8. Minimizing exposure in accidents
9. Notification procedures in accidents
10. Record Keeping
11. Daily checklist

Following the period of initial training, a written examination will be given.

Following successful completion of the initial training and testing, candidate radiographers will undergo a one week on-the-job training under the supervision of the Radiation Protection Officer. Oral examination and evaluation on safe handling of isotopes will be given.

5.2 Additional Training

The trainee will gain additional experience with specific radiographic equipment and radiation measurement instruments and record keeping necessary for the taking of radiographs using our written Operating and Emergency Procedures. A review of applicable Federal Regulations will be a part of the on-the-job training. This training will include an oral examination and a surprise "mock" emergency staged by the Radiation Protection Officer. The Radiation Protection Officer may require any extension of this job training period until he is satisfied that the trainee has adequate knowledge of Federal requirements, specific radiographic equipment to be used, radiation detection devices to be used and has adequate skills to take radiographs to company specifications.

5.3 Training for Radiographers

During the three month period as a radiographers assistant, persons who are to become radiographers will be given further training in the subjects outlined below:

1. Fundamentals of radiation safety
2. Radiation detection instruments to be used
3. Radiographic equipment to be used
4. The requirements of pertinent Federal Regulations
5. Written Operating and Emergency Procedures

Instruction in Parts 1 to 5 above will be given by our Radiation Protection Officer. During this instruction, the relevant material from part 4 will be covered a second time.

Following the instruction in subjects 1 through 5, a written examination will be given in all five subjects. The candidate will be required to demonstrate, to the Radiation Protection Officer, competence in the use of radiographic equipment and survey instruments in a practical demonstrating which will include all the steps in making radiographs following our written Operating and Emergency Procedures.

He shall be required to give a demonstration to the Radiation Protection Officer of his competence using the equipment, with a "dummy source" instead of a radioactive source.

5.4 Training for Experienced Radiographers and Assistants

Persons who are hired as experienced radiographers shall be given training in the company's written Operating and Emergency Procedures and on-the-job training in the use of the specific equipment.

They will then be given the same written tests as will be given newly trained radiographers. They will be required to demonstrate to the Radiation Protection Officer competence in the use of the Company's specific radiographic equipment and survey equipment, following the company's written Operating and Emergency Procedure.

Experienced radiographer's assistants will be given the same training and testing as inexperienced assistants.

5.4 (continued)

Periodic training will be given at six month intervals to radiographers and assistants. This course will review:

1. Federal Regulations
2. Written Operating and Emergency Procedure
3. Company policies
4. Specific radiographic equipment to be used
5. Radiation detection instruments to be used
6. Any changes in 1 through 5 above.

This training will be given by the Radiation Protection Officer. Alonso & Carus Iron Works, Inc. shall certify that all radiographers have satisfactorily fulfilled the requirements of this manual.

Gamma Industries

A Division of Nuclear Systems, Incorporated



This is to certify that MR. LAUREANO CARUS, JR.
has successfully completed ISOTOPE RADIOGRAPHY TRAINING PROGRAM
conducted on FEBRUARY 7-11, 1983 in BATON ROUGE, LOUISIANA,

FEBRUARY 27, 1983
Date

S. G. Stuckey
MR. S. G. STUCKEY
TRAINING COORDINATOR



ALONSO & CARUS

IRON WORKS INC. 0938

ROAD 869, KM. O H9, BO PALMAS, P.O. BOX 566, CATAÑO, PUERTO RICO 00632, PHONE (809) 788-1065
TELEX No. 3450186 - ALONCAR

P.O. NO. 058-83 (C.O.#1)

THIS NUMBER MUST APPEAR ON ALL PAPERS AND PACKAGES RELATIVE TO THIS ORDER.

SHIP TO

Gamma Industries
P.O. Box 2543
Baton Rouge, Louisiana 70821

PLEASE FURNISH THE MATERIAL SPECIFIED BELOW SUBJECT TO THE CONDITIONS AND INSTRUCTIONS SET FORTH ON THE FACE AND REVERSE SIDE HEREOF.

DATE	SHIP TO ARRIVE AT JOB BY RUSH	PROTECT LOWEST RATE	SHIP VIA	DATE OF ORDER January 31, 1983
	TERMS usuals	F.O.B.		REQUISITION NUMBER
	TYPED BY gb	JOB. NO. Machinery	DATE OF REQ.	REQUESTED BY Laureano Carus

ITEM	QUANTITY	STOCK NUMBER OR DESCRIPTION	UNIT	PRICE	TOTAL PRICE
		<u>CHANGE ORDER NO.1 to our P.O.# 058-83</u>			
1	4	VICTOREEN - Model 541/R (0-200 Hr)-----	ea.	70.00	
2	1	Radiation Survey Meter - Model 252B-----		375.00	

IMPORTANT INSTRUCTIONS

- PLEASE ACKNOWLEDGE RECEIPT AND SPECIFY SHIPPING DATE.
- SEND ITEMIZED INVOICE IN FIVE COPIES TO PURCHASING DEPT., BOX 566, CATAÑO, P.R. 00632, ATTACHING ORIGINAL BILL OF LADING OR SHIPPING RECEIPT.
- INVOICE MUST SHOW ITEM NUMBER SHOWN ON PURCHASE ORDER.
- WHEN PREPAID, ATTACH ORIGINAL TRANSPORTATION RECEIPT.
- CASH DISCOUNT PERIOD WILL DATE FROM RECEIPT OF INVOICE CORRECTLY EXECUTED.
- PLEASE NOTIFY US IMMEDIATELY IF YOU ARE UNABLE TO SHIP COMPLETE ORDER BY DATE SPECIFIED.

P.O. NO. 058-83 (C.O.#1)

ALONSO & CARUS IRON WORKS, INC.

PURCHASING DEPARTMENT

Laureano Carus

BY _____

ACCOUNTING DEPT.



ALONSO & CARUS IRON WORKS INC.

ROAD 669, KM O HR, BO PALMAS, P.O. BOX 566, CATAÑO, PUERTO RICO 00632, PHONE (809) 788-1065
TELEX No. 3450186 - ALONCAR

P.O. NO. 058-88

THIS NUMBER MUST APPEAR ON ALL PAPERS AND PACKAGES RELATIVE TO THIS ORDER.

SHIP TO

*Gamma Industries
P.O. Box 2543
Baton Rouge, Louisiana 70821*

PLEASE FURNISH THE MATERIAL SPECIFIED BELOW SUBJECT TO THE CONDITIONS AND INSTRUCTIONS SET FORTH ON THE FACE AND REVERSE SIDE HEREOF

DATE	SHIP TO ARRIVE AT JOB BY RUSH	PROTECT LOWEST RATE	SHIP VIA	DATE OF ORDER January 21, 1988
	TERMS usuals	F.O.B.		REQUISITION NUMBER
	TYPED BY gb	JOB NO. Machinery	DATE OF REQ	REQUESTED BY Laureano Carus

ITEM	QUANTITY	STOCK NUMBER OR DESCRIPTION	UNIT	PRICE	TOTAL PRICE
1	1	Dosimeter @ Model 06-608 (0-10 R)	ea.	\$ 116.00	

IMPORTANT INSTRUCTIONS

- PLEASE ACKNOWLEDGE RECEIPT AND SPECIFY SHIPPING DATE
- SEND ITEMIZED INVOICE IN FIVE COPIES TO PURCHASING DEPT., BOX 566, CATAÑO, P.R. 00632, ATTACHING ORIGINAL BILL OF LADING OR SHIPPING RECEIPT.
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- PLEASE NOTIFY US IMMEDIATELY IF YOU ARE UNABLE TO SHIP COMPLETE ORDER BY DATE SPECIFIED.

P.O. NO. 058-88

ALONSO & CARUS IRON WORKS, INC.

PURCHASING DEPARTMENT

Laureano Carus

BY

ACCOUNTING DEPT.



ALONSO & CARUS

IRON WORKS INC.

ROAD 869, KM. O. H9, BO. PALMAS, P.O. BOX 566, CATAÑO, PUERTO RICO 00632, PHONE (809) 788-1065
TELEX No. 3450186 - ALONCAR

P.O. NO 1419-82

THIS NUMBER MUST APPEAR ON ALL PAPERS AND PACKAGES RELATIVE TO THIS ORDER.

SHIP TO

*Gamma Industries
Box 2543
Baton Rouge, Louisiana 70827*

PLEASE FURNISH THE MATERIAL SPECIFIED BELOW SUBJECT TO THE CONDITIONS AND INSTRUCTIONS SET FORTH ON THE FACE AND REVERSE SIDE HEREOF

DATE	SHIP TO ARRIVE AT JOB BY Feb. 15 1983	PROTECT LOWEST RATE	SHIP VIA	DATE OF ORDER 24 Dec. 82
TERMS 30 days	F.O.B.		REQUISITION NUMBER	
TYPED BY mb	JOB. NO.	DATE OF REQ. 10 Dec. 82	REQUESTED BY L. Carus	

ITEM	QUANTITY	STOCK NUMBER OR DESCRIPTION	UNIT	PRICE	TOTAL PRICE
1	1	821-1001-006 Gamma Century SA Iridium-192 Radiography device, per attached brochure			2065.00
2	1	811-1002-013 Gamma Industries remote control assembly, 25 foot length, per attached brochure			440.00
3	1	811-1003-104 Gamma Industries source tube assembly, metal, 7 foot length, per attached brochure			109.75
4	1	811-1003-001 Gamma Industries source tube assembly, 14 foot length, metal, per attached brochure			146.50
5	1	821-0090-252 Gamma Industries survey meter with dosimeter charger, Model 252B, per attached brochure			375.00
6	1	801-1004-001 Gamma Industries Mini-1 side collimator, tungsten, per attached brochure			162.50
7	1	801-8001-003 Gamma Industries Iridium-192 radiography source, 100 curies, Model A-2-A, to be used in Gamma Century S or Gamma Century SA radiography device			675.00

IMPORTANT INSTRUCTIONS

- PLEASE ACKNOWLEDGE RECEIPT AND SPECIFY SHIPPING DATE
- SEND ITEMIZED INVOICE IN FIVE COPIES TO PURCHASING DEPT., BOX 566, CATAÑO, P.R. 00632, ATTACHING ORIGINAL BILL OF LADING OR SHIPPING RECEIPT.
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P.O. NO 1419-82

ALONSO & CARUS IRON WORKS, INC.

PURCHASING DEPARTMENT

BY

L. Carus

ACCOUNTING DEPT.

DAVID E. CINTRON, P.E.

CONSULTING ENGINEER

465 SCHUCK COURT
HATO REY, PUERTO RICO 00917
(809) 754-0708

NAME: David E. Cintrón, P.E.

ADDRESS: 465 Schuck Court - Floral Park
Hato Rey, Puerto Rico 00917
Tel.: (809) 754-0708

LICENSES: Registered Enginner No. 4882

EDUCATION: BSCE - 1965
School of Engineering - Mayaguez
Campus - University of Puerto Rico

: Radiation Safety Courses - 1969-80
Arnold Greene Testing Labs., Inc.
6 Huron Drive
Natick, Mass. 01760

: Radiation Rules & Regulations - 1969 - 80
Arnold Greene Testing Labs., Inc.
6 Huron Drive
Natick, Mass. 01760

: NDT Training - 1969 - 80
Arnold Greene Testing Labs., Inc.
6 Huron Drive
Natick, Mass. 01760

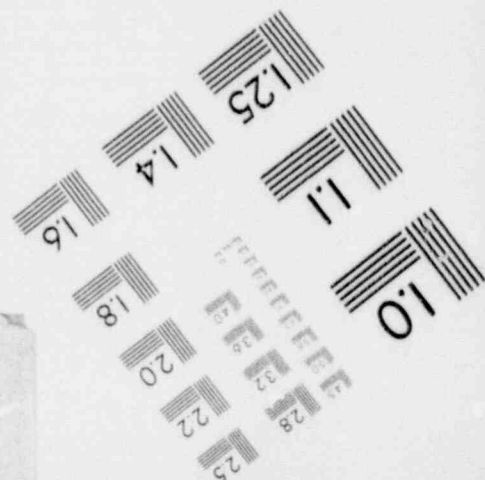
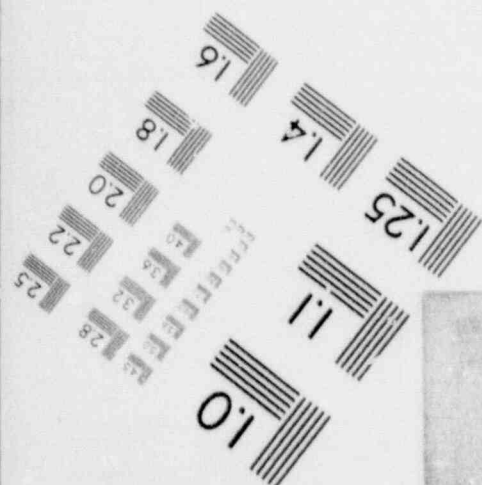
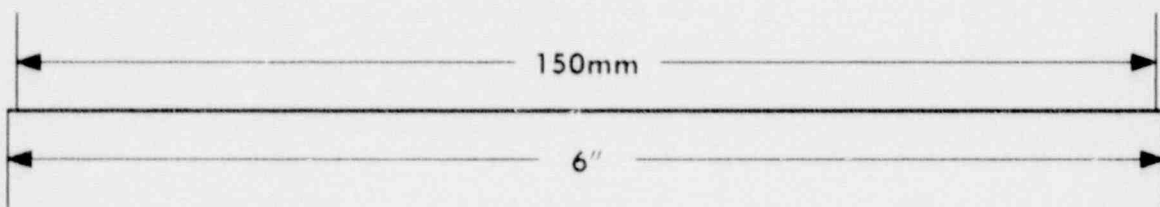
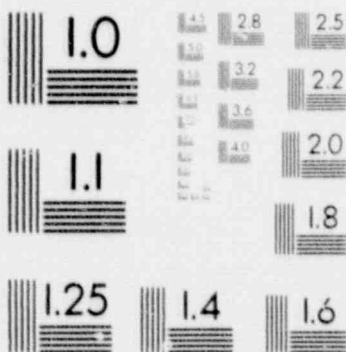
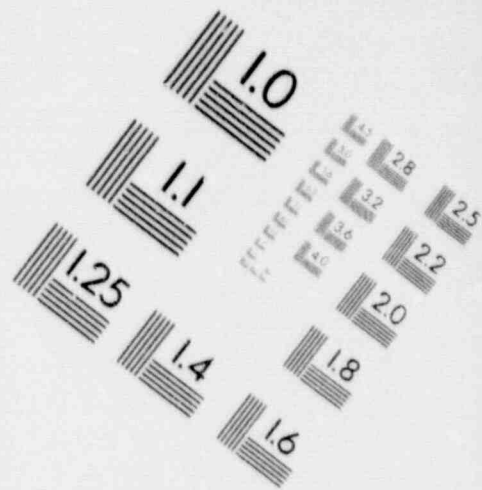
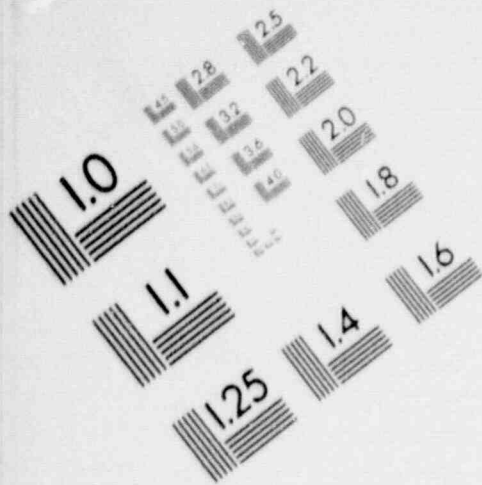
CERTIFICATIONS: NDT Level III (RT)
SNT - TC - 1A

