

Form NRC-313R  
(7-77)  
10 CFR 34

U.S. NUCLEAR REGULATORY COMMISSION  
APPLICATION FOR BYPRODUCT MATERIAL LICENSE—  
USE OF SEALED SOURCES IN RADIOGRAPHY

Approved by GAO  
B-180255(R0335)

(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 TO STATE, DEFICIENT OR INCOMPLETE APPLICATIONS MAY BE RETURNED WITHOUT CONSIDERATION. LICENSE FEE REQUIRED, SEE ITEM 7 OF INSTRUCTIONS.

30-19856

1(a) NAME AND ADDRESS OF APPLICANT AND TELEPHONE NUMBER OKLAHOMA STEEL CASTINGS COMPANY 1200 N. PEORIA TULSA, OK 74106	2. THIS IS AN APPLICATION FOR: (Check appropriate item) A. <input checked="" type="checkbox"/> NEW LICENSE LAL 21159 B. <input type="checkbox"/> AMENDMENT TO LICENSE NO. 13310 C. <input type="checkbox"/> RENEWAL OF LICENSE NO.
1(b) TELEPHONE NO.: Area Code (918) 585-9285	
1(c) APPLICANT IS: An individual <input type="checkbox"/> A partnership <input type="checkbox"/> A Corporation <input checked="" type="checkbox"/> An Unincorporated Association <input type="checkbox"/> Other <input type="checkbox"/> 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.) EXPOSURE VAULT LOCATED IN THE PREMISES OF OKLAHOMA STEEL CASTING COMPANY

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. Co60	A. A-453-1	A. TECH/OPS	A. 100 Curies	A. 2
B. Ir 192	B. 200-520-009	B. AUTOMATION-	B. 100 Curies	B. 2
C.	C. or-010	C. INDUSTRIES	C.	C.

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

MODEL NUMBER	NAME OF MANUFACTURER (Include description if custom made)
A. Model 500	A. TECH/OPS
B. Model 520	B. AUTOMATION INDUSTRIES
C.	C.

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

MODEL NUMBER	NAME OF MANUFACTURER (Include description if custom made)
A. SOURCE CHARGER #T/O 771	A. TECH/OPS
B. SOURCE CHARGER AUTOMATION	B. AUTOMATION INDUSTRIES
C. INDUSTRIES 500-SU or 43866	C.

RECEIVED BY LFMB

Date 9/3/82

Log AUG PG 3 D.L.

By. Brown

Orig. To.

Action Compl. 9/3/82

6. THE FOLLOWING INFORMATION IS ATTACHED AS A 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"/>
(b) Description of radiation detection instruments to be used (Instruction 6-b)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(c) Instrument calibration procedures (Instruction 6-c)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(d) Personnel monitoring equipment (Instruction 6-d)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(e) Operating and emergency procedures (Instruction 6-e)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(f) Training program (Instruction 6-f)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(g) Internal inspection system or other management control (Instruction 6-g)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(h) Overall organizational structure (Instruction 6-h)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
(i) Leak testing procedures (Instruction 6-i)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Applicant.	14053
Check No.	8190/82
Amount Fee	Application
Type of Fee	9/3/82
Date Check	9/3/82
Received by	Brown

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 \$ 190.00

8512050387 851031  
REG4 LIC30  
35-21159-01 PDR

BY: *L.C. Englebaugh*  
(Signature)

L.C. ENGLEBAUGH

(Type or print name of certifying official)

12398

GENERAL MANAGER & VICE-PRESIDENT

(Title of certifying official)

DATE 8/25/82

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.

## 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 OKLAHOMA STEEL CASTINGS CO., AN OKLAHOMA CORPORATION

NO. OF SHARES AUTHORIZED	NO. OF SHARES ISSUED	NO. OF SHARES SUBSCRIBED	TOTAL NUMBER OF:	
25,000 shares common \$1 par value	500	None	(a) Stockholders One	(b) Subscribers None

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.

AMERICAN FOUNDRY GROUP INC., 14602 S. GRANT STREET, BIXBY, OK 74008

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. Same as above

(b) Identify by name and address all officers and directors of the corporation. MADAN P. MAKHANI, PRES. & DIR.; LAURENCE M. NEFF, V-PRES. & DIR.; LESLIE A. O'BRIEN, DIR. & SEC.; JERRY MCGOULDRIK, DIR.; ROBERT BELL, DIR. & TREAS.; EVERETT FORREST, DIR.; JORGE PRATS, DIR.; L.C. ENGLEBAUGH, V-PRES. & DIR. ADDRESS SAME AS ABOVE EXCEPT FOR LC ENGLEBAUGH: 1200 NORTH PEORIA, TULSA, OK 47106

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

OKLAHOMA

## 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.

6A

## DESCRIPTION OF RADIOGRAPHIC FACILITY

The radiographic exposure vault which has been constructed at Oklahoma Steel Castings Company, 1200 North Peoria, Tulsa, Oklahoma, is shown on the attached drawing. The vault is constructed of walls eleven feet high and containing 48 inches of poured concrete which was calculated to reduce the radiation from a 100 curie cobalt 60 source to a 0.5 mr per hour against the outside walls. The walls of the vault are supported by 13 concrete pillars, 30 inches in diameter, which are sunk in the ground to solid blue shale. The floor of the vault is approximately 10 inches of poured concrete. The roof of the building is plywood. The vault is restricted to the use of 100 curies of Co 60 and 100 curies of Ir 192 because of the limitations of the source storage containers. The outer walls and entrance way of the vault contain signs saying "CAUTION - RADIATION AREA" and each wall is furnished with a rotating red beacon which signals when the radiation level at the gamma alarm exceeds 2 mr per hour. The entrance door to the facility is locked at all times when radiation at the gamma alarm exceeds 2 mr per hour. Breaking of the interlock circuit by opening the door during exposure will result in the sounding of an audible horn. The inner entrance beyond the gate has a sign saying "CAUTION - HIGH RADIATION AREA." Both the exposure devices and the entrance doorway will be locked at all times when the source is not in operation and the radiographer is not present. The roof, which can only be reached by placing an extension ladder against the vault wall, is estimated at 200 mr per hour above the source, when it is exposed. The walls of the vault are posted with signs reading no admittance to roof without approval from Nuclear Supervisor and the roof itself has 4 signs directed at each wall saying "CAUTION - HIGH RADIATION AREA." The entire section of property containing the vault is fenced in and entrance admitted only through a guarded doorway. The back of the vault is 17 feet from the fence line and the other side is a railroad track. The right side of the vault is adjacent to a corrugated metal building, inside of which are employees. The entire area is thoroughly monitored when the source was first installed to insure a maximum of 2 mr per hour of exposure in unrestricted areas within the adjacent building, or a maximum of 100 mr exposure for any person in seven consecutive days. The entrance way of the vault is approximately 50 feet from the back corner of a storage area which is a red brick building. There are no structures above or below the vault.

Exposure device to be used with the 100 curie Co 60 will be TECH-OP model 500 gamma ray projector. The devices to be used to store the 100 curie Ir 192 source will be Automation Industries Model 520 projector. In addition, the Co source will use TECH-OP Model 527 gamma ray collimator unit when deemed necessary by the radiographer.

ALL RADIATION SHIELDING WALLS ARE 48" THICK

CONCRETE - 11' HIGH



0.5 MR. HR. CALCULATED  
WITH UNWEIGHED SOURCE  
ADJACENT TO VARI WALL

STUDY: RADIATION: AREA:

SOURCE CONTROL: STATION CONTROL (0.5 MR/HR)

SLUING ACCESS DOORS INTERLOCKED TO PREVENT ENTRY WHEN GAMMA RADIATION MONITOR PRE-DETERMINED LEVEL. DOOR CAN BE OPENED FROM INSIDE AT ALL TIMES.

① DENOTES SIGNS WHICH STATE:  
NO ADMISSIONS ON ROOF WITHOUT  
APPROVAL OF NUCLEAR SUPERVISOR.

Two gamma survey meters which comply with Part 34, Section 34.24 will be used. These meters will be either:

1. Victorene Model 492
2. Eberline Model 130 G

The Victorene Model 492 has ranges of 0-10, 0-100, 0-1000 mr/h in three linear ranges. The detector is a halogen-quenched GM tube.

The use of these survey meters is outlined in the Operating and Emergency Procedures.

Survey instruments will be calibrated in accordance with CFR 34, Section 34.24 every 3 months. Documentation of these calibrations will be maintained. The calibration will be performed by Xmas Inc., a unit of Magnaflux, located in Tulsa, Oklahoma.

The procedure used for the calibration of the survey meters is included.

## PERSONNEL MONITORING EQUIPMENT

Film badges and pocket dosimeters will be worn by each radiographer and assistant radiographer. Daily records will be maintained under provisions of Part 20, Section 20.202 and Part 34, Section 34.33. Pocket dosimeters will be supplied by either:

1. Victorene Instrument Company  
Model 2000 A Charger and 541-A Direct  
Reading Dosimeter
2. Dosimeter Corp of America  
Cincinnati, Ohio  
Model 906 Charger and 862 Dosimeter

Pocket dosimeters will be calibrated on an annual basis in accordance with Part 34, Section 34.33. Capital X-Ray Service of Tulsa, Oklahoma will perform the calibration in accordance with the enclosed procedure.

Film badges will be supplied to each individual on a monthly basis by either:

1. ICN Pharmaceuticals, Inc.  
Cleveland, Ohio
2. Guard Ray Film Badge Service from  
R.S. Landour, Jr. and Co., Glenwood, Illinois



X Ray Manufacturing and Supply • 8186 East 44th Street • Tulsa, Oklahoma 74145 • 918-663-4555

### XMAS SURVEY INSTRUMENT

#### CALIBRATION PROCEDURES

- (A) Survey instruments are calibrated by qualified XMAS personnel using two (2) calibration devices manufactured by the EON Corporation containing not more than .1 curies of CS137.
- (B) Each range of the instrument is checked twice, once near the low end of the scale and once near the high end. The instrument is adjusted until the indicated radiation level is within 10% of the actual radiation intensity.
- (C) An instrument calibrations certificate is issued with each unit calibrated. The certificate contains the following information.
  - 1. Customer's name and address.
  - 2. Model and Serial No. of survey instrument.
  - 3. Calibration date and previous calibration date.
  - 4. Instrument range, actual intensity of field and actual meter reading.
  - 5. Signature of technician performing calibration.
  - 6. Date next calibration due.  
(See attached calibration certificate)
- (D) The original calibration certificate is for the customer's records, one copy is placed inside the survey instrument and one copy is placed in XMAS files.
- (E) A stick-on label is placed on the outside of the instrument case showing the model and serial number of the unit, the calibration void date and by whom calibrated. (See attached)



# CALIBRATION CHECK

MODEL \_\_\_\_\_

SERIAL NO. \_\_\_\_\_

VOID DATE \_\_\_\_\_

CHECKED BY \_\_\_\_\_

8186 East 44th Street • Tulsa, Oklahoma 74145



X Ray Manufacturing and Supply  
8186 East 44th Street • Tulsa, Oklahoma 74145

# INSTRUMENT CALIBRATIONS CERTIFICATE

CUSTOMER \_\_\_\_\_

ADDRESS \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

MODEL 492 SERIAL NO. \_\_\_\_\_

CALIBRATION DATE \_\_\_\_\_ PREVIOUS CALIBRATION DATE \_\_\_\_\_

	INSTRUMENT RANGE	DISTANCE	ISOTOPE INTENSITY	METER RESPONSE
I	0-10 MR/H	123 INCHES	3 MR/H	_____MR/H
		75.3 INCHES	8 MR/H	_____MR/H
II	0-100 MR/H	38.8 INCHES	30 MR/H	_____MR/H
		23.8 INCHES	80 MR/H	_____MR/H
III	0-1000 MR/H	12.3 INCHES	300 MR/H	_____MR/H
		8.7 INCHES	600 MR/H	_____MR/H

NOTES: \_\_\_\_\_  
\_\_\_\_\_

This instrument was calibrated, using 90 millicuries Cs 137, in accordance with N R C Rules and Regulations.