: NDT - Level III (MT, UT, PT, LT)
SNT - TC - 1A

: Welding Inspector - QCI-82
American Welding Society

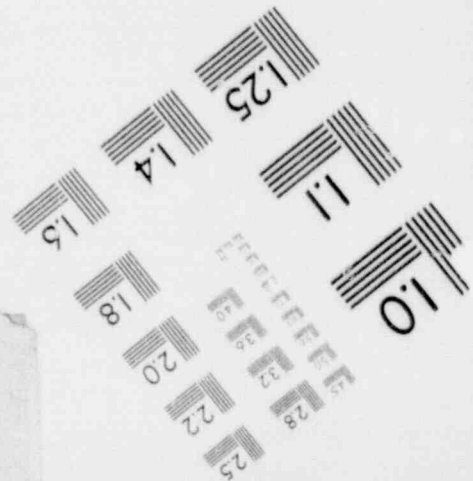
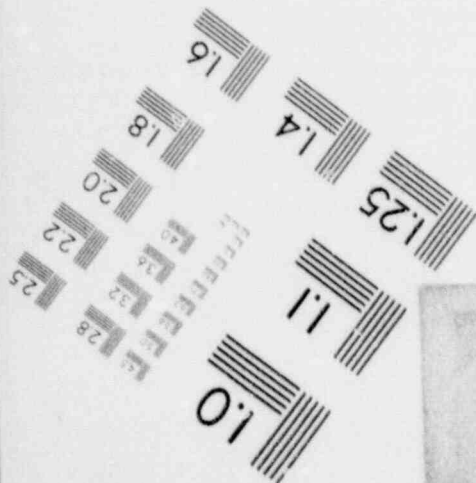
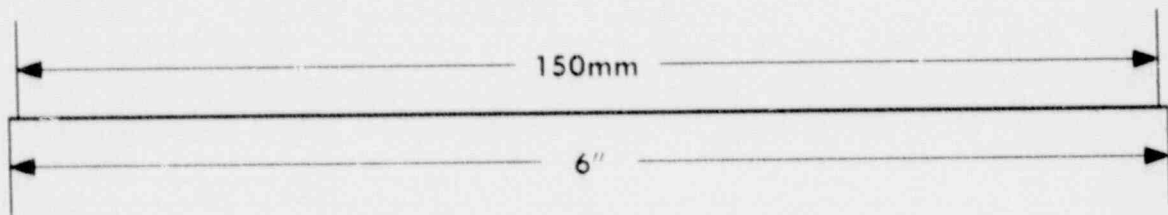
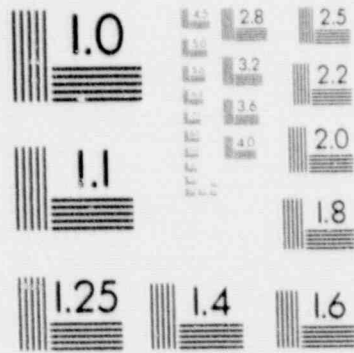
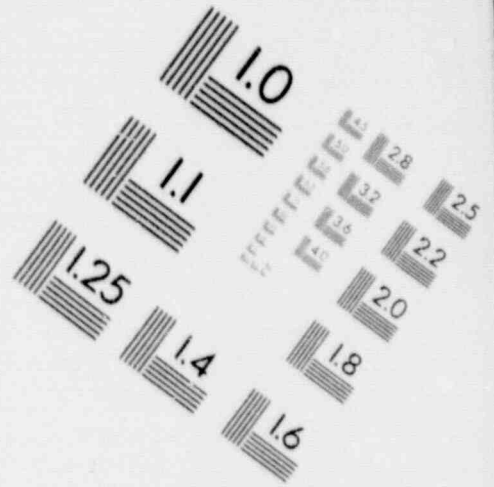
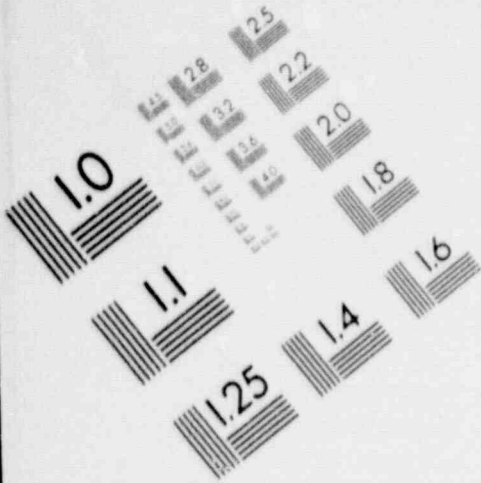
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IMAGE EVALUATION TEST TARGET (MT-3)



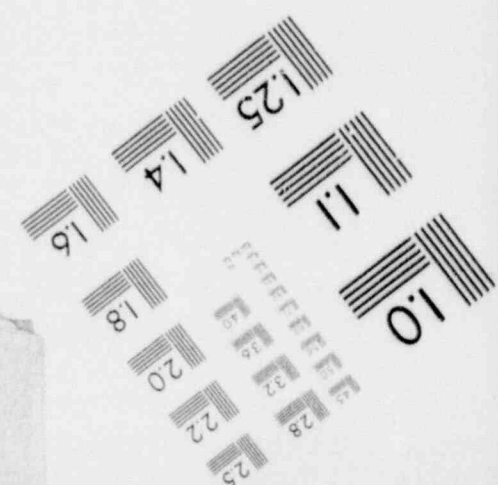
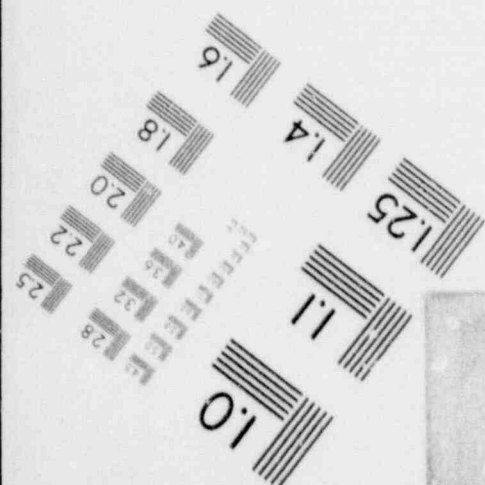
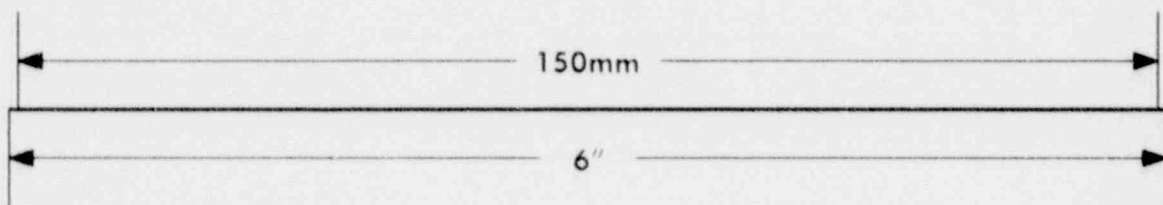
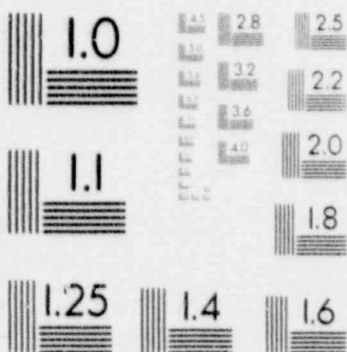
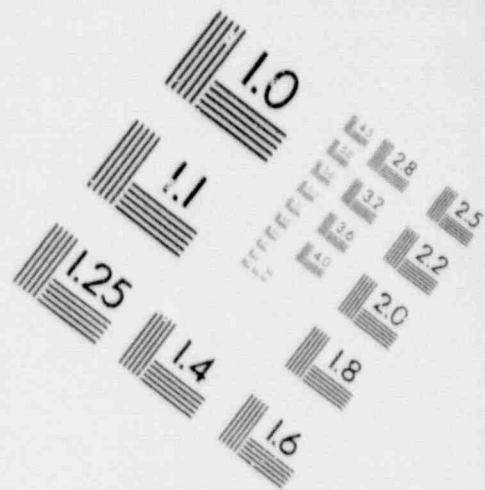
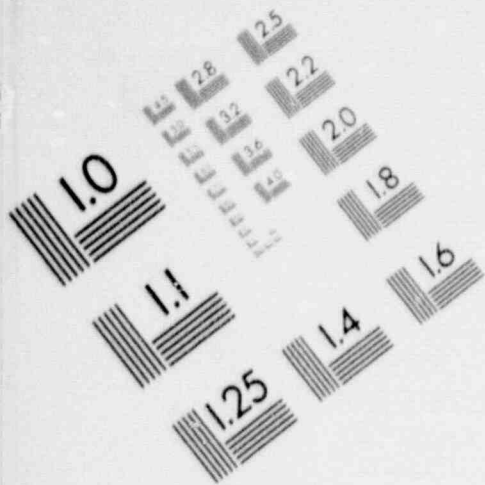
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IMAGE EVALUATION TEST TARGET (MT-3)



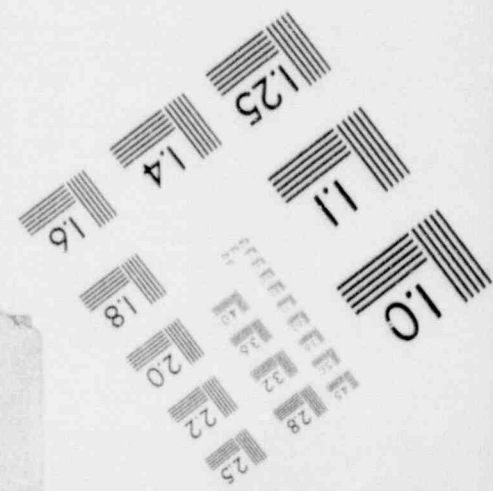
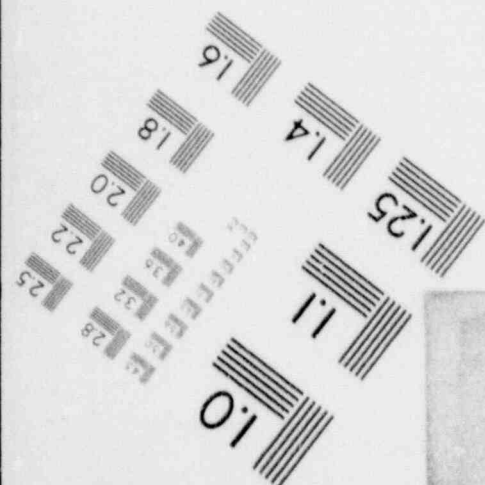
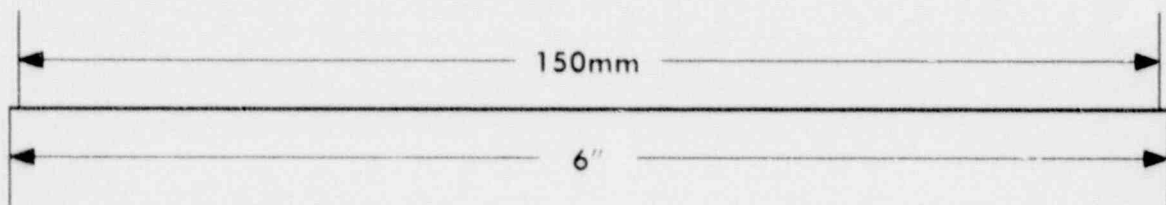
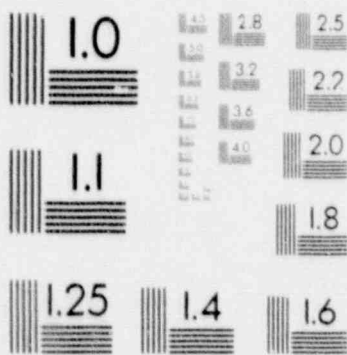
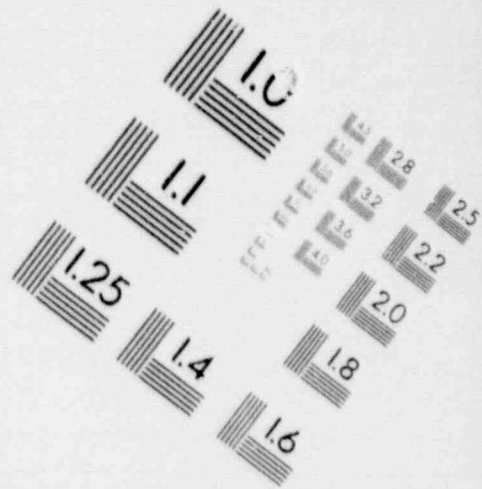
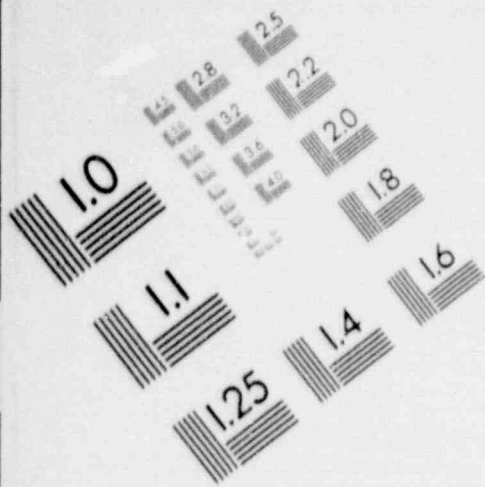
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IMAGE EVALUATION TEST TARGET (MT-3)



1

IMAGE EVALUATION TEST TARGET (MT-3)



Page 2

DAVID E. CINTRON
CONSULTING ENGINEER

WORK EXPERIENCE:

Radiation Safety Officer 1969-80
Arnold Greene Testing Labs. of P.R., Inc.
167 Quisqueya Avenue
Hato Rey, P. R. 00917

PROFESSIONAL AND
TECHNICAL ASSOC. :

College of Engineers & Surveyors
American Welding Society
American Society of Mechanical Engineers
American Society for Metals
American Society for Testing & Materials
American Society of Nondestructive
Testing

CERTIFIED CORRECT:



David E. Cintrón

MAY 13 1983

FCML:JCW
030-20541
(14514)

Alonso & Carus Iron Works, Inc.
ATTN: Laureano Carus
P.O. Box 566
Road 869 K.M. O. 09B0.
Palmas Catano, PR 00632

Gentlemen:

This letter is in response to your application, dated March 14, 1983, for a byproduct material license in industrial radiography. Additional information is needed to support your application.

1. Section 2.4.1 of your application requests that Alonso & Carus Iron Works, Inc. be given authorization to calibrate instruments and pocket dosimeters with a Series 28 calibrator. However, you have not requested to possess the source for such a calibrator. Please clarify.
2. You have submitted the name of Mr. Laureano Carus Gonzales as the assistant RPO. However, Mr. Gonzales is not yet a qualified radiographer in that he has only taken a 40-hour classroom training course (documentation needed). Therefore, Mr. Gonzales cannot qualify to be the assistant RPO based on the information submitted. Also, is this Mr. Laureano Carus Gonzales the same person as the Mr. Laureano Carus, Chairman of the Board, who signed the application, dated March 14, 1982?
3. In your organization chart, you did not mention the name of any consultants. If you should have a consultant in preparing this application and/or to advise future radiography operations, please provide the name and qualification of the consultant(s).

We will continue the review of your application upon receipt of the requested information. Please reply in duplicate and reference Mail Control No. 14514.

Sincerely,

Joseph C. Wang
Material Licensing Branch
Division of Fuel Cycle and
Material Safety

CRESS:SS
5520
5/11/83

FCML *JCW*
JCWang:mw
5/12/83



ALONSO & CARUS iron works, inc.

ROAD 869, KM. 0.09, BO. PALMAS, P. O. BOX 566, CATAÑO, PUERTO RICO 00632
PHONE (809) 788-1065, TELEX NO. 3450186 ALONCAR

April 7, 1983

83
APR 13 P3:39

Director, Div. of Fuel Cycle and
Material Safety
Office of Nuclear Material
Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sirs:

Enclosed are two (2) copies each of our application and operating and emergency procedures booklets as well as a check for \$460.00 as specified in "Instructions for Preparing Application for By Product Material License - Use of Sealed Sources in Radiography (Form NRC-313R)."