Calibrated by \_\_\_\_\_

Next Calibration Date \_\_\_\_\_

OKLAHOMA STEEL CASTINGS COMPANY

PROCEDURE NAME: CALIBRATION OF DOSIMETERS BY: JIM HAMILTON

PROCEDURE NUMBER: OS-CD

REVISION NUMBER: 0

DATE: 12/1/80

1. SCOPE:

This procedure covers the Calibration of Dosimeters used by radiographers at Oklahoma Steel Castings Company.

2. PURPOSE:

To outline the procedure used to calibrate dosimeters. The procedure meets the requirements of Nuclear Regulatory Commission concerning dosimeter calibrations.

3. PERSONNEL QUALIFICATION:

Personnel performing calibrations shall have on file at Oklahoma Steel Castings Company a record of their qualification and the procedure and finding shall be witnessed by a member of the Oklahoma Steel Castings Company Nuclear Department.

4. REFERENCE STANDARDS:

4.1 NRC Regulations.

4.2 Capital X-Ray Services "Dosimeter Radiation Response Calibration Procedures".

5. EQUIPMENT AND MATERIAL:

5.1 Victoreon 541 and 541/A dosimeter used in Nuclear Department.

5.2 Instrument calibration source provided by Capital X-Ray Services.

6. TIME OF EXAMINATION:

Calibration of all dosimeters used by Oklahoma Steel Castings Company is required on an annual basis.

FOR			OKLAHOMA STEEL CASTINGS CO., INC. TULSA, OKLAHOMA
DRAWN	DATE 12-12-80	CHECKED JH	
DRAWN NO.	SCALE	APPROVED JFH	

7. METHOD OF CALIBRATION:

For the purposes of calibration, the procedure used by Capital X-Ray Services, which is attached to this procedure, will be utilized. To verify the procedure, a member of the Oklahoma Steel Castings Nuclear Department will witness and sign off on the report prepared by Capital X-Ray Services.

8. ACCEPTANCE CRITERIA:

The allowable variance from the known standard for dosimeters is plus 30% or minus 30%. If any dosimeter is found to be out of this range, it is to be replaced immediately.

9. RECORDS:

The Dosimeter Calibration Certificate provided by Capital X-Ray Services and signed by a member of the Oklahoma Steel Castings Company Nuclear Department is to be kept on file in the Nuclear Department for a period of 5 years.

WM		DATE	CHECKED
		12-12-80	JBM
ORWG. NO.	SCALE	APPROVED	
		J.F.H.	

OKLAHOMA  
STEEL CASTINGS CO., INC.  
TULSA, OKLAHOMA

## DOSIMETER CALIBRATION PROCEDURES

### 1.0 DOSIMETER CALIBRATION

#### 1.1 Calibration Intervals

1a Each Dosimeter shall be calibrated for accuracy of radiation accumulated totals at least once every year or sooner if causes exist; such as a "leaking" dosimeter or possibly "damaged" dosimeter.

#### 1.2 Calibration Accuracies

2a Each calibrated Dosimeter shall be calibrated to assure that accumulated radiation dosages are accurate within  $\pm$  30% of the calibration isotope intensities (milliroentgens - time - distance).

#### 1.3 Calibration Personnel

3a GEORGE W. JOHNSON - Radiation Safety Officer, Capital X-Ray Service - 8/1/65 to present date.

a1 Chief Instructor, Assistant Radiographer and Radiographer Training Programs, Capital X-Ray Service.

a2 SNT-TC-1A Training Instructor, ASNT Oklahoma Section, Radiographic Training Courses (including Radiation Safety - 1974 to present).

a3 Total Radiographic Experience, Uninterrupted - 24 years:

a3a Field Inspection Service

- a3b Thayer Inspection Service
- a3c ConAm Inspection (completed "Radiation Health Physics Training Program" - The Budd Company Instruments Division, June 20, 1963).
- a3d Capital X-Ray Service, 8/1/65 to present date

a4 Equipment:

- a4a X-Ray to 2.5 MEV
- a4b Iridium 192 to 100 Curies
- a4c Cobalt 60 to 100 Curies
- a4d Cesium 137 to 10 Curies
- a4e COBALT 60 to .015 Curie - Instrument Calibration
- a4f RADIUM 226 to .100 Curie - Instrument Calibration

3b W. F. CONWAY - Assistant Radiation Safety Officer, Radiography Operations Manager, Capital X-Ray Service - 8/1/65 to present date.

- b1 Instructor, Assistant Radiographer and Radiographer Training Programs, Capital X-Ray Service.
- b2 Total Radiographic Experience, Uninterrupted - 20 years
  - b2a Field Inspection Service
  - b2b ConAm Inspection (completed "Radiation Health Physics Training Program" - The Budd Company Instruments Division, June 20, 1963)
  - b2c Capital X-Ray Service, 8/1/65 to present date.
- b3 Equipment:

- b3a X-Ray to 2.5 MEV
- b3b Iridium 192 to 100 Curies
- b3c Cobalt 60 to 100 Curies
- b3d COBALT 60 to .015 Curie - Instrument Calibration

3c DOUGLAS R. COOPER - Radiographic Equipment Maintenance

Manager, Capital X-Ray Service - 8/1/65 to present date.