Additional information shall be supplied upon your request. Thank you.

Sincerely,

ALONSO & CARUS IRON WORKS, INC.

Laureano Carus,
President

/gb

Enclosures

COPIES SENT TO OFF. OF
INSPECTION AND ENFORCEMENT

14514

03310 30-2184

(SEE ATTACHED FORM NRC-313R INSTRUCTIONS AND NRC REGULATORY GUIDE 10.6—USE SUPPLEMENTAL SHEET WHERE NECESSARY) BE SURE ALL ITEMS ARE COMPLETED AND THAT ALL NECESSARY ATTACHMENTS ARE FURNISHED. IF ANY PORTION OF THE APPLICATION IS NOT APPLICABLE SPECIFICALLY SO STATE. DEFICIENT OR INCOMPLETE APPLICATIONS MAY BE RETURNED WITHOUT CONSIDERATION. LICENSE FEE REQUIRED, SEE ITEM 7 OF INSTRUCTIONS.

1(a) NAME AND ADDRESS OF APPLICANT AND TELEPHONE NUMBER
 Alonso & Carus Iron Works, Inc.
 P.O. Box 566, Rd. 869 KM. 0.09 BO. Palmas
 Cataño, Puerto Rico 00632 (809)788-1065

1(b) TELEPHONE NO. - Area Code ()

2 THIS IS AN APPLICATION FOR: (Check appropriate item)
 A. NEW LICENSE
 B. AMENDMENT TO LICENSE NO. L E L 21850
 C. RENEWAL OF LICENSE NO. _____

1(c) APPLICANT IS: An individual A partnership A Corporation An Unincorporated Association Other If applicant is other than an individual, the applicable section on the reverse side must be completed.

3 LOCATION(S) WHERE SEALED SOURCES WILL BE USED AND/OR STORED. (If use will be made in states other than named in 1(a), they should be listed here.)
 Puerto Rico - Stored as in (1) and at temporary job sites.

4. SEALED SOURCES TO BE USED IN RADIOGRAPHY (Attach supplementary pages, if necessary)

BYPRODUCT MATERIAL (Element and Mass No.)	SOURCE MODEL NUMBER	NAME OF MANUFACTURER	MAXIMUM ACTIVITY PER SOURCE	NUMBER OF SOURCES
A. Ir-192	A. A-2-A	A. Gamma Industries	A. 100 Ci	A. Any
B.	B.	B.	B.	B.
C.	C.	C.	C.	C.

5(a) RADIOGRAPHIC EXPOSURE DEVICES (Attach supplementary pages, if necessary)

MODEL NUMBER	NAME OF MANUFACTURER (Include description if custom made)
A. Gamma Century S & SA	A. Gamma Industries
B.	B.
C.	C.

Date: 4/21/83
 Log: APRIL 4 N.L.
 By: Brown

5(b) RADIOGRAPHIC SOURCE CHANGERS (Attach supplementary pages, if necessary)

MODEL NUMBER	NAME OF MANUFACTURER (Include description if custom made)
A. Gamma C-10	A. Gamma Industries
B.	B.
C.	C.

Applicant: 2268
 Check No. 46230
 Amount: \$462.30
 Type: APPLICATION
 Date: 4/21/83
 Action Compl: Brown

6 THE FOLLOWING INFORMATION IS ATTACHED AS PART OF THIS APPLICATION. Check appropriate blocks and attach information called for in the instructions with this form.

	Not Applicable	Attached	Previously Submitted
(a) Description of radiographic facilities (Instruction 6-a)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/> ON _____ (DATE)
(b) Description of radiation detection instruments to be used (Instruction 6-b)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/> ON _____ (DATE)
(c) Instrument calibration procedures (Instruction 6-c)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/> ON _____ (DATE)
(d) Personnel monitoring equipment (Instruction 6-d)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/> ON _____ (DATE)
(e) Operating and emergency procedures (Instruction 6-e)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/> ON _____ (DATE)
(f) Training program (Instruction 6-f)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/> ON _____ (DATE)
(g) Internal inspection system or other management control (Instruction 6-g)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/> ON _____ (DATE)
(h) Overall organizational structure (Instruction 6-h)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/> ON _____ (DATE)
(i) Leak testing procedures (Instruction 6-i)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/> ON _____ (DATE)

CERTIFICATE (This item must be completed by applicant)

7 THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PART 30, AND THAT ALL INFORMATION CONTAINED HEREIN, INCLUDING ANY SUPPLEMENTS ATTACHED HERETO, IS TRUE AND CORRECT TO THE BEST OF OUR KNOWLEDGE AND BELIEF.

LICENSE FEE ENCLOSED \$ 460.00

BY X Laureano Carus
 (Signature)

Laureano Carus
 (Type or print name of certifying official)

Chairman of the Board
 (Title of certifying official)

DATE March 14, 1983

LEGAL STRUCTURE OF APPLICANT

If applicant is a corporation, complete Items 8 through 11; if applicant is a partnership, complete Items 12 through 14; if applicant is an unincorporated association or a legal entity other than a partnership or corporation, complete Items 15 and 16. Attach separate sheets where space provided proves inadequate.

CORPORATION

8. STOCK OF APPLICANT CORPORATION

NO. OF SHARES AUTHORIZED	NO. OF SHARES ISSUED	NO. OF SHARES SUBSCRIBED	TOTAL NUMBER OF:	
			(a) Stockholders	(b) Subscribers
2,000-	1456	-	Four (4)	-

9. Is applicant corporation directly or indirectly controlled by another corporation or other legal entity?

YES NO

If answer is "YES" give name and address of other corporation or other legal entity and describe how such control exists and the extent thereof.

10. (a) Identify by name and address any individual, corporation, or other legal entity (1) owning 10 percent or more of the stock of applicant corporation issued and outstanding or (2) subscribing to 10 percent or more of the authorized but unissued stock of the corporation.

(b) Identify by name and address all officers and directors of the corporation.

* See Exhibit A

11. Identify the State, District, Territory, or possession under the laws of which the applicant is incorporated.

San Juan, Puerto Rico

PARTNERSHIP

12. Name and address of each individual or legal entity owning a partnership interest in the applicant.

13. State the percent of ownership of the applicant partnership held by each of the individuals or legal entities listed in item 12.

14. Identify the State, District, Territory, or possession under the laws of which the applicant partnership is organized.

OTHER

15. Describe the nature of the applicant and identify the State, District, Territory, or possession under the laws of which it is organized.

16. State the total number of members or persons holding an ownership in the applicant, identify each by name and address, and indicate the ownership interest thereof.

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SEALED SOURCES AND DEVICES

1.1 General

- 1.1.1 The company is licensed to use only the sealed sources designated on its license.
- 1.1.2 Instructions for the safe use of these devices are outlined in Section II of these procedures.
- 1.1.3 Each device containing a sealed source shall be plainly labeled with the radiation symbol and the words "CAUTION - RADIOACTIVE MATERIAL." Also, each shall carry a label or tag clearly stating the kind of radioactive material contained in the device, together with the quantity thereof and the date of measurement of the quantity.

1.2 Sealed Sources and Exposure Devices

- 1.2.1 The company will be authorized to use only those sources and exposure devices listed below:
 - a. Iridium 192--maximum source size, 100 curies. The source to be encapsulated in an A-2-A capsule and housed in a Gamma Industries Century S or SA exposure device.

OPERATING INSTRUCTIONS

2.1 General

- 2.1.1 The following operating instructions shall be observed whenever radiography is to be performed using radioactive isotopes.
- 2.1.2 The information contained in the operating manuals which are contained in this procedure and made part of it shall be carefully read and all instructions shall be followed when using the equipment to perform radiography.

2.2 Posting and Restricting Radiographic Areas

- 2.2.1 The boundaries of restricted areas and high radiation areas are required to be posted. "CAUTION--RADIATION AREA" signs should be posted at the boundary of the restricted area, and "CAUTION--HIGH RADIATION AREA" signs should be posted at the boundary of the high radiation area. High radiation area signs should not be used at the boundary of a restricted area; these signs should be used only at the boundary of a high radiation area which may be easily calculated.
- 2.2.2 Signs, by themselves, do not provide an adequate means of access control. Ropes and/or barricades may be necessary to control access to the restricted area in addition to constant visual surveillance of the area for operations performed outside a permanent radiographic installation.
- 2.2.3 A radiation level of 2 milliroentgens per hour for the boundary of the restricted area and 100 milliroentgens per hour for the boundary of the high radiation area are acceptable. A physical survey with a survey meter should be performed to confirm the 2 milliroentgens per hour radiation level for the restricted area boundary after the source has been exposed. It is neither necessary nor desirable for a physical survey to be made to confirm the radiation level at the boundary of the high radiation area since such a survey could lead to unnecessary exposure of personnel.

2.2.4 Collimating devices shall be used whenever possible to reduce the radiation level and the radiation boundary.

2.2.5 Any other shielding methods and techniques which are practical to reduce the radiation levels shall be used.

2.3 Operating Instructions for Radiographic Exposure Devices

2.3.1 The following preliminary instructions shall apply prior to exposing the sealed source for radiographic work:

- a. The radiographer shall have read and understood all of the information contained in the operating manuals.
- b. Only qualified radiographers or radiographers' assistants shall handle or operate the radiographic exposure devices and conduct radiation surveys as required by 34.43(b). The radiographer's assistant shall be under the personal supervision of a radiographer. The personal supervision shall include (a) the radiographer's personal presence at the site where the sealed sources are being used, (b) the ability of the radiographer to give immediate assistance if required, and (c) the radiographer's watching the assistant's performance of the operations.
- c. The radiographer must inspect daily used equipment and complete an inspection check list each day the equipment is used. Inspection of exposure devices must be made before and after daily use. The "Source Utilization Log" and "Radiation Survey and Dosimetry Report" must also be completed each day the equipment is in use. Any malfunction of, or damage to, the radioactive sources, the devices in which they are contained and the associated equipment, in addition to survey meters, dosimeters and film badges, must be reported immediately to the Radiation Protection Officer. If all items on the daily inspection check list check out satisfactorily, the radiographer or assistant must enter "ok" on the form for that day. If any malfunctions are found, describe these on the back of the form, how corrected, and date and sign the entry.

2.3.1 (Continued)

- d. The radiographic exposure device to be used shall be checked at the storage site with a gamma radiation survey meter to make sure that the sealed source is locked in the safe position before moving the device to the job site.
- e. The exposure device shall be moved to the job site in the manner prescribed in Section 2.7, "Transportation of Sources."
- f. The radiographer shall make sure that the area is properly roped off, barricaded, or otherwise secured and posted with signs as designated in Section 2.2.3.
- g. The radiographer shall assure that proper personnel monitoring devices are made available and worn by all personnel involved in radiographic work.
- h. The radiographer shall make sure that there are no sharp bends or kinks in the guide tube.
- i. Whenever possible, a collimator shall be used.
- j. The radiographer shall position the exposure device into a lock position before moving either the exposure device or reel.

2.3.2 Surveillance of the Area

- a. While the radioactive isotope is exposed, the radiographer shall keep the restricted area under constant surveillance to make sure that no person enters the area. He shall also check the perimeter of the restricted area with a survey meter, to make certain that the radiation levels are not in excess of those set forth in Section 2.2.3.
- b. If the radiographer finds the radiation level in excess of 2 mR/hr at any part of the perimeter of the restricted area, he shall immediately return the isotope to its safe position and redetermine the correct distance.

2.4 Radiation Surveys

2.4.1 Procedures

- a. A calibrated and operable survey meter, having range sufficient to measure radiation levels from two milliroentgen per hour through one roentgen per hour must be maintained at each job site where radiographic work is performed. A small tag attached to the survey meter shall show the date of the last calibration and by whom. The tag should be checked before starting each day's work. Each radiation survey instrument shall be calibrated at energies appropriate for use and at intervals not to exceed 3 months and after each instrument servicing.
- b. Gamma Industries survey meters shall be used to perform radiation surveys.
- c. Survey meters shall be calibrated by Gamma Industries or by Alonso & Carus Iron Works, Inc. using the Series 28 Calibrator and procedures as described on Page 2.19 herein.
- d. If for any reason survey meters become inoperable or out of calibration date, DO NOT perform any radiation work. Secure operations, and notify the Radiation Protection Officer immediately.
- e. A properly operating survey meter means radiation safety. DO NOT allow instrument to be coated with mud or debris. DO NOT allow to sit in excessive moisture areas. These instruments are delicate pieces of equipment and it is the radiographer's responsibility to keep them operating properly.
- f. Prior to starting each day's work, turn your instrument on battery check. If batteries are low, replace them with the extra set that has been furnished to you for this purpose.
- g. With battery check procedure completed, turn instrument on to X-1 scale and check against radiation source to make sure the instrument is operable before starting the day's operations.
- h. If, for any reason, there is a malfunction of your instrument, DO NOT tamper or try to self adjust. Suspend all radiographic operations and notify the Radiation Protection Officer.

- 2.4.2 Area surveys must be made during each exposure to ensure that levels outlined in 2.2.3 are not exceeded.
- 2.4.3 Radiation surveys of the source container shall be made at the following times to ensure that the source is in a shielded (safe) position:
- a. Prior to removing the source container from the locked storage cabinet.
 - b. As soon as the sealed source has been retracted into the source container after a radiographic exposure or source changing operation. Container guide tube and complete circumference of the container shall be checked.
 - c. A record of the survey required in (b) above shall be maintained for two years when the survey is the last survey prior to locking the radiographic exposure device and ending direct surveillance of the operation.
 - d. Prior to securing the source container in the locked storage cabinet at the end of radiographic operations.
- 2.4.4 Records of 2.4.2 and 2.4.3 c. will be kept as stated in 2.3.1 c.

2.5 Personnel Monitoring

- 2.5.1 Pocket dosimeters, having a range of 2 to 200 milli-roentgens, and film badges shall be worn by all radiography personnel at all times when using radiographic sources. Frequent readings during the work day shall be made by the radiographer to be sure that an "off scale" or high reading on the dosimeter does not exist.
- a. Victoreen Model 541R pocket dosimeters shall be used in conjunction with a Gamma Industries dosimeter charger.
 - b. Dosimeters are delicate instruments and should be treated as such.
 - c. Dosimeters will be zeroed prior to starting work and the readings recorded at the completion of each day that radiographic operations are to be performed. The dosimeter

2.5.1 (Continued)

charger has a "charging contact" with up or down scale control for setting the hairline indicator within the dosimeter to zero. To zero, place the end of the dosimeter opposite the pocket slip over the charging contact on the dosimeter charger. Press down lightly. The illumination should allow sighting of the hairline indicator. Next, press down firmly and adjust the hairline indicator until the hairline is located at zero. Then, adjust to a full scale reading and back to the zero mark on the dosimeter scale. Remove the dosimeter from the charging contact. Check the dosimeter to be sure the indicator has not shifted. If it has, zero the dosimeter again.

- d. Whenever a dosimeter is discharged beyond 200 milliroentgens, work shall cease immediately and the film badge shall be immediately sent for processing. The wearer shall be suspended from radiographic operations until the film badge report is evaluated. The Radiation Protection Officer shall be notified immediately.
- e. Film badges shall be evaluated every 30 days by Eberline Instrument Corporation, Post Office Box 2108, Santa Fe, New Mexico 87501. Dosimeters shall be checked at intervals not to exceed one year for correct response to radiation by Gamma Industries, Post Office Box 2543, Baton Rouge, Louisiana 70821, or by Alonso & Carus Iron Works, Inc. using the Series 28 calibrator.

2.5.2 Film badges shall be worn by all radiographic personnel during working hours. Each film badge shall be worn only by the person assigned to that particular badge.

2.5.3 In the event of any equipment malfunction or doubts regarding the safe operation of the equipment or safety of the area in which equipment is to be used, the Radiation Protection Officer shall be consulted.