- c1 Instructor, Assistant Radiographer and Radiographer Training Programs, Capital X-Ray Service (Radiographic Equipment Usage and Maintenance).
- c2 Total Radiographic Experience, Uninterrupted - 20 years
  - c2a Field Inspection Service
  - c2b ConAm Inspection (completed ConAm Inspection "Radiation Safety Program" - 1964)
  - c2c Capital X-Ray Service, 8/1/65 to present date.
- c3 Equipment:
  - c3a X-Ray to 2.5 MEV
  - c3b Iridium 192 to 100 Curies
  - c3c Cobalt 60 to 100 Curies
  - c3d COBALT 60 to .015 Curie - Instrument Calibration

1.4 Calibration Procedure

- 4a Employing the Manufacturer furnished "Standards Laboratory Report", Form SLR-1, Page No. 10 for the present-in-use Cobalt 60 Calibration Source, determine the Curie Strength, and the Accumulated Milliroentgens per the Dosimeter Cali-

NOTE: DUE TO POSSIBLE OPTICAL PARALLAX, 0 - 200 MR  
DOSIMETERS SHALL BE VISUALLY READ TO THE  
NEAREST 5 MR.

E. 0 - 500 mr Dosimeters approximate Mid-Scale Range  
Calibration - 3/4 hr - 45 minutes - .75)

25.0 cm <u>+30%</u>	25.0 cm <u>Exact</u>	25.0 cm <u>-30%</u>
274.0 mr/45 min.	211.0 mr/45 min.	148.0 mr/45 min.

NOTE: DUE TO POSSIBLE OPTICAL PARALLAX, 0 - 500 MR  
DOSIMETERS SHALL BE VISUALLY READ TO THE  
NEAREST 10 MR.

4b Enter the caluclations and all pre-dosimeter calibration  
information in the appropriate places on the "Dosimeter  
Calibration Certificate", Page No. 14.

4c "CHARGE" all dosimeters to be calibrated to their "0" scale  
setting and visually observe each dosimeter to assure a  
stationary "0" scale setting following a 10 minute "set"  
time.

NOTE: ANY DOSIMETER THAT CANNOT BE CHARGED TO THE "0"  
SCALE SETTING, OR THAT IS FOUND TO BE "LEAKING"  
WILL NOT BE CALIBRATED AND WILL BE REJECTED FOR USE.

- 4d With an operable Survey Instrument "in hand" and switched "on" to a mid-range sensitivity scale (0 to 100 mr/hr), physically survey the Technical Operations Model 571 Survey Instrument Calibration Device to assure that the "Source Rod" is in its fully shielded position - LESS THAN 50 MILLIROENTGENS PER HOUR AT 6" FROM ANY EXTERIOR SURFACE OF THE DEVICE.
- 4e Remove the T/O Model 571 Survey Instrument Calibration Device from the Permanent Storage Area and place the locked device at its proper location in the RESTRICTED AREA which has been erected in accordance with FIGURE 6(d) A, TECH/OPS 571 CALIBRATION DEVICE, Layout of RESTRICTED AREA, RADIATION AREA, and HIGH RADIATION AREA, Page No. 11.

CAUTION: ASSURE THAT THE T/O 571 CALIBRATION DEVICE HAS BEEN PLACED ON A LEVEL PLANE WITH THE CENTER OF THE DIRECTIONAL PORT AT A MINIMUM OF 1.0 METER (39 INCHES) ABOVE ANY FLOOR.

- 4f In accordance with FIGURE 6(d) B, Page No. 12, place the front radiused area of the DOSIMETER CALIBRATION PLATE in contact with and below the Directional Port of the locked T/O 571 Calibration Device.
- 4g In accordance with FIGURE 6(d) C, DOSIMETER CALIBRATION, Page No. 13, place the "zeroed" dosimeters to be calibrated

(7 maximum at one time) in their proper locations at either the 25.0 cm. or 30.0 cm. calibration distance.

- 4h With the "in hand" Survey Instrument switched "on" to a low sensitivity scale (0 to 10 mr/hr) and STANDING TO THE REAR OF THE DIRECTIONAL PORT, unlock the padlock of the handle-locking mechanism of the T/O 571 Calibration Device.
- 4i Raise the knurled tope of the Source Rod to its fully extended position and clamp in place with wooden or plastic "clothes pin". THE CALIBRATION STOP-WATCH TIMER SHALL BE STARTED IMMEDIATELY AT THIS TIME TO ASSURE CORRECT CALIBRATION TIME.
- 4j With the Survey Instrument "in hand" and switched "on" to a low sensitivity scale (0 - 10 mr/hr) physically survey the perimeters of the RESTRICTED AREA to assure that the radiation levels are LESS THAN 2 MR/HR, and at a vantage point outside the barricaded perimeter of the RESTRICTED AREA, CONSTANT SURVEILLANCE SHALL BE MAINTAINED DURING THE ENTIRE TIMED CALIBRATION PERIOD.
- 4k Immediately at the end of the timed calibration period and STANDING TO THE REAR OF THE DIRECTIONAL PORT of the T/O 571 Calibration Device, release the "clothes pin" .

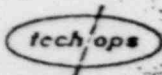
clamp and push the Source Rod down into its fully shielded position within the device.

- 4l Lock the T/O 571 Calibration Device and physically survey the device TO ASSURE THAT THE SOURCE ROD IS IN ITS FULLY SHIELDED POSITION AND THAT THE RADIATION LEVELS AT ALL EXTERIOR SURFACES DO NOT EXCEED 50 MR/HR.
- 4m Replace the locked T/O 571 Calibration Device in its proper location in the Permanent Storage Area.
- 4n Visually read and record the accumulated radiation "dose" totals of each dosimeter and enter the results in their proper locations on the "Dosimeter Calibration Certificate", Page No. 14.

NOTE: ANY DOSIMETER SHOWING AN ACCUMULATED RADIATION DOSE THAT IS NOT WITHIN THE  $\pm$  30% RANGE OF ACCEPTABILITY WILL BE REJECTED FOR USE BY ANY RADIOGRAPHER OR ASSISTANT RADIOGRAPHER.

## 2.0 RECORDS AND REPORTS

- 2.1 Dosimeter Calibration Certificates shall be maintained for inspection.



TECHNICAL OPERATIONS, INCORPORATED  
Burlington, Mass.