2.6 Source and Equipment Storage

2.6.1 The storage of sealed sources shall conform to the following standards:

- a. Sealed sources, when not in use, shall be stored inside of a locked steel box (see Section VII) which is fastened securely inside a locked darkroom camper or in building 9 at the Barrio Palmas facility in Catano, Puerto Rico. The room shall be posted with "CAUTION - RADIOACTIVE MATERIAL" signs. The room has only one (1) entrance which is locked at all times, and only the Radiation Protection Officer has keys to this lock.
- b. The darkroom camper or trailer shall be posted on the entrance to the storage area with a "CAUTION - RADIOACTIVE MATERIAL" sign.
- c. Prior to storage of the devices, the radiographer shall survey with a radiation survey meter to make certain that the source is in the proper storage position. He shall also see that the exposure device is properly locked as provided for by the manufacturer's locking provisions as outlined in the operating manual which is included in Section IV. He shall also survey the area outside the storage facility.

NOTE: Readings outside of storage areas shall not exceed 2 mR/hr at a distance of 18 inches from any external surface.

2.6.2 Quarterly Inventory--

Each calendar quarter, a physical inventory shall be made of the sources on hand. Quarterly inventories shall be conducted by the Radiation Protection Officer and recorded. A record of the quarterly inventory shall be kept by Alonso & Carus Iron Works, Inc. for a minimum of two years.

2.7 Transportation of Sources

2.7.1 When transporting sealed sources in radiographic exposure devices from the storage area to the job site, the following precautions shall be followed:

2.7.1 (Continued)

- a. All shipping plugs and locking devices shall be checked to be sure that the source is in the safe position.
- b. The exposure device shall be posted with a "CAUTION - RADIOACTIVE MATERIAL" sign, and it shall be locked. Keys are to be kept by the responsible radiographer and Radiation Protection Officer. The exposure device must be secured in a storage compartment of the vehicle to prevent shifting or loss.
- c. When vehicles are used, only company owned or leased vehicles shall be used to transport the exposure device to the job site. Radiation surveys should be conducted to ensure readings of less than 2 mR/hr at a distance of 18 inches from any external surface of the vehicle. The cab of the vehicle shall be monitored to determine that the radiation level within the cab does not exceed 2 mr/hr. Complete "Daily Vehicle Utilization Log." The survey meter should be placed next to the driver while in transit and periodically observed to ensure the safe storage of the exposure device.
- d. The radiography device (package) must be properly labelled with the appropriate category of RADIOACTIVE label in accordance with 49 CFR 172.403 (a) through (d). This requires affixing two labels on opposite sides of the package based on the radiation dose rates at the surface and at three feet (Transport Index) from the package.

<u>LABEL</u>	<u>DOSE RATE LIMIT AT ANY POINT ON ACCESSIBLE SURFACE OF PACKAGE</u>	<u>DOSE RATE LIMIT AT 3(FT) FROM EXTERNAL SURFACE OF PACKAGE (TRANSPORT INDEX)</u>
"RADIOACTIVE - WHITE I"	0.5 mr/hr	
"RADIOACTIVE - YELLOW II"	50 mr/hr	1.0 mr/hr
"RADIOACTIVE - YELLOW III"	200 mr/hr	10.0 mr/hr

The transporting vehicle must be placarded in accordance with the Department of Transportation regulations. The signs shall be posted on all four sides of the vehicle. This placard bears the word RADIOACTIVE and must be displayed if YELLOW III labels are placed on the transport package.

2.7.1 (Continued)

- e. The radiographer must have a minimum of the following equipment with him while transporting any device containing radioactive material: survey meter, dosimeter, film badge, Operating and Emergency Procedures, and radiation signs.
- f. When shipping an exposure device by common carrier, the device must be plainly marked and the appropriate signed shipper's certification must be included. The exposure device and/or shipping container shall be locked. A survey shall be made and recorded to determine that the radiation from the shipping container measures less than 200 mR/hr at any external surface. The licensee should offer the required placards to the carrier at the time the packages are picked up.

2.8 Receiving Radioactive Material

A package of radioactive material must be accepted from a carrier at the time it is delivered.

- 2.8.1 Upon receipt of a package of radioactive material, a survey of the exterior surfaces of the package shall be conducted. The radiation levels shall not exceed 200 milliroentgens per hour at the surface.
- 2.8.2 A survey shall be conducted at a distance of three feet from the exterior surface of the package to ensure that radiation levels do not exceed ten milliroentgens per hour.
- 2.8.3 The results of these surveys shall be recorded on the receiving report accompanying the package. If any of the above limits are exceeded, notify the Radiation Protection Officer.
- 2.8.4 The source, model number, serial number, isotope, activity and shipping container number shall be recorded on the receiving report.
- 2.8.5 The package shall be inspected for damage. The results of the inspection shall be recorded on the receiving report. A copy of the receiving report shall be forwarded to the Radiation Protection Officer.

2.9 Operating Instructions For Use of Leak Test Kit

2.9.1 Each sealed source shall be tested for leakage at intervals not to exceed six months. In the absence of a certificate from a transferor that a test has been made within six months prior to the transfer, the sealed source shall not be put into use until tested.

- a. All leak tests shall be capable of detecting the presence of 0.005 microcuries of removable contamination on the sealed source. Records of leak test results shall be kept in units of microcuries.
- b. Only a qualified radiographer shall perform the wiping in accordance with the attached Gamma-Industries Leak Test Procedure (pg. 2.18).

2.10 Operating Instructions for Use of Source Changers

2.10.1 The Gamma Industries Model C-10 is a portable, shielded container for transferring encapsulated radioisotope sources into radiography devices. The changer is designed to safely contain the radiographic sources during shipment and to permit field exchange of old for new sources without exposing the operator to unsafe radiation levels. The following instructions shall apply prior to the start of the source exchange.

- a. Only qualified radiographers shall perform the source exchange.
- b. The radiographer shall have read and understood all of the information contained in the instructions for use of the source changers contained in Section IV which are made part of this procedure.

2.11 Quarterly Inspections and Maintenance

2.11.1 A quarterly inspection of all devices shall be performed by the Radiation Protection Officer. All required maintenance at the time shall be performed by the Radiation Protection Officer with assistance from a radiographer, if required.

2.11.1 (Continued)

If at any time during daily or quarterly inspection the source appears to be worn or faulty in any way, Gamma Industries is to be contacted for further instructions. The "Daily Check List," and "Quarterly Maintenance and Inspection Report" in Section II and the maintenance procedures found in Section IV shall be followed carefully.

RADIATION SURVEY AND DOSIMETRY REPORT

A Survey is to be made on each Radiographic Operation

Date _____

Customer: _____

Location: _____

Material to be Radiographed: _____

EXPOSURE DEVICE USED:

Make: _____ Serial # _____ Model # _____

Date Leak Tested: _____ Time Out _____ Time In _____

Calculated Exposure Time Per Hour _____

SURVEY INSTRUMENT USED:

Make: _____ Serial # _____ Model # _____

LAST CALIBRATION DATE: _____

Sketch & Surveys of Restricted Areas:

dosimeter readings; (Total for Day) Radiographer _____ mR

Radiographer's Asst. _____ mR

SURFACE mR OF EXPOSURE DEVICE: _____ Beginning of Day _____ mR/Hr

End of Day _____ mR/Hr

Radiographer _____

Radiographer's Asst. _____

DAILY INSPECTION CHECK LIST

Device _____

- A. Exposure Device and Associated Equipment
 - 1. Radiation level when removed from storage.
 - 2. Device crank-out and guide tube free from visible damage.
 - 3. Device properly labelled.
 - 4. Source identification plate in place.
 - 5. Proper operation of lock mechanism.
 - 6. Proper operation of crank mechanism.
 - 7. Connections.
 - 8. Normal operation of entire assembly.

- B. Radiation Survey Meter
 - 1. Meter free from visible damage.
 - 2. Calibration due date not exceeded.
 - 3. Battery check.
 - 4. Proper response to radiation (compare to known level of radiation from radiography device--source inside).

- C. Pocket Dosimeter and Film Badge
 - 1. No visible damage.
 - 2. Dosimeter hairline visible and set on zero.
 - 3. Slips in place and both devices being worn.

All items O.K. yes _____ no _____ If no, see back of sheet for explanation.

Date _____

Signature _____

Title _____

DAILY VEHICLE UTILIZATION LOG

Name _____ Month _____ Year 19 _____

Date	Vehicle	Reading in mR's in cab	Reading in mR's, left side	Reading in mR's, right side	Reading in mR's, back	Radiographer

QUARTERLY MAINTENANCE & INSPECTION REPORT

SOURCE

Location of Device _____

LOCKING APPARATUS (CAMERAS) _____

PIG TAILS _____

DECALS _____

PLUGS (BOTH ENDS OF CAMERA) _____

IDENTIFICATION MARKINGS _____

MISCELLANEOUS _____

SURVEY METER

BATTERIES _____

CALIBRATION _____

OVERALL CONDITION _____

SOURCE TUBES

KINKS _____

FRAYED AREAS _____

CONNECTIONS _____

CRANKOUTS

HANDLE _____

INTERNAL PARTS (HANDLE) _____

CONDITION OF CABLE _____

EXTERIOR _____

PLUGS & CONNECTORS _____

DOSIMETER CHARGER

BATTERIES _____

INTERNAL CONDITION _____

SIGNS

ARE THEY READABLE _____

PROPER MARKINGS REMAINING _____

COLLIMATORS & SOURCE TIPS

PROPER WORKING ORDER _____

DATE: _____

SIGNATURE: _____

TO BE POSTED AT PERMANENT STORAGE SITE EACH MONTH

Year 19

Month

Date	Exposure Device Number	Isotope Number	Curies	Transfer to	Received from	Remarks

Gamma Industries
Leak Test Kit

LEAK TEST PROCEDURES FOR
CRANKOUT DEVICES
GAMMA INDUSTRIES CODE 5

NAME:

LOCATION:

DATE:

ISOTOPE:

SOURCE NO.:

REMARKS:

1. Using a survey meter, ascertain that the source is in the safe or shielded position.
2. With unit locked and secure, disconnect the source tube.
3. Remove the swab from the leak test kit and thoroughly wipe the inner walls of the device outlet nipple or other orifice or surface normally in contact with the source during operation.
4. After wiping, place the swab in the plastic bag and seal securely. Slide the plastic bag containing the swab into the return envelope and seal the flap.
5. Using a survey meter, determine if there is any radiation being emitted from the swab.
 - a. If there is no detectable radiation, the leak test kit should immediately be mailed back to Gamma Industries
 - b. If there is detectable radiation, DO NOT MAIL the leak test kit. Immediately call RSO.

NOTE: Be sure requested information on the envelope is provided as completely as possible.

OPERATING PROCEDURES

FOR

SERIES 28 CALIBRATOR

Radiation Safety

1. The calibrator emits an intense beam of radiation in the area subtended by the beam port (cone) when the source is in the "on" position. The dose at one foot in front of calibrator in the "on" position is 3.3 R/hr. Attenuator attachments can reduce the intensity of radiation by factors of 2 to 8000. A much lower level of scatter radiation extends in a penumbra surrounding the primary beam. THE OPERATOR SHOULD NEVER STAND IN THE DIRECT BEAM WHILE OPERATING THE UNIT. THE UNIT MUST BE OPERATED AT ALL TIMES FROM A POSITION BEHIND THE CALIBRATOR, ON THE SIDE OPPOSITE THE BEAM PORT. The calibrator in the "off" position measures less than 2 mR/hr at the surface. The area around the calibrator shall be secured and limited access to the room shall be maintained during any operations with the unlocked calibrator.
2. The sealed source shall be tested for leakage at intervals not to exceed six months. In the absence of a certificate from a transferor that a test has been made within six months prior to the transfer, the sealed source shall not be put into use until tested. The leak test shall be conducted with the KOWIPE leak test kit from Gamma Industries. Using the instructions provided in the KOWIPE kit, wipes shall be taken at the nearest accessible surface of the source when it is in the "off" position. The surface to be wiped is located at the top of the calibrator where the operating rod extends through the top plate. After wiping, place the swab in the plastic bag and seal securely. Slide the plastic bag containing the swab into the return envelope and seal the flap. Using a survey meter, determine if there is radiation being emitted from the swab. If there is no detectable radiation, the leak test should be mailed to Gamma Industries, 2255 Ted Dunham Avenue, Baton Rouge, Louisiana 70821. If there is detectable radiation, DO NOT MAIL the leak test kit. Immediately call the Radiation Safety Officer.

All leak tests shall be capable of detecting the presence of 0.005 microcuries of removable contamination on the sealed source. Records of leak test results from Gamma Industries shall be kept in units of microcuries and maintained for inspection by regulatory personnel.

Installation

Series 28 Calibrators are normally shipped in two parts: The source shield and the stand. TO INSTALL, bolt the source shield to the stand in the location where the calibrator is to be used. Plug the cord into a 115V, 1 phase socket.

Operation

1. Remove the padlock which locks the source in the "off" position during shipment using the key provided. NOTE: This padlock may be used to lock the source in the "off" position at any time the calibrator is not being used.
2. To expose the source, grasp the black operating knob (while standing behind the calibrator, opposite the beam port) and raise it until the spring loaded detent engages the depression on the operating shaft. The source is now exposed.
3. To return the source to the "off" position, push the operating knob down until the pin on the shaft strikes the stop on the calibrator top. The source is now fully shielded.

Safety Features

The shield provides for full shielding in all directions at all times except out the beam port when the source is in the "on" position.

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

Calibration Procedure

Two points on each survey meter range in the vicinity of 1/4 to 1/3 and 2/3 to 3/4 of full scale and separated by 50 percent of full scale shall be measured. The exposure rate measured by the instrument should differ from the true exposure rate by less than 20 percent of the value specified for the standard source. If a meter cannot be calibrated to within +20 percent, it should be noted. A survey meter should not be used in radiographic operations unless it can be adjusted to read within +20 percent of that of the known standard source.

OPERATING PROCEDURES FOR SERIES 28 CALIBRATOR
Page 3

A copy of the survey meter service record shall be completed showing the calibration output and adjusted survey meter reading for each of the points checked. The service record must be kept on file.

A calibration sticker shall be placed on the meter indicating the date, instrument, identification, person performing the calibration and the due date of the next calibration.

EMERGENCY PROCEDURES

3.1 General

- 3.1.1 Although remote, there is always the chance of an accident, therefore, it is necessary that all personnel be familiar with the steps to be taken in any emergency.
- 3.1.2 While these procedures set forth the steps to be taken in the event of an emergency, it must be the policy of all radiographic personnel to operate in such a manner as to avoid or prevent emergencies. Any unusual condition or occurrence which might indicate or cause an emergency should be immediately reported to the Radiation Protection Officer, who shall investigate and determine any necessary action. (Examples: A droppe meter, which, while still operating, might be inaccurate; difficulty in extending or retracting the source which might be a warning of conditions which could cause the loss of or inability to retract the source.) The Radiation Protection Officer shall not permit radiological work to proceed until he has made certain that all necessary corrective actions have been taken and all equipment is in safe operating condition.
- 3.1.3 Our radiography safety program is the responsibility of the Radiation Protection Officer. In any emergency such as a lost source, fire, vehicle accident, or overexposure, he is to be contacted immediately.
- 3.1.4 While the Radiation Protection Officer is in charge of the overall program, the direct responsibility for safety at any given site has to rest with the radiographer. By definition, radiographer means "any individual who performs or who, in attendance at the site where the sealed source or sources are being used, personally supervises radiographic operations and who is responsible to the licensee for assuring compliance with the requirements of the commission's regulations and the conditions of the license." Also by definition, the radiographer's assistant means "any individual who, under the personal supervision of a radiographer, uses radiographic exposure devices, sealed sources or related handling tools, or radiation survey instruments in radiography."

3.1.5 The procedures you are now reading are part of our license, and from the foregoing definitions you can see that the radiographer is charged with assuring compliance with the regulations and the conditions of our license. Hence, he must be familiar with our license and he also must see to it that these procedures are followed.