## STANDARDS LABORATORY REPORT

### Gamma Ray Source Calibration

Decay of cobalt-60 and iridium-192 sources may be compensated by multiplying reported strength by appropriate tabulated factors.

Age in:	Cobalt-60 (5.25 yrs)		Iridium-192 (75 days)	
	yrs	mos	weeks	days
0	1.000	1.000	1.000	1.000
1	.876	.989	.937	.991
2	.768	.978	.879	.982
3	.673	.967	.824	.972
4	.590	.957	.772	.964
5	.517	.947	.723	.955
6	.453	.937	.678	.946
7	.397	.926	.636	.937
8	.348	.916	.595	
9	.305	.906	.559	
10	.267	.896	.523	
11	.234	.886	.491	
12	.205	.876	.460	

The gamma-ray emission from the radiation from a reference source is either one that had been standardized against air using a plastic-lined feedback circuit with standard atmospheric pressure. The ionization chamber percentage of the observed and detector is less than

Date of  
Measurement

6-25-75

The source was measured and detector. The reported uncertainty of the reference is  $\pm 1$  percent.

\*assuming 1.35 rhm/curie or 0.55 rhm/curie iridium

LEGEND

ROPE BARRICADED "RESTRICTED AREA"

CAUTION - "RADIATION AREA" SIGNS -  $< 2.0 \text{ MR/HR}$

**CAUTION-HIGH RADIATION AREA" SIGNS**

T/O	57	CRITICAL	RADIATION AREA
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10
11	11	11	11
12	12	12	12
13	13	13	13
14	14	14	14
15	15	15	15
16	16	16	16
17	17	17	17
18	18	18	18
19	19	19	19
20	20	20	20
21	21	21	21
22	22	22	22
23	23	23	23
24	24	24	24
25	25	25	25
26	26	26	26
27	27	27	27
28	28	28	28
29	29	29	29
30	30	30	30
31	31	31	31
32	32	32	32
33	33	33	33
34	34	34	34
35	35	35	35
36	36	36	36
37	37	37	37
38	38	38	38
39	39	39	39
40	40	40	40
41	41	41	41
42	42	42	42
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TECH/OPS 571 CALIBRATION DEVICE

Layout of RESTRICTED AREA, RADIATION AREA, and HIGH RADIATION AREA.

NOTE: CALIB. DEVICE shall be placed on a level plane with the center of the Directional Port a minimum of 1.0 meter above floor.

CAPITAL X-RAY SERVICE  
TULSA, OKLAHOMA

TULSA, OKLAHOMA

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1-1-79	EFFECTIVE DATE

ACCEPT, BY

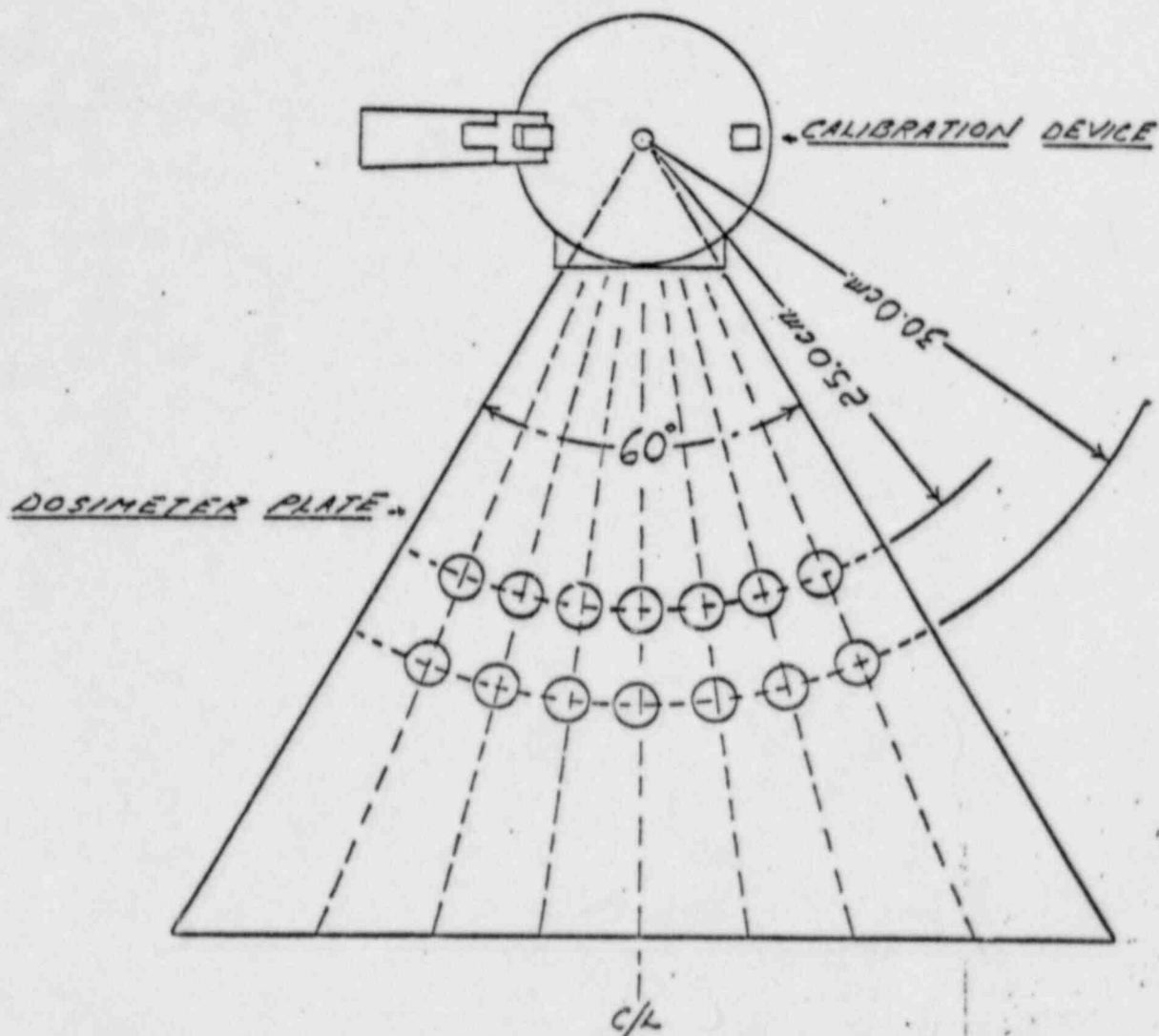
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CAPITAL X-RAY SERVICE  
TULSA, OKLAHOMA

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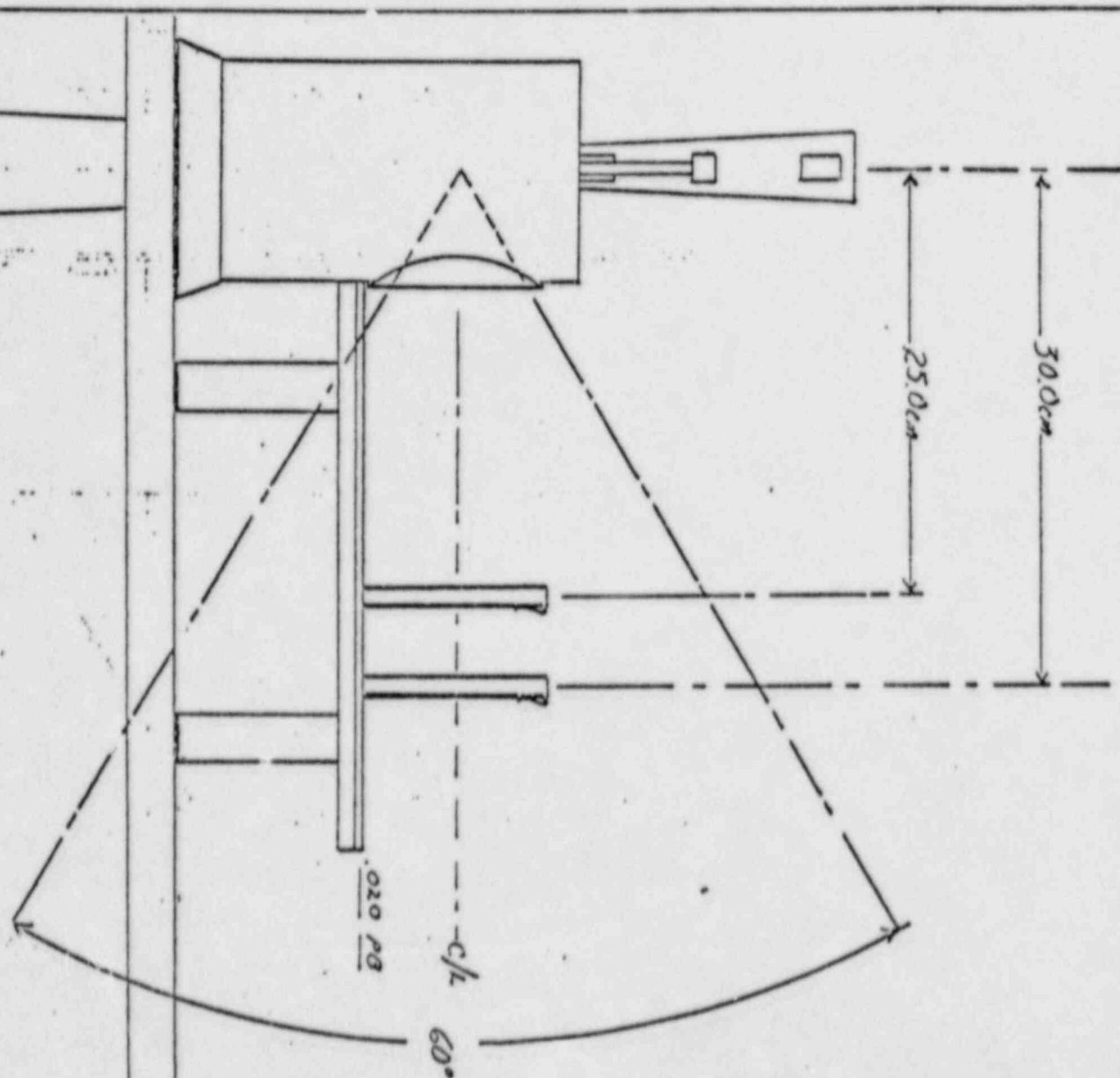
OVERHEAD (TOP) VIEW - DOSIMETER CALIBRATION PLATE

The SURVEY INSTRUMENT CALIBRATION DEVICE as viewed with the DOSIMETER PLATE in the proper location and the placement locations for DOSIMETERS at either (not simultaneously) 25.0 cm. or 30.0 cm.

CAPITAL X-RAY SERVICE  
TULSA, OKLAHOMA

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SIDE VIEW - DOSIMETER CALIBRATION

The SURVEY INSTRUMENT CALIBRATION DEVICE as viewed with the Source Rod in the open position and the DOSIMETER PLATE in the proper location with DOSIMETERS placed at either (not simultaneously) 25.0 cm. or 30.0 cm.