3.1.6 Sources are only to be manipulated by, or under the direct supervision of, the radiographer. "Direct supervision" means that the radiographer must be physically present. Under these circumstances, the radiographer's assistant may operate the source, but remember, the radiographer must be present!

3.2 Equipment Malfunction

3.2.1 Survey Meter--If for any reason the meter becomes inoperable, (due to damage, battery failure, etc.), or if there is any doubt as to the accuracy of operability of the meter, radiographic work shall stop immediately and the source returned to the safe position until another operable meter can be brought to the job site.

3.2.2 Damage to exposure devices and source containers--

- a. If the source can be returned to the shielded position in the exposure device, do the following:
 1. Return the source to the shielded position and lock the device.
 2. Survey the exposure device and guide tube to be sure the source is in the shielded position.
 3. Notify the Radiation Protection Officer and report what has happened and what has been done.
- b. In the event the source cannot be returned to the shielded position, immediately do the following:
 1. Establish and post a restricted area as specified in Section 2.2.3 of these procedures.

2. Prohibit entrance to this area; maintain personnel surveillance of this posted area at all times.
3. Notify the Radiation Protection Officer and report all pertinent information.

3.3 Emergency Situation at Job Site

3.3.1 In the event of an emergency in an area adjacent to the source (such as fire or an accident to personnel,) do the following:

- a. Return the source to the shielded position and lock the device. Perform a physical radiation survey of the device to ensure that the source is in the shielded position.
- b. Remove the guide tube and control cables, insert the safety plugs, and remove the device to a safe area. In the event of a fire, the source must be returned to the storage area.
- c. The Radiation Protection Officer shall be notified when such action is taken.
- d. If the source cannot be returned to the shielded position and removed from the danger area, set up a restricted area as specified in Section 2.2.3 using a radiation survey meter to determine the perimeter of this area.
 1. The radiographer shall notify the Radiation Protection Officer of the situation and describe the restricted area.
 2. The Radiation Protection Officer shall notify the guards and the appropriate civil agencies, such as the fire and police departments, of the restricted area.
 3. In any emergency, the unit or area foreman shall be notified of the restricted area.
 4. The restricted area boundary, the location of sealed sources and the nature of the radiation hazard shall be made known to all persons who must enter the emergency area.

3.4 Loss of Source

3.4.1 When it is determined that a sealed source is missing from its proper radiographic exposure device, storage, or shipping container, the following steps shall be immediately taken by the radiographer:

- a. Determine the last known location of the source.
- b. Using radiation survey meters, determine the general area of the source.
- c. Check the area with radiation survey meters to determine the proper restricted area.
- d. Rope off, barricade or otherwise secure the area and post signs.
- e. Locate the source by means of survey meters.
- f. Prior to any attempts or action to place source in its proper device or container, contact the Radiation Protection Officer.

3.5 Vehicle Accidents

3.5.1 In the event of an accident involving radioactive material while traveling to an exposure site, a restricted area must be established as specified in Section 2.2.3 of these procedures.

- a. Immediately check the device housing of the sealed source with a radiation survey meter to make certain that it has not been damaged and that a safe radiation level exists.
- b. If a radiation hazard does exist, the radiographer or his assistant shall establish a restricted area and make certain that all non-monitored personnel are out of the area.
- c. The radiographer shall make every reasonable effort to maintain radiation exposures and releases of radioactive material as low as is reasonably achievable.

3.5.1 (Continued)

- d. In the event that medical aid or the fire department is required, the radiographer or his assistant shall notify these people of the radiation hazard.
- e. The radiographer shall notify the Radiation Protection Officer of the emergency as soon as possible.

3.6 Notification of Emergencies

- 3.6.1 In the event of any emergency involving or threatening to involve any radioactive materials or devices, the following persons are to be notified immediately:

Mr. Wilfredo Rivera Febus--RPO
Laureano Carus Gonzales--Assistant RPO
(809) 788-1065

Nuclear Regulatory Commission
Region II
Office of Inspection and Enforcement
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303
Phone (404) 221-4503

MANUALS

4.1 Manufacturer's Operation and Instruction Manuals

1. Gamma Century SA
2. Model C-10 Source Changer

GAMMA INDUSTRIES
GAMMA CENTURY S & SA

Your Gamma Century exposure device is the result of our best efforts in engineering, materials and workmanship. Nothing has been spared in our endeavor to make this unit the finest radiography device on the market.

Drawing #607-7001-001 at the back of this pamphlet is a cross-sectional view of the unit with source pigtail in position. You will note that the component parts are essentially the depleted uranium shield, the steel case, top and bottom plates and lock box assembly. In addition to the top and bottom plates used to support the shield, polyurethane foam is employed as support for the shield casting. With only a minimum of maintenance, your unit should give trouble free, safe operation for an indefinite period.

DESCRIPTION

The Gamma Century is a uranium-shielded industrial radiography device for the making of panoramic and similar exposures with iridium 192. The unit is distinguished by the following features.

CAPACITY

Maximum capacity is 100 curies of iridium 192.

REMOTE CONTROL

Positive mechanical control of the source is provided by a 25 foot control assembly and a 14 foot metal source tube assembly. No external power supply is required.

MOBILITY

The Gamma Century is compact, entirely self-contained and weighs only approximately 38 pounds.

SAFETY FEATURES

A safety plug assembly in the outlet nipple and a safety cap in the lock box assembly assure the security of the source when not in use.

The source cannot be exposed unless a secure connection between the source pigtail assembly and the control cable is made. This feature is provided only on the SA model.

The control cable cannot be disconnected after use unless the source is in the safe position in the shield. This feature is provided on the SA model only.

The source cannot be withdrawn from the shield through the lock box assembly even when the lock is open.

The Gamma Century S & SA meet all DOT regulations for shipping and all USNRC regulations for isotope radiography devices.

OPERATION

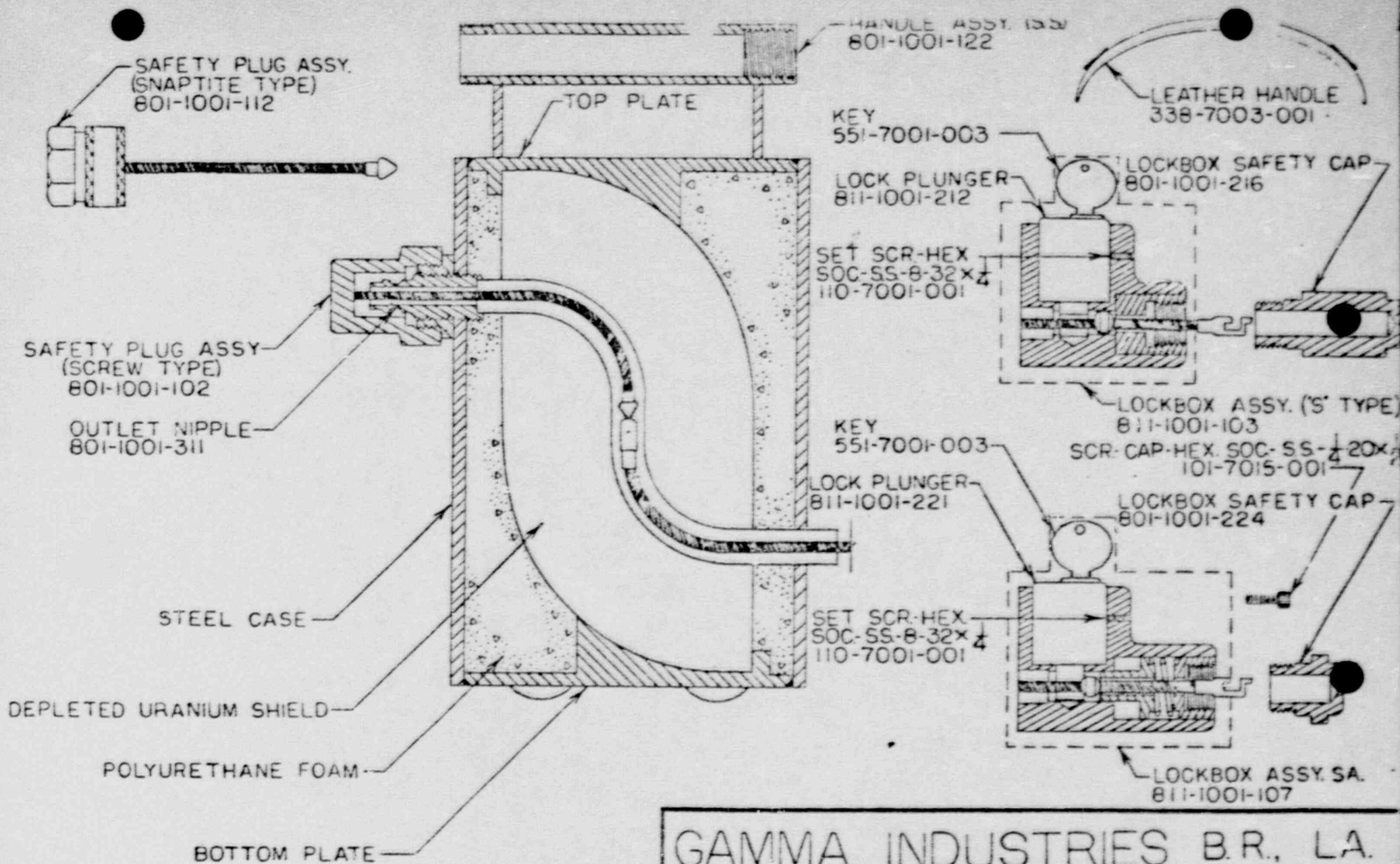
1. Have an operating survey meter on hand always and use it.
2. Remove the lock box safety cap from the lock box assembly thereby exposing the pigtail connector.
3. Crank the control cable to a length of approximately six inches.

OPERATION (CONTINUED)

4. Connect control cable to pigtail.
5. Crank control cable in so that male connecting thread can be screwed into lock box.
6. Screw connecting thread into lock box.
7. Remove safety plug from protruding nipple located approximately one inch from top of unit.
8. Connect source tube.
9. Place free end of source tube in desired position trying to keep it in a straight line without kinks.
10. Stretch control cable away from exposure device in as straight a line as possible.
11. Unlock the unit by turning the handle back (counter-clockwise) which will permit the key to be turned. This is required only on the SA model.
12. Crank source out as smoothly as possible. When you feel that source is approaching end of source tube, slow the turning speed so that pigtail does not strike the end of the source tube with undue force.
13. Survey to see that radiation levels are within limits.
14. At the end of the exposure, retract source into unit.
15. Now for the most important step of all:
Survey carefully to be sure that source has returned to safe position.

OPERATION (CONTINUED)

16. Turn crank back (counter-clockwise) and depress lock plunger. The SA models only require that the handle be pulled back.
17. Disconnect cable.
18. Screw safety cap into place.
19. Disconnect source tube.
20. Insert safety plug.



NOTE: PARTS WITH AJJOINING NUMBERS
 CAN BE PURCHASED FROM
 GAMMA INDUSTRIES

GAMMA INDUSTRIES B.R., LA.		
SCALE: NONE	APPROVED BY:	DRAWN BY KJR
DATE: 11-1-77		REVISED
CATALOG DWG. FOR CENTURY 'S', 'SA' & 35 'S', 'SA'		
		DRAWING NUMBER 607-7001-001

PERIODIC INSPECTION AND MAINTENANCE FOR
GAMMA CENTURY, GAMMA "35", SA MODELS, GAMMATRONS & UTILITY TWINS

Periodic inspection of exposure devices should be performed at intervals not to exceed 90 days or whenever operation of the device appears to be impaired through abuse or wear. However, it should be emphasized that this applies only to the device. DO NOTHING TO THE SOURCE. If the source appears worn or faulty in any way, contact Gamma Industries. In order to perform device inspection and maintenance, proceed as follows:

1.1 Remove safety cap in lock box and inspect source connector.

The holding pin should still have a true 90 degree elbow; it should be straight and parallel with axis of source connector and the key on apex of elbow should not be worn excessively. Check flexible cable at connector for straightness.

Maintenance: If the elbow is not bent out of line, the mating connector should then be connected to the source and tested by pulling straight back on cable applying about 30 to 40 pounds of pressure.

1.2 The lock plunger should be inspected and checked for ease of operation. Foreign matter may at times foul the plunger and make it inoperative. The lock plunger may not retract to its fullest extent which is 1/2 inch. This would prevent free travel of the source in and out of the lock box.

Maintenance: The lock plunger may be removed by removing the protector cap from the lock box thereby exposing the pigtail

connector and connect the controls to camera. To unlock the unit, turn the crank handle back (counter clockwise) which will permit the key to be turned so the plunger will pop up into the unlocked position. Then remove the two 8-32 set screws in the lock box which will allow the lock plunger to be removed from the lock box. This provides access to the spring loaded lock insert. Wash lock insert and lock plunger in solvent to remove dirt or other foreign matter. Lock plunger and spring loaded insert may also be cleaned and lubricated by spraying a lubricant (such as WD-40) into lock plunger and spring loaded lock insert.

- 1.3 Inspect the source outlet nipple by first removing safety plug. The outlet nipple should be round and smooth so that it will match the I. D. of the source tube.

Maintenance: If the outlet nipple should be out-of-round, it can sometimes be straightened by using a punch or round bar on the inside of the outlet. If it cannot be straightened or if the nipple has been broken by dropping the unit, it must be replaced. This replacement can be done in the field shop, or returned to Gamma Industries.

- 1.4 Inspect labeling on exposure device. The warning signs and source identification tags should be distinct and legible.
- 1.5 Inspect source tubes for damage such as crimps, foreign matter, ease of connecting, and disconnecting from exposure

device.

Maintenance: Crimps, kinks, and other damaged places may be cut out, and connectors placed on ends so that tube is not shortened excessively. The quick disconnect coupling that connects to outlet nipple of exposure device may be removed with heat and replaced. Foreign matter may be washed from tube with solvent and blown with compressed air.

- 1.6 Inspect source connector on drive cable. The hole should be 7/64 inch in diameter when new. This hole should show some wear after much use, but should not be out-of-round to the extent that it will disconnect from the mating piece other than in the correct position. It should not be loose on the drive cable. The portion of the connector with the connector hole should not be bent, but should be straight and parallel with body of connector.

Maintenance: This worn connector may be replaced by one of two methods.

1. Send back to Gamma Industries to have new connector replaced by swedging on new replacement.
2. Order new core with connector attached.

- 1.7 Inspect remainder of drive cable for wear, rusty sections, causing cable to become stiff and non-flexing, kinks, or other

damaging conditions that would prevent cable from running on gear in the gear box housing.

Maintenance: The drive cable should be cleaned with a solvent such as varsol, diesel fuel or some other solvent that will not dry out. This is done to remove sand, dust and other foreign matter that will cause abrasions in the exposure device and gear box drive mechanism. Drive cable that has become rusty and non-flexible should be replaced. Failure to replace cable may cause controls to become stiff, hard to operate, wear excessively, and possibly break. The cable would usually break when the source is exposed. Lubrication of the drive cable is important. In areas where there is a problem with sand or other abrasive material, dry powdered graphite is excellent. Graphite should not be packed continually since it will tend to pack in the gear box and cause excessive wear to the gear housing and to the gear. Where the control cables can be kept reasonably clean, a light oil will be adequate.

- 1.8 Inspect the control assembly. This assembly consists of the gear box assembly and the crank handle. The bronze bushings in the gear housing and the plate are the most likely places to find wear. When these bushings are worn

they tend to permit the gear to wobble and eventually wear out. Usually (due to some build-up on the drive cable or the gear teeth) there will be some wear around the inner circumference of the housing. This will permit the drive cable to slip on the gear and prevent source from moving properly through the exposure device.

Maintenance: It is suggested that if powdered graphite is used as a lubricant the gear box be cleaned with compressed air occasionally so as to remove any packed graphite in the gear mechanism. The application of some type light oil on bronze bushings will help prevent excessive wear.

- 1.9 Inspect drive cable housing or conduit. This conduit can be damaged by dropping it across a hot weld, severe kinking, or by dropping some object on the conduit. Any of these can prevent the drive cable from moving freely. The conduit at the end connections may become damaged from excessive flexing while being assembled or disassembled.

Maintenance: In any case where the inner liner has been damaged, the conduit must be replaced. When the outer covering has been damaged, waterproof tape should be wrapped around the break to prevent the entrance of water or other corrosive substances. If the extreme ends of the conduit

are damaged, they tend to permit the gear to wobble and eventually wear out.

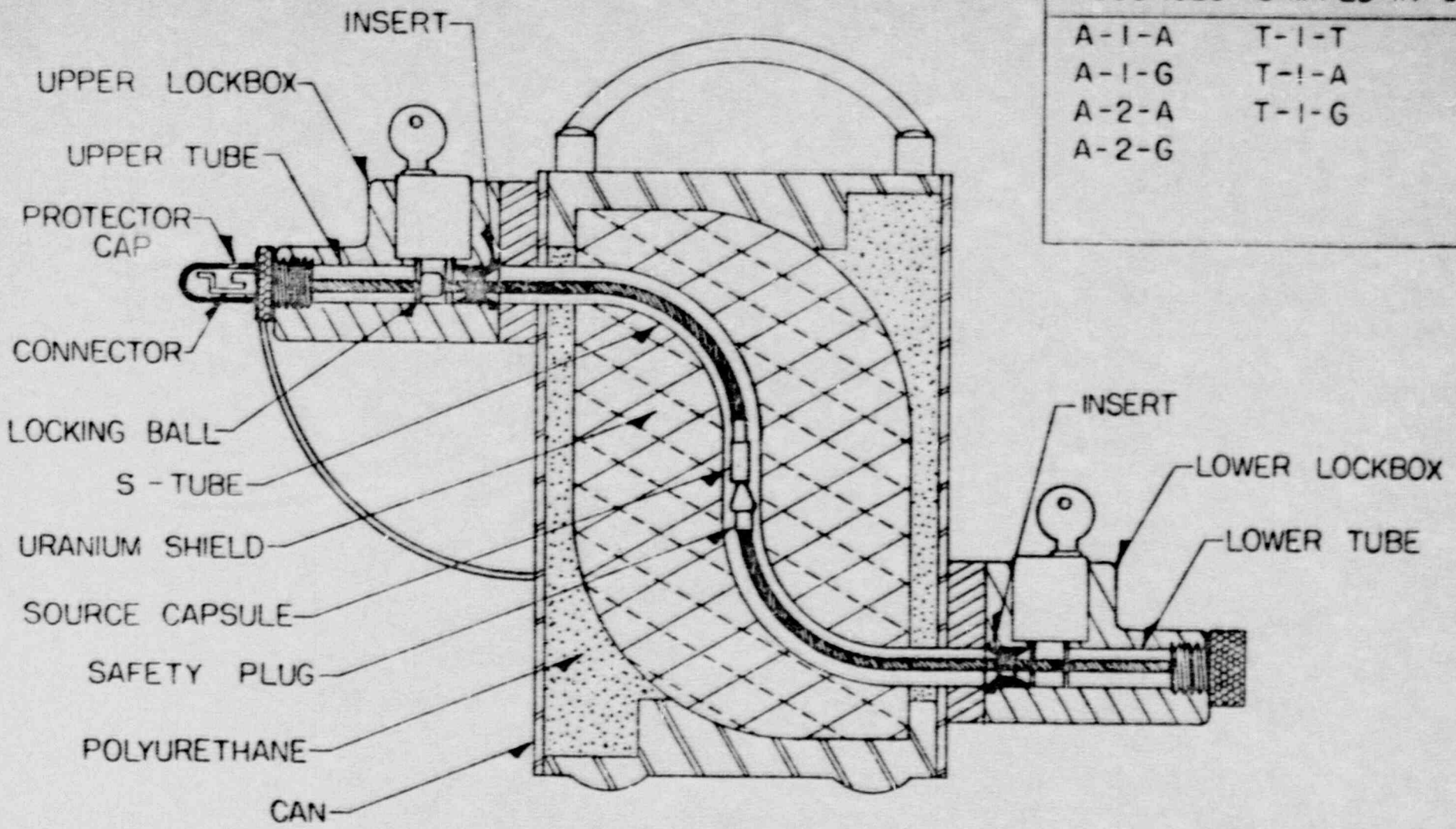
Source Changing Instructions for C-10 Shipping Container

Attached is a cross-sectional view of the shipping container used for transporting your pigtail source. The container has two lock boxes--one on each side. One lock box is labeled "New Source" and the lock box on the opposite side is empty and is to be used for the decayed source to be returned to Gamma Industries. The following procedure should be used in the source changing operation:

ALWAYS HAVE PROPERLY OPERATING SURVEY METER AT HAND WHEN CHANGING SOURCES!

1. Survey container with meter. Surface reading should not exceed 200 mR/hr.
2. Connect the short exchange tube provided to the empty lock box with the other end attached to your camera.
3. Unlock the lock box.
4. Connect your control cable to the pigtail.
5. Crank source from your camera into shipping container.
6. Survey.
7. Lock the lock box. Be certain to position ball on pigtail directly beneath lock plunger as indicated on attached cross-sectional view.
8. Disconnect source tube from shipping container.
9. Disconnect pigtail from the control cable.
10. Connect control cable to new pigtail.
11. Screw exchange tube into coupling of container.
12. Unlock new source side.
13. Standing as far away as possible, retract control cable which will pull source out of shipping container and into your camera.
14. Survey.
15. Lock camera and shipping container.
16. Disconnect control cable from pigtail.

17. Unscrew the exchange tube from your camera and from the shipping container.
18. Survey shipping container and do not ship if surface radiation levels exceed 200 mr/hr, or 10 mR/hr at three feet.
19. After the exchange has been completed, the radiographer shall prepare the decayed source for shipment to Gamma Industries. Records must be maintained by the radiographer showing receipt and transfer of the radioactive material.



SOURCES SHIPPED IN C-10	
A-1-A	T-1-T
A-1-G	T-1-A
A-2-A	T-1-G
A-2-G	

GAMMA INDUSTRIES, B. R., LA.

SCALE: NONE	APPROVED BY:	DRAWN BY WDL
DATE: 9-20-74		REVISED

C-10 SHIPPING CONTAINER

REVISIONS TO DRAWING NO. 323	DRAWING NUMBER 323-02
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TRAINING

5.1 Initial Training

Each radiographer trainee shall attend a one week course, given by Gamma Industries, specifically to fulfill the NRC's requirement for initial training.

In addition, radiographer trainees will receive eight hours instruction given by the Radiation Protection Officer on written Operation and Emergency Procedures. This will include a review of Federal Regulations and the following:

1. General Introduction
2. The handling and use of radiographic equipment
3. Methods and occasions for conducting surveys, including acceptable exposure levels
4. Methods for controlling access to restricted areas
5. Methods and occasions for locking and securing radiographic equipment
6. Personnel monitoring
7. Transportation requirements
8. Minimizing exposure in accidents
9. Notification procedures in accidents
10. Record keeping
11. Daily checklist

Following the period of initial training, a written examination will be given.

Following successful completion of the initial training and testing, candidate radiographers will undergo a minimum of eight hours of on-the-job training under the supervision of the Radiation Protection Officer. Oral examination and evaluation on safe handling of isotopes will be given.

5.2 Additional Training

The trainee will gain additional experience with specific radiographic equipment and radiation measurement instruments and record keeping necessary for the taking of radiographs using our written Operating and Emergency Procedures. A review of applicable Federal Regulations will be a part of the on-the-job training. This training will include an oral examination and a surprise "mock" emergency staged by the Radiation Protection Officer. The Radiation Protection Officer may require any extension of this job training period until he is satisfied that the trainee has adequate knowledge of Federal requirements,

5.2 (Continued)

specific radiographic equipment to be used, radiation detection devices to be used and has adequate skills to take radiographs to company specifications.

5.3 Training for Radiographers

During the three month period as a radiographer's assistant, persons who are to become radiographers will be given further training in the subjects outlined below:

1. Fundamentals of radiation safety
2. Radiation detection instruments to be used
3. Radiographic equipment to be used
4. The requirements of pertinent Federal Regulations
5. Written Operating and Emergency Procedures

The instruction on parts 1, 2, 3 and 4 above will be obtained in the course offered by Gamma Industries.

Instruction in part 5 above will be given by our Radiation Protection Officer. During this instruction, the relevant material from part 4 will be covered a second time.

Following the instruction in subjects 1 through 5, a written examination will be given in all five subjects. The candidate will be required to demonstrate, to the Radiation Protection Officer, competence in the use of radiographic equipment and survey instruments in a practical demonstration which will include all the steps in making radiographs following our written Operating and Emergency Procedures.

He shall be required to give a demonstration to the Radiation Protection Officer of his competence using the equipment, with a "dummy source" instead of a radioactive source.

5.4 Training for Experienced Radiographers and Assistants

Persons who are hired as experienced radiographers shall be given training in the company's written Operating and Emergency Procedures and on-the-job training in the use of the specific equipment.

5.4 (Continued)

They will then be given the same written tests as will be given newly trained radiographers. They will be required to demonstrate to the Radiation Protection Officer competence in the use of the company's specific radiographic equipment and survey equipment, following the company's written Operating and Emergency Procedure.

Experienced radiographer's assistants will be given the same training and testing as inexperienced assistants.

Periodic training will be given at six month intervals to radiographers and assistants. This course will review:

1. Federal Regulations
2. Written Operating and Emergency Procedure
3. Company policies
4. Specific radiographic equipment to be used
5. Radiation detection instruments to be used
6. Any changes in 1 through 5 above.

This training will be given by the Radiation Protection Officer. Alonso & Carus Iron Works, Inc. shall certify that all radiographers have satisfactorily fulfilled the requirements of this manual.

MANAGEMENT CONTROL

6.1 Management Control Procedures

The management control system should assure compliance with all applicable regulations through a system of management maintenance and review of records and procedures.

The Radiation Protection Officer shall be responsible for reviewing and verifying that all records are in good order and up-to-date, including utilization logs, personnel monitoring records, radiation surveys, and source receiving and transfer reports. He shall be responsible for semiannual leak tests, quarterly source inventory and annual dosimeter calibration. When the RPO does not personally perform the activity, he is responsible for seeing that outside service shall be performed as required.

The Radiation Protection Officer shall have the authority to stop any operation for reasons of safety and shall have the authority to remove a radiographer or assistant from a job for reasons of safety.

When a safety deficiency is observed, the deficiency shall be reported in writing to the Radiation Protection Officer, Wilfredo Rivera Febus.

The Radiation Protection Officer has the authority to issue purchase orders in a radiological or other safety related emergency.

The Radiation Protection Officer shall conduct periodic inspection (at least quarterly and usually unannounced) of radiographic operations to assure that license conditions, Federal rules and regulations, and company's written Operating and Emergency Procedures are followed.

The Radiation Protection Officer shall keep the source receipt, disposal logs and quarterly inventory records.

When deficiencies in performance are noted, either as a result of periodic inspection or as a result of other management inspections, a determination shall be made as to the cause. The results of the investigation shall be made in writing and shall be reported to the Radiation Protection Officer. A determination shall also be made by the Radiation Protection Officer as to the nature of the action required and the amount and type of additional training required.

Internal Inspection Form

I. General

- A. Name of Radiographer _____ Date Previously Inspected _____
- B. Name(s) of radiographer's assistant: _____
_____ Date Previously Inspected _____
_____ Date Previously Inspected _____
- C. Inspection performed at _____
(name of job site)
on _____ by _____
(date) (name of inspector)
- D. Announced inspection _____ Unannounced inspection _____

II. Inventory of Licensed Material

	<u>Isotope</u>	<u>Activity</u>	<u>Model No. of Source</u>	<u>Model No. of Camera</u>	<u>Serial No. of Camera</u>
A.					
B.					
C.					

III. Personnel Monitoring

- A. Film badges available and worn _____
- B. Dosimeters available and used _____
- C. Dosimeter charger available _____
- D. Dosimeters zeroed at beginning of work shift _____
- E. Dosimeter reading:
- | <u>Name</u> | <u>Current Dosimeter Reading</u> |
|-------------|----------------------------------|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

Internal Inspection Form (Continued)

IV. Instruction of Personnel

- A. Radiographer has copy of license _____
- B. Radiographer has copy of operating procedures _____
- C. Radiographer has copy of emergency procedures _____
- D. Notice to Employees, posted _____
- E. Radiographer has copy of regulations _____

V. Records

- A. Survey records adequate _____
- B. Dosimeter reports adequate _____
- C. Shielded position survey adequate _____
- D. Utilization log adequate _____
- E. Daily equipment inspection record adequate _____
- F. Inspector verified condition of equipment _____

VI. Storage and Use Precautions

- A. Device secured when left unattended _____
- B. Radiation levels determined outside storage area _____
- C. Survey made prior to storage _____
- D. Exposure device lock working properly _____
- E. Survey of device (and source tube) after each exposure _____
- F. Radiographer maintains surveillance over radiographer's operations _____
- G. Maximum radiation level at restricted area boundary _____
- H. Unrestricted area exposure rates comply with regulations _____ mR/hr
- I. Radiation area posted adequately _____
- J. High radiation area posted adequately _____
- K. Storage area posted adequately _____
- L. Transporting vehicle placarded properly _____
- M. Devices secured in vehicle _____

VII. Instruments

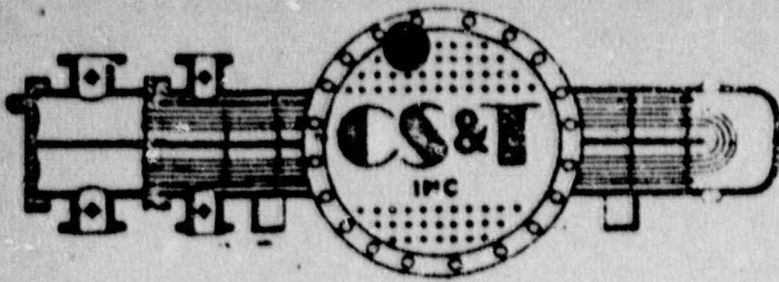
- A. Manufacturer of survey meter _____
- B. Model of survey meter _____
- C. Date of last survey meter calibration _____
- D. Date calibration due _____
- E. Survey meter working properly _____

DUTIES AND RESPONSIBILITIES

OF

RADIATION PROTECTION OFFICER

1. Serve as the licensee's liaison officer with the Nuclear Regulatory Commission on license matters.
2. Maintain control of procurement and disposal of licensed material.
3. Develop and maintain up-to-date operating and emergency procedures.
4. Establish and maintain a personnel monitoring system.
5. Procure and maintain radiation survey instruments.
6. Establish and conduct the training program for radiographers and radiographers' assistants.
7. Examine and determine competency of radiographic personnel.
8. Establish and maintain storage facilities.
9. Maintain exposure devices, radiography facilities, and associated equipment.
10. Establish and maintain the leak testing program.
11. Establish and maintain the internal inspection system.
12. Perform source replacement and source tagging operations.
13. Conduct quarterly inventories and maintain utilization logs.
14. Maintain survey instrument calibration program.
15. Establish and maintain the licensee's record keeping system.
16. Assume control and institute corrective action in emergency situations.
17. Investigate cause of incidents and determine necessary PREVENTIVE action.
18. Consult with management and radiography personnel.



CARIBE SHELL AND TUBE, INC.

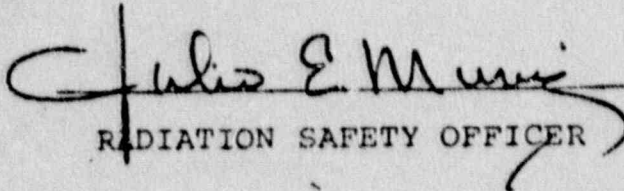
Telex: 154-112051INC
Telephones: 54-0510-1140
544-0140

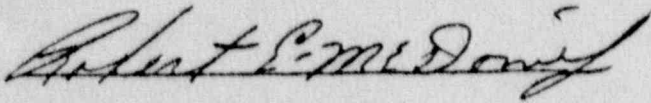
RADIOGRAPHER'S DESIGNATION

Wilfredo RIVERA has successfully completed the Radiation Safety Course and the Radiographer's Test. He is now authorized to perform the duties of Radiographer under this Company's By-Product Material License.