## SIMETER CALIBRATION CERTIFICATE

CUSTOMER \_\_\_\_\_ P.O.# \_\_\_\_\_ CALIBRATION DATE \_\_\_\_\_  
 LESS \_\_\_\_\_ PREVIOUS CALIB. DATE \_\_\_\_\_  
 ISOTOPE: TYPE \_\_\_\_\_ S/N \_\_\_\_\_ CURIE STRENGTH \_\_\_\_\_  
 CALIBRATION DEVICE: MANUF./MODEL \_\_\_\_\_ S/N \_\_\_\_\_

CALIBRATION DISTANCE \_\_\_\_\_ CALIBRATION TIME \_\_\_\_\_  
 MAX. ACCEPT. +30% MR/ \_\_\_\_\_ AT CALIB. DISTANCE MIN. ACCEPT. -30%  
 \_\_\_\_\_

## DOSIMETERS CALIBRATED

NO.	MANUF. - MODEL MR RANGE	SERIAL NUMBER	PERSONNEL ASSIGNMENT	DOSIMETER RESPONSE MR	ACC.	REJ.
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						

CALIBRATION PERFORMED BY: \_\_\_\_\_ NEXT CALIB. DUE \_\_\_\_\_

CAPITAL X-RAY SERVICE

USNRC LICENSE NO. 35-11114-01

DOSIMETER RADIATION RESPONSE CALIBRATION PROCEDURES

OKLAHOMA STEEL CASTINGS  
OPERATING AND EMERGENCY PROCEDURES

SECTION I

N R C ISOTOPE LICENSE

The NRC license (copy attached) is a limited license for use of isotopes in radiography. Under this license, operations are subject to certain restrictions. All radiographic personnel are to be thoroughly familiar with this license and its restrictions.

1. Isotopes are to be sealed sources and are to be used and stored in the equipment named in the license. No modifications to this equipment are allowed unless approved by the NRC.
2. Source type, strength and number are limited to that stated in the NRC license. If, at any time, it is suspected that the limitations of the license are exceeded by a source in our possession, the Radiation Safety Officer should be notified at once.
3. Only those specifically named on the license can act as radiographers, as defined in NRC Part 20. We have included our training program in the license application, though it is not required in this type of application, to indicate the training we require prior to amending our limited license. No person may be allowed to operate the isotope equipment unless he meets the full requirements of either a radiographer or an assistant radiographer. Assistant radiographers can operate the equipment only when under the personal supervision of a radiographer and when the radiographer is physically present and watching the operation.
4. Sources must not be removed from the exposure vault except for shipment during exchange.
5. Sources must only be operated in compliance with the NRC Regulations, Parts 19, 20, 30 and 34; and according to the stipulations of the NRC license and the Operating and Emergency Procedures.

## SECTION II

### SOURCE HANDLING AND EQUIPMENT OPERATION

1. The company is licensed only to use the sources and devices listed on the license and to use this equipment only within the confines of the exposure vault.
2. Each device containing a source should be marked with the radiation caution symbol and the words "CAUTION RADIOACTIVE MATERIALS"; and shall have identification as to type and strength at a given date of the source contained.
3. The design of the exposure vault is such that there is no limitation as to source positioning within the confines of the vault except that an unshielded source should never be used greater than 6 feet from the ground level of the vault. Either collimated or uncollimated exposures can be made although collimated isotopes often result in better radiographs.
4. All equipment must be used only as recommended by the manufacturer and should never be modified except by permission of the NRC. Only radiographers and assistant radiographers under personal supervision of radiographers can use the equipment. Step by step instruction as recommended by the manufacturer are as follows:

4.1 Operation of the Automation Industries Model 520 Exposure Device.

WARNING: BE CERTAIN EXPOSURE DEVICE HAS BEEN SURVEYED AS PER SECTION III OF THE EMERGENCY AND OPERATING PROCEDURES BEFORE OPERATING THIS DEVICE. DAILY INSPECTION OF THE DEVICE IS TO BE PERFORMED IN ACCORDANCE WITH SECTION X OF THE OPERATING AND EMERGENCY PROCEDURES PRIOR TO USE.

- a. Attaching the Source Drive Control Assembly to the Loaded Iriditron.
- b. Unscrew the lockbox plug. The source-cable coupling should protrude about 1/2 inch; this is normal. Store the lockbox plug in the threaded receptacle provided on the end plate of head.
- c. Turn the crank handle of the Source Drive Control Assembly clockwise until the control disconnect is fully exposed.
- d. Connect the Source Drive Cable disconnect coupling to the source-cable coupling. They must be engaged at a right angle and then straightened.
- e. Turn the swivel fitting on the Source Drive Cable Housing until the swivel fitting is snug in the lockbox barrel.
- f. Exposing the Source.
- g. Position the source tube with the closed end at the desired exposure point, and the open end at the outlet of the Iriditron. The source tube should be as straight as possible.

SECTION II  
SOURCE HANDLING AND EQUIPMENT OPERATION  
PAGE 2

- h. Remove the outlet plug assembly from the Iriditron and store it in the hole in the end plate.
- i. Screw the fitting at the open end of the source tube into the threaded outlet hole of the Iriditron.
- j. The lockbox should now be unlocked. The key should be removed and kept in the operator's possession.
- k. The exposure can now be made by rapidly cranking the Source Drive Control handle clockwise until the source capsule hits the cap at the end of the source tube. This will take approximately 30 revolutions of the handle. The operator should be sure to remain in a safe position during the exposure.
- l. At the end of the exposure time, rapidly crank the Source Drive Control handle counterclockwise until a firm stop is felt. After this operation the dial on the Source Drive Control should indicate "0".
- m. When approaching the Iriditron, a survey meter must be carried to verify safety. Move the survey meter along the length of the source tube to make sure that the source has not become disconnected from the control cable and stuck in the tube. Also, check the Iriditron to make sure that the source is in a safe position within the shielded head (indicated by a reading of less than 50 mr/hr at any point 7 inches from the surface of the Iriditron).
- n. Press the barrel of the lock down until it latches. Move the Source Drive Control crank handle back and forth to make sure that the source is locked in position.
- o. If more exposures are not required, remove the source tube and screw the outlet plug back in place.
- p. Removing the Source Drive Control Assembly from the Iriditron.
- q. Check that the lockbox is locked (lock barrel "IN" and key removed) and that the outlet plug assembly is screwed all the way into the outlet of the Iriditron.
- r. Remove the Source Drive Control conduit by unscrewing the swivel fitting at the lockbox.
- s. When the threads are disengaged, disconnect the source cable from the control cable by moving the Source Drive Control drive cable 90° to disengage the coupling. (The source-cable coupling will remain exposed approximately 1/2 inch. Do not attempt to push it in.)
- t. Remove the lockbox plug from the plate and screw it into the lockbox housing.