License No. 52-19438-1

Date: June 18, 1972


RADIATION SAFETY OFFICER


PRESIDENT

Mr. Wilfredo Rivera worked with Arnold Greene Testing Labs, using Ir-192 crank out sources from 1975 until March, 1980. He worked with Co-60 crank out sources for four months. Mr. Rivera worked with Ir-192 crank out sources while employed at Caribe Shell and Tube from June, 1982 until November, 1982.



ARNOLD GREENE TESTING LABORATORIES, OF PUERTO RICO, INC

NONDESTRUCTIVE MATERIALS TESTING LABORATORIES, INC. (AGTI)
INSPECTION EVALUATION SERVICE, INC.

11-7 QUISQUEYA AVENUE - HATO REY, PUERTO RICO 00917 - (R091) 750-6033, 750-8800 - TELEX 345-0034 (AGTL-PH)

May 15, 1980

TO WHOM IT MAY CONCERN:

This is to certify that Mr. Wilfredo Rivera Febus (SS: 583-66-4895) was employed by our firm since April 1975, and was continuously employed thereafter until March 11 1980 when we ceased all operations.

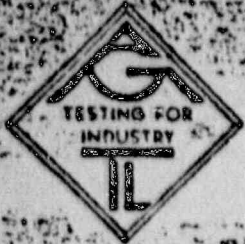
To this date Mr. Rivera held the following Qualifications in accordance with the A.S.N.T. requirements.

- Radiographic Testing - Level II
- Magnetic Particle - Level I
- Liquid Penetrant - Level I

CERTIFIED CORRECT:

David E. Cinton
President





ARNOLD GREENE TESTING LABORATORIES, OF PUERTO RICO, INC.

NONDESTRUCTIVE - MATERIALS - WELDING - PHYSICAL - CHEMICAL - POLLUTION - METALLURGICAL
INSPECTION - EVALUATION - ANALYSIS - SAMPLING

187 QUISQUEYA AVENUE - HATO REY, PUERTO RICO 00917 - (809) 766-0312, 766-2212 - TELEEX 3450034 (AGTL-PRI)

NONDESTRUCTIVE TESTING PERSONNEL QUALIFICATION RECORD

NAME: Wilfredo Rivera Febus Level of Certification: Trainee Level I

NDT. METHOD: Radiographic Testing Date of Certification: June 1975

EDUCATIONAL BACKGROUND AND EXPERIENCE:

- 1970 - 1973 -- High School
Francisco Oller - Cataño
- 1973 - 1975 -- Electronic Course
Vocational School
Tomas Jongay - Bayamon
- 1975 to present - Arnold Greene Testing Labs. of P.R., Inc.

NDT TRAINING:

Arnold Greene Testing Laboratories of P.R., Inc.

EXAMINATION DATA:

<u>Date of Exam.</u>	<u>General</u>	<u>Actual Grades</u>			<u>Final Grade</u>
		<u>Specific</u>	<u>Practical</u>		
June 1975	80%	80%	90%		83%

Final grade computed as follows:

Percentile weights assigned:

- General = 0.5
- Specific = 0.2
- Practical = 0.3

$$(General\ grade\ in\ \% \times 0.5) + (Specific\ grade\ in\ \% \times 0.2) + (Practical\ grade\ in\ \% \times 0.3) = Final\ grade$$

VISION TEST RESULTS:

Distance Vision = 20/20 Near Vision = O.K.

David Eric Cintron, P.E.
Chief Examiner

-7.5-



(2)

N. D. T. TRAINING RECORD

TECHNICIAN:

WILFREDO RIVERA FEBUS

DATE HIRED:

4/75

BIRTH DATE:

12/MARCH/55

PREVIOUS EXPERIENCE:

Magnetic Particle _____;

Penetrant F _____ D _____;

Eddy Current _____;

Ultrasonic _____;

X-Ray _____;

Gamma Ray _____;

Radiation Safety _____;

Other: _____

see file.

DATE	TYPE TRAINING	INSTRUCTOR	ELAPSED time	SUBJECT
6/17/77	Magnetic Part.	H. Greene	20 minutes	Review of Magnetic Particle dry pack
6/17/77	Penetrant	H. Greene	20 minutes	Review of Cleaning + penetrant technique
12/16/77	Rules & Reg. Rad. Safety	H. Greene	2 hrs	Review of Operating Emergency and Maintenance
4/6/78	Penetrant	F. Torres	8 hrs	Procedure in Radiation Recog incident of NLRB.
4/6/78	Radiation Safety	F. Torres	20 Min	Review of Post-Radiation Incident Techniques
12/78	Radiation	Mr. Greene	2 hrs	Review Safety problem of source heat
1/79	Radiation Training	D. E. Cintho	3 hrs	Review
7/79	Radiation Safety	D. E. Cintho	4 hrs	Review of Safety & Emergency Procedure
12/79	Rules & Regulation	D. E. Cintho	3 hr	Review of Operation Emergency & Safety
				Review of Regulation & Rule.

N. D. T. TRAINING RECORD

TECHNICIAN: Wilfredo Linares Flores DATE HIRED: April / 75 BIRTH DATE: 12. MARZ. / 55

PREVIOUS EXPERIENCE: Magnetic Particle _____; Penetrant F _____ D _____;
 Eddy Current _____; Ultrasonic _____; X-Ray _____;
 Gamma Ray _____; Radiation Safety _____;
 Other: High school - _____

DATE	TYPE TRAINING	INSTRUCTOR	ELAPSED time	SUBJECT
<u>April 1977</u> <u>Feb 1977</u>	<u>Radiography, Mag</u>	<u>D.E. CINTA</u>	<u>80 hrs</u>	<u>All subjects Level I & Level II</u>
	<u>Penetrant & Penetrant</u>	<u>D.E. CINTA</u>	<u>15 Hrs.</u> <u>20 Hrs.</u>	<u>TO ASNT requirements</u>
<u>April 1977</u> <u>Feb 1977</u>	<u>RADIATION THEORY</u>	<u>A. GARCIA - E. CINTA</u>	<u>72 Hrs</u>	<u>RADIATION Principle AEC Regs</u>
<u>3-3-77</u>	<u>Rules + Regs for Safety</u>	<u>A. Garcia</u>	<u>2 Hrs.</u>	<u>Review of Operating + Emergency Procedures</u>
<u>3-3-77</u>	<u>Magnetic Particle</u>	<u>A. Garcia</u>	<u>1 Hr.</u>	<u>Recap of accident at NLAB Nov. 1976</u>
<u>3-3-77</u>	<u>Dye Penetrant</u>	<u>A. Garcia</u>	<u>15 min</u>	<u>Use of Probe & Coil</u>
<u>3-3-77</u>	<u>Magnetic Particle</u>		<u>15 min</u>	<u>Application of penetrant + removal.</u>
<u>6-17-77</u>	<u>Radiation Safety</u>	<u>A. Garcia</u>	<u>1 Hour</u>	<u>Review of types indicators in Forging</u>
<u>6-17-77</u>	<u>Geometric - Radiation</u>	<u>A. Garcia</u>	<u>1 Hr.</u>	<u>Review of Amess of law as regards to max. (2 me/hr) safety lines -</u>
				<u>Geometric, Penetrant, Indicators</u>
				<u>Penetration - setup of machine & rules.</u>

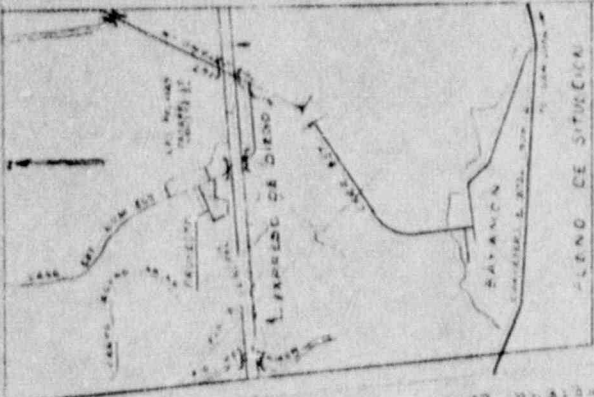
Mr. Laureano Carus Gonzales, the designated Assistant RPO, attended North Eastern University (1980-1981) majoring in mechanical engineering. He completed a one week radiography training course at Gamma Industries, Baton Rouge, Louisiana, Course #187, in February 1983.

PLANO DE MENSURA
DE UNA FINCA
PROPIEDAD DE ALONSO LARUS
BIENIO PLUMBE
CAYAMA, PUERTO RICO

NO 1 OFICINA	4510 SQ FT
NO 1 TOOL ROOM	4500 SQ FT
NO 4 TANKS	24100 SQ FT
NO 2 BSTR. LITRAS	86700 SQ FT
NO 4 TALLER REP	8200 SQ FT
NO 5 PLAS/STEEL	8750 SQ FT
NO 6 WAREHOUSE	1378 SQ FT
NO 7 PAINT WAREHOUSE	2400 SQ FT
NO 8 DIRECTOR	4000 SQ
OPRINA TALLER	3200 SQ
CON-EDOR	8700 SQ

-1788 SQ FT

JUNIO 27 1972



ESTACION DE
SERVICIO ESSO

GILLETTE
DE FR. INC.

CIRQUE
DISTRIB. TR. INC.

540'-0"

CALLE

410 EDIFICIO NO 2

CON-EDOR

50'-0"

PREDIO "A"

400 EDIFICIO NO 4

CON-EDOR

JUAN DELENOS

PREDIO "A"

NO	DESCRIPCION	AREA SQ. FT.	DIST. FT.	VALOR
1	CON-EDOR	8700	100	100.00
2	OPRINA TALLER	3200	100	32.00
3	CON-EDOR	8700	100	100.00
4	OPRINA TALLER	3200	100	32.00
5	CON-EDOR	8700	100	100.00
6	OPRINA TALLER	3200	100	32.00
7	CON-EDOR	8700	100	100.00
8	OPRINA TALLER	3200	100	32.00
9	CON-EDOR	8700	100	100.00
10	OPRINA TALLER	3200	100	32.00
11	CON-EDOR	8700	100	100.00
12	OPRINA TALLER	3200	100	32.00
13	CON-EDOR	8700	100	100.00
14	OPRINA TALLER	3200	100	32.00
15	CON-EDOR	8700	100	100.00
16	OPRINA TALLER	3200	100	32.00
17	CON-EDOR	8700	100	100.00
18	OPRINA TALLER	3200	100	32.00
19	CON-EDOR	8700	100	100.00
20	OPRINA TALLER	3200	100	32.00
21	CON-EDOR	8700	100	100.00
22	OPRINA TALLER	3200	100	32.00
23	CON-EDOR	8700	100	100.00
24	OPRINA TALLER	3200	100	32.00
25	CON-EDOR	8700	100	100.00
26	OPRINA TALLER	3200	100	32.00
27	CON-EDOR	8700	100	100.00
28	OPRINA TALLER	3200	100	32.00
29	CON-EDOR	8700	100	100.00
30	OPRINA TALLER	3200	100	32.00

AREA TOTAL DE 100 AC. 00.00

CALLE INDUSTRIAL

FINCA INDUSTRIAL



ALONSO & CARUS IRON WORKS INC.
 P.O. BOX 566, CATANO, PUERTO RICO 00632, PHONE (809) 788-1065

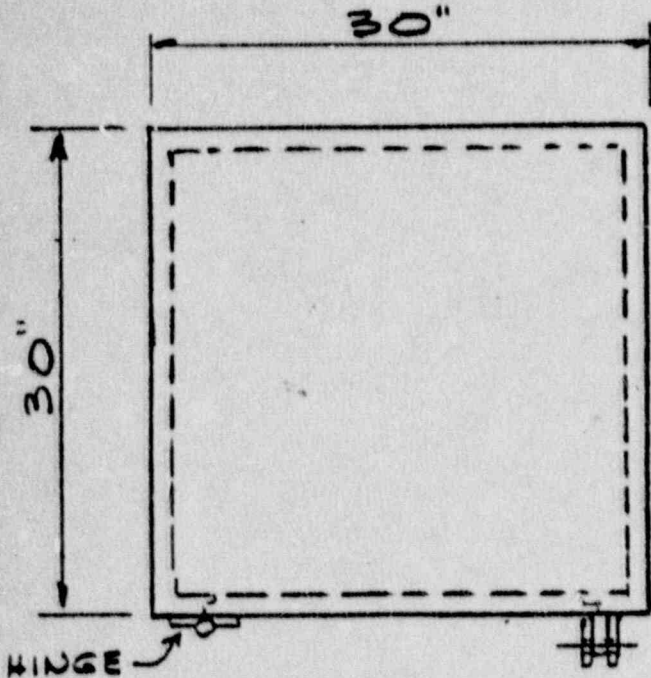
JOB. NO.

CLIENT ALONSO & CARUS
 SUBJECT NUCLEAR DEVICES STORAGE VAULT

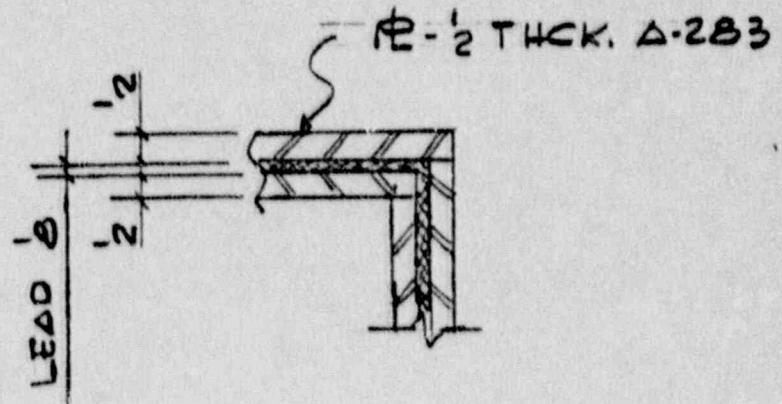
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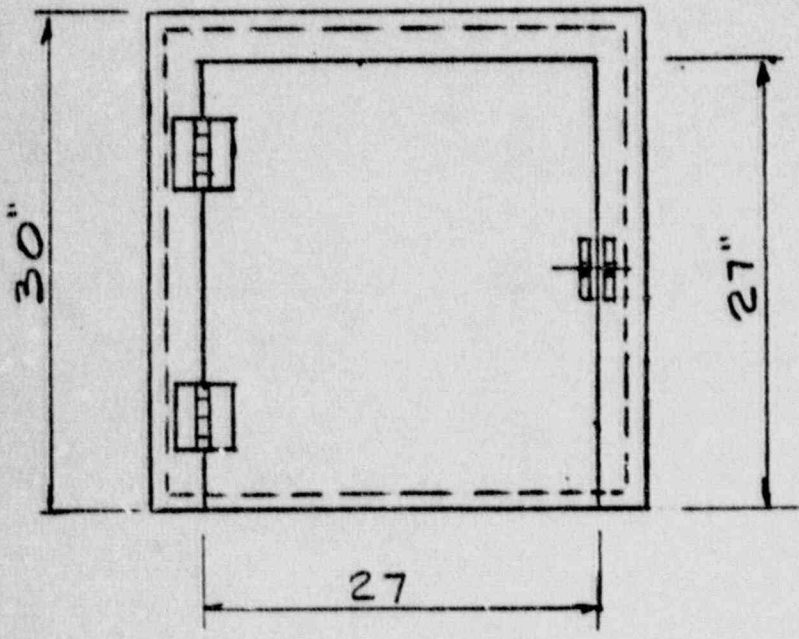
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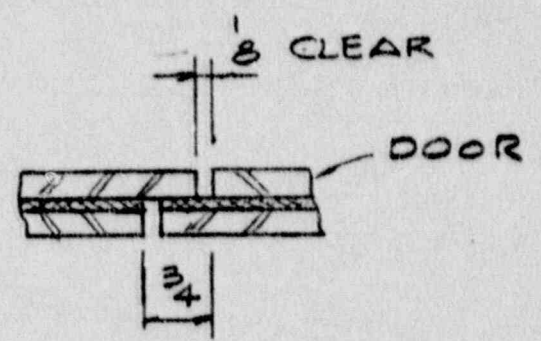
PLAN



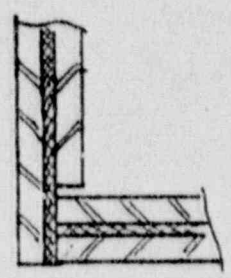
TYP. WALL DET.



ELEVATION

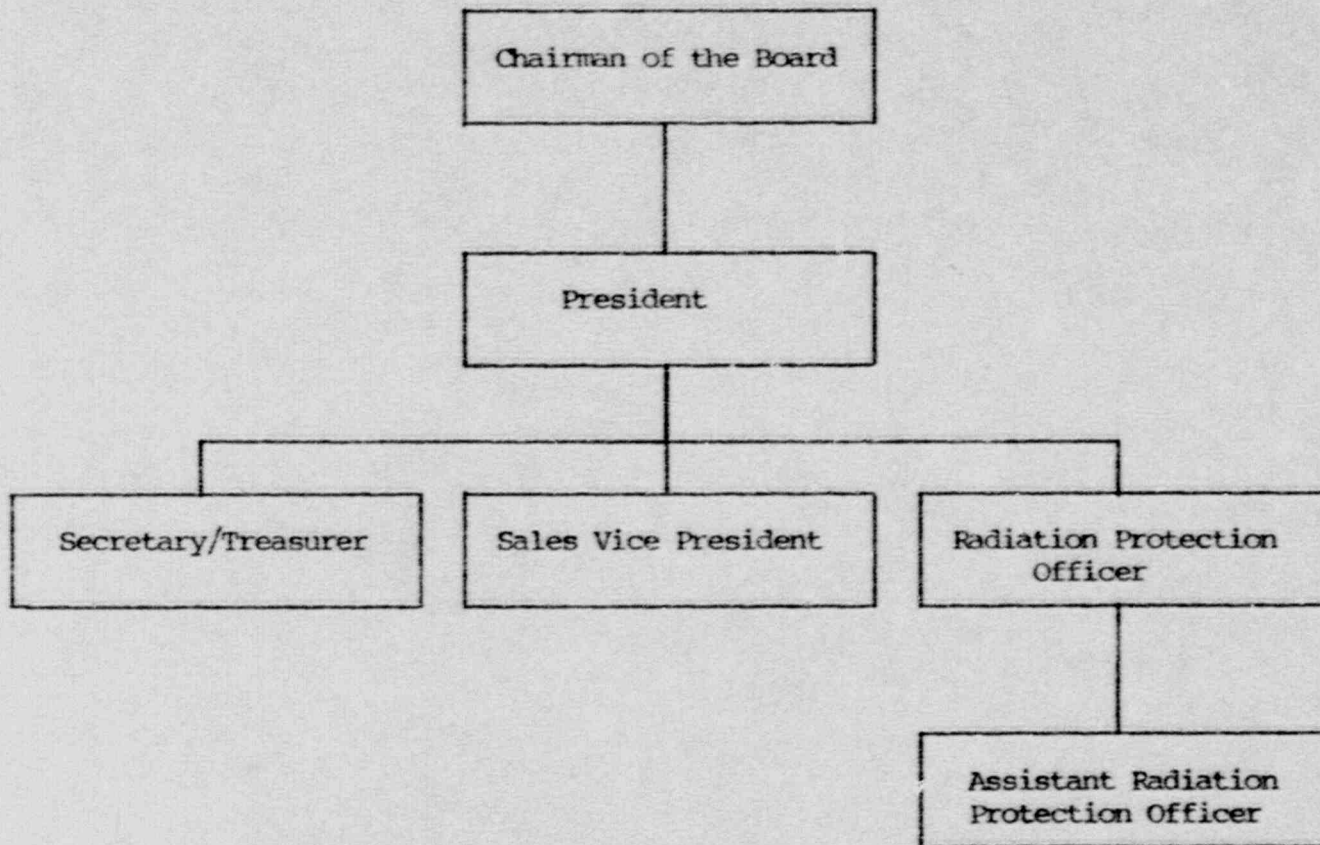


TYP. DOOR DET.
TOP & SIDES



BOTT. DOOR DET.

ORGANIZATIONAL STRUCTURE



8.2 (Continued)

III. RADIOGRAPHIC EQUIPMENT

1. $I. = 10 \times 14.4 = 144 \text{ R/hr.}$
 $d. = 1 \text{ ft.}$
 $d = 10 \text{ ft.}$

$$1/144 = (1/10)^2$$
$$I. = 144 \times (1/10)^2 = 144 \times 1/100 = 1.44 \text{ R/hr.}$$
$$1,440 \text{ mR/hr.}$$

In 8 hours, the men would receive $8 \times 1,440 \text{ mR/hr}$
 $= 11,520 \text{ mR/hr.}$

2. 10 HVL
3. True
4. False
5. True
6. The radiographer must inspect the exposure device and complete an inspection list each time the equipment is used.
7. A quarterly inspection of all inspection devices will be performed by the R.P.O. All required maintenance at the time will be performed by the R.P.O. with assistance from a radiographer if required.
8. To ensure that the source is in shielded (safe) position.
9. All shipping plugs and locking devices will be checked to make sure that the source is in the safe position.
10. End of the short leader cable.

IV. FEDERAL REGULATIONS

1. When radiographic operations are conducted in the field, a radiographer must be physically present at the site of the operation and provide direct, personal supervision at all times. True _____ False _____
2. The radiographer's assistant can take a radiographic device to a remote site without the radiographer's supervision, provided he has the radiographer's authorization. True _____ False _____
3. Provided a sealed source is new, the first leak test can be done six months after it is put into use, even if untested by the manufacturer. True _____ False _____
4. During radiographic operations, the sealed source assembly shall be secured in the shielded position each time the source is returned to that position. True _____ False _____
5. Daily doismeter readings need not be recorded for all personnel when no radiography has been done. True _____ False _____
6. A radiographer need not determine that a sealed source has been returned to its shielded position after each use. A survey at the end of the working day will suffice. True _____ False _____
7. Each radiographic exposure device shall be provided with a lock or outer locked container, . . . and shall be locked at all times except when under the direct surveillance of a _____

8. Locked radiographic exposure devices and storage containers shall be physically secured to prevent tampering or removal by _____

8.2 (Continued)

9. Each survey instrument shall be calibrated at intervals not to exceed _____ months.
10. Each sealed source must be tested for leakage at intervals not to exceed _____.

8.2 (Continued)

IV. FEDERAL REGULATIONS

1. True
2. False
3. False
4. True
5. False
6. False
7. Radiographer; Assistant Radioographer
8. Unauthorized individuals
9. Three months
10. Six months

V. WRITTEN OPERATING AND EMERGENCY PROCEDURE

Specific Procedure:

1. We do not always have to carry radiation warning signs on our truck since many of our clients have them for our use.
True _____ False _____
2. Batteries may be changed in the field without recalibration of the survey meter.
True _____ False _____
3. The proper way to handle a source disconnect is:

4. The radiographer's assistant may maintain surveillance over a restricted area and reel if the radiographer is not present.
True _____ False _____
5. The radiographer's assistant may carry in the source from a remote site without the direct supervision of the radiographer.
True _____ False _____
6. The utilization log remains in the office so that the President of the company knows where the source is. True _____ False _____
7. If a dosimeter goes off scale, it must be immediately recharged so that as much as is possible of the day's exposure can be recorded.
True _____ False _____
8. Even when the perimeter of the restricted area is posted, the radiographer or his assistant must maintain direct surveillance of the area. True _____ False _____

8.2 (Continued)

9. When is a dosimeter supposed to be zeroed?

10. Describe the signs to be used on vehicles hauling radiography sources on public roads when yellow III labels must be used. _____

8.2 (Continued)

V. WRITTEN OPERATING AND EMERGENCY PROCEDURE

Specific Procedure:

1. False
2. True
3. Do not panic, do not try to rescue the source. Establish and post a restricted area, prohibit entrance to this area, notify protection officer.
4. True
5. False
6. False
7. False
8. True
9. Daily or at the beginning of shift.
10. "Radioactive" signs meeting the requirements of the Department of Transportation shall be in evidence on all four sides of the vehicle.

8.2 (Continued)

9. What is the function of a Safety Plug?

10. The source capsule is connected to the _____

COMPETENCY EXAMINATION AND EVALUATION

8.1 General Testing Procedures

- 8.1.1 Following the initial stage of radiographer training, a 60 question written examination shall be given. The examination is divided into five parts:

<u>QUESTIONS</u>	<u>SUBJECT</u>
20	Fundamentals of radiation safety
10	Radiation detection instruments
10	Radiographic equipment
10	Federal regulations
10	Alonso & Carus Iron Works, Inc. written Operating & Emergency Procedure

- 8.1.2 A passing grade will constitute 80% correct answers on each section. If a section or sections are not passed, the trainee may retake those sections in one week, following a period of review. If a section is failed a second time, additional training will be given before the test can be retaken.
- 8.1.3 A sample test and answers follow (pages 8.2-8.18). At least 25% of the questions will be changed each time the test is administered.
- 8.1.4 A formal oral examination shall be given and on-the-job examination procedure shall include questions by the examiner to aid in determining competency in all areas of operation. Performance shall be checked by the examiner in all areas of the written Operating and Emergency Procedure, including specific adherence to the procedure, ability to properly define and post radiation and high radiation areas, use of radiographic equipment, surveying instruments and personnel monitoring devices, proper transportation of sources and the trainee response to a "mock emergency" such as a source disconnect. A written evaluation of the trainee performance will be made at this stage.
- 8.1.5 The tests given to radiographers and assistant trainees and their results, as well as records of oral and practical examinations and the Radiation Protection Officer's evaluation of trainees, will be maintained by Alonso & Carus Iron Works, Inc.

8.2 Sample Test

I. FUNDAMENTALS OF RADIATION SAFETY

1. The following quarterly exposures are permissible under the regulations of the U.S.N.R.C.: whole body; head and trunk; active blood forming organs; lens of eyes; or gonads--
_____ rem.
2. The dose to the whole body, when added to the accumulated occupational dose to the whole body shall not exceed _____ rems where "N" equals the individual's age in years at his last birthday.
3. An individual within a restricted area who is under 18 years of age shall not be exposed to radiation in excess of _____ percent of the limits specified in Part 20.
4. Ordinarily, radiation levels in unrestricted areas must not exceed _____ millirem in any one hour or _____ millirem in any seven consecutive days, assuming an individual were _____ present in the area.
5. High radiation area posting is required in areas where a major portion of the body would receive, in any one hour, a dose in excess of _____ millirem.
6. Define "radiographic exposure device."

7. Personnel monitoring is required for each individual who enters a high radiation area. True _____ False _____
8. An area in which a major portion of the bodies of employees could be exposed to 4 mR/hr, 8 hours/day, 4 days/week must be posted as a "Radiation Area." True _____ False _____

8.2 (Continued)

9. In general, containers of radioactive materials must bear labels bearing the radiation caution symbol and the words "Caution--Radioactive Material." An exception to the general rule applies to licensed materials in quantities less than certain specified limits.
True _____ False _____
10. We are required to report immediately, by telephone and telegraph, thefts or losses of licensed material, provided it appears to us as a substantial hazard which may result to persons in unrestricted areas.
True _____ False _____
11. Men are working in an area which is 20 feet from a source of Cs 137. The radiation intensity is 8192 mR/hr without any shielding. How many half-value layers will be required to reduce the dosage level to 8 mR/hr?
12. If a person is in a 400 mR/hr field, how many minutes may he remain if he is to accumulate 100 mrem? _____
13. Define:
Curie _____

14. Define:
Dose _____

15. Define:
Half Life _____

16. Define:
Half Value Layer _____

8.2 (Continued)

17. Define:
Occupational Dose _____

18. High Radiation Area _____

19. An Ir 192 source irradiates 50 mR at 50 feet.
What is the dosage rate at 20 feet? _____

20. At a distance of three feet in air from a
source of Cobalt 60, the radiation level is
200 mR/hr. What is the source strength,
assuming no scatter? _____

8.2 (Continued)

1. FUNDAMENTALS OF RADIATION SAFETY

1. 1-1/4 per calendar quarter.
2. 5 (N-18)
3. 10
4. 2; 100; Continuously
5. 100
6. Any instrument containing a sealed source fastened or contained therein, in which the sealed source thereof may be moved, or otherwise changed, from a shielded to an unshielded position for purposes of making a radiographic exposure.
7. True
8. True
9. True
10. True
11. Approximately 9-1/2 HVL of lead.
12. 15 minutes
13. A curie is that quantity of radioactive material which undergoes 37 billion disintegrations per second
(3.7×10^{10} DPS)
14. The quantity of radiation absorbed per unit of mass by the body or any portion of the body.
15. The period of time required by a radioactive material to lose half of its original radioactivity.
16. The thickness of material required to reduce the intensity of the radiation by one-half.
17. Exposure of an individual to radiation.
18. Any area accessible to personnel in which there exists radiation originating in whole or in part within licensed material at such levels that a major portion of the body could receive in any one hour a dose in excess of 100 millirem.

8.2 (Continued)

19. 312.5 mR/hr.

20. 124 mc

8.2 (Continued)

II. RADIATION DETECTION INSTRUMENTATION

1. Define:
Survey _____

2. Define:
Dosimeter _____

3. Define:
Film Badge _____

4. Define:
Geiger Counter _____

5. Define:
Personnel Monitoring _____

6. Define:
Survey Meter _____

7. When should a survey meter be used? _____

8. What are the characteristics of a survey meter
that should be selected for use in radiography
operations? _____

8.2 (Continued)

9. What devices are required to be used for personnel monitoring? _____

10. What distance from a 10 ci source of Co 60 would a survey meter measure 20 mR/hr? _____

II. RADIATION DETECTION INSTRUMENTATION

1. An evaluation of the radiation hazards incident to the production, use, release, and disposal of radiation under a specific set of controls.
2. A device designed to be worn or carried by an individual for the purpose of measuring the dose received.
3. A package of photographic film worn like a badge by workers to measure exposure to ionizing radiation.
4. Radiation detection and measuring device. It contains a gas filled tube which discharges electrically when ionizing radiation passes through it.
5. Devices to be worn or carried by an individual for the purpose of measuring the dose received.
6. A portable instrument which measures dose rate of exposure or radiation intensity.
7. At all times when performing surveys and radiographic operations.
8. Ruggedness, fast response to radiation, and it must measure accurately 1 R per hour.
9. Dosimeters, film badges, survey meters or TLD.
10. D = 7,200 or approximately 85.1 feet.

8.2 (Continued)

III. RADIOACTIVE EQUIPMENT

1. A 10 curie source of Co 60 is to be used at 10 feet from a group of workmen. What dose rate will they receive? What dose would they receive in 8 hours?

NOTE: The dose rate for Co 60 is 14.4 R/hr/ci at 1 foot.

2. A 10 curie source of Co 60 is to be used at 10 feet from a group of workmen. How much lead shielding would be needed to reduce the dose rate to less than 2 mR per hour?
3. The pigtail connector may be taken out, cleaned and examined. True _____ False _____
4. The source capsule is contained in a shield which reduces the exposure to a maximum of 500 mR/hr at surface.
True _____ False _____
5. The source tube should be checked daily for bends, worn ends or anything else that may affect its use while in operation.
True _____ False _____
6. How often does the radiographer have to check the camera and equipment? _____

7. How often is the R.P.O. required to check the camera and equipment for maintenance?

8. Why should a radiographer survey his equipment after every exposure? _____