4.2 Operation of the Automation Industries Models 500 SU and 43866 Source Changers.

WARNING: BE CERTAIN EXPOSURE DEVICE HAS BEEN SURVEYED AS PER SECTION III OF THE EMERGENCY AND OPERATING PROCEDURES BEFORE OPERATING THIS DEVICE.

4.2.1. Locate the Source Charger

- a. Be certain to have an operating survey meter on hand.
- b. Locate the Source Charger within two feet of the shielded head.
- c. Remove plug or source tube from your machine outlet.
- d. Remove ROUND PLUG from Source Charger. Save (new) source number plate.

SECTION II  
SOURCE HANDLING AND EQUIPMENT OPERATION  
PAGE 3

- e. Connect the short change tube supplied, to your machine outlet, and to the Source Changer outlet. (Empty hole).
- f. Connect Source Position Indicator control to your machine lock box and extend control, so that operator is positioned full 25 feet from machine. (Now unlock your machine.)
- g. Run decayed source into Source Changer, by turning control handle clockwise until source stops in the changer.
- h. At this point, the survey meter MUST be employed to insure that source has been safely located in shielded position.
- i. Disconnect short change tube at Source Changer, and disengage disconnects, being careful not to pull out source.
- j. Replace ROUND PLUG, securing decayed source in Changer.
- k. Remove HEX HEAD PLUG from Source Changer, being careful not to pull out source cable inside. (This is your new source.)
- l. Carefully pull the source cable disconnect only enough to allow joining of disconnects.
- m. Join the disconnects on control cable and source cable.
- n. Connect short Change tube to Source Changer outlet.
- o. Pull source into machine by turning control handle counter-clockwise. (Check Radiation Level and Lock your Machine.)
- p. After a monitor check has been made with a survey meter, remove short change tube.
- q. Replace HEX HEAD PLUG on empty Source Changer hole.
- r. Removed decayed source number plate from plate holder on your machine, and replace with new source number plate attached to lead seal wire. Attach old source number plate to Source Changer cap plug, by lacing seal wire provided through number plate when sealing returned source.
- s. A Lead Seal wire has been furnished with your new source. It is to be used for re-sealing Source Changer cap plugs and attaching old source number plate.
- t. Two D.O.T. style shipping labels are included in the envelopes. These are to be pasted over the similar labels on the shipping box. The blank spaces should be filled in as follows:

Principal Radioactive Content - SPELL OUT:  
Iridium-192  
(Not IR-192)

Activity of Contents - - - - - Number of Curies

Transportation Index - - - - - By radiation survey  
MH/hr. at 3 feet

- u. Place the short Change Tube within the compartment, close the hinged cover, and secure with the padlock.

4.3. Operation of the Technical Operation Model 500'  
Exposure Device

WARNING: THE SOURCE POSITION INDICATOR LIGHTS ARE NOT RELIABLE AND DO NOT WORK! USE SURVEY METER AT ALL TIMES!

- a. Survey CO<sup>60</sup> camera per Section III of Operating and Emergency Procedures.
- b. Perform daily check list as outlined in Section X of Operating and Emergency Procedures.
- c. Position collimator or open source stop and subject to be radiographed.
- d. Attach source guide tube to collimator or open source stop. Unlock lock on shipping plug. Remove shipping plug and attach source guide tube to connector or camera. Position guide tube so that there are no sharp bends or kinks in tube.
- e. Lock vault door and unlock crank handle on CO<sup>60</sup> cranking mechanism. Move source into exposure position by rotating crank handle counter-clockwise to a firm stop.
- f. Survey unrestricted area as outlined in Section III of Operating and Emergency Procedures. Make sure gamma alarm system is working properly. Check interlock on vault door to insure warning horn is working.
- g. Upon completion of exposure retract source by rotating crank handle in clockwise direction. Lock crank handle and observe warning lights on gamma alarm system.
- h. Enter vault with survey meter and survey source guide tubes and camera as instructed in Section III of Operating and Emergency Procedures.

#### 4.4 Operation of the Technical Operations Model 488 Source Changer.

NOTE: ALL THE PRECAUTIONS USED WHEN MAKING RADIOGRAPHIC EXPOSURES MUST BE FOLLOWED. WEAR PERSONNEL MONITORING DEVICES DURING ALL SOURCE CHANGING OPERATIONS. MONITOR ALL OPERATIONS WITH A CALIBRATED, OPERABLE SURVEY METER.

- a. Upon receipt of the source changer, survey the source changer to ensure that the source is in the proper storage position.
- b. Locate the source changer and projector in a restricted area. Locate the devices so as to avoid sharp bends in the guide tube or control housing.
- c. Set the projector as for an exposure.
- d. Remove the cover plates from the source changer by breaking the seal wires and removing the bolts.
- e. Connect one end of a guide tube extension to the projector and the other end to the fitting of the empty chamber in the source changer. Insure that the selector ring is in the unlock position.
- f. At the projector controls, crank the source from the projector to the source changer.
- g. Approach the projector with the survey meter. Survey the projector on all sides, survey the guide tube and survey the source changer on all sides to ensure the source has

been properly transferred. The maximum radiation level at the source changer should be less than 200 milliroentgens per hour at contact.

- h. Rotate the selector ring to the LOCK position and depress the plunger lock. Disconnect the guide tube from the source changer. Disconnect the drive cable from the source assembly by moving the lock pin down and sliding the drive cable connector out through the keyway.
- i. Couple the drive cable to the new source by depressing the lock pin, sliding the drive cable connector into the keyway, and releasing the lock pin. Test for proper engagement. Connect the guide tube to the fitting of the chamber. Unlock the key operated plunger lock and rotate the selector ring to the UNLOCK position.
- j. At the projector controls, crank the source from the source changer to its storage position in the projector.
- k. Approach the projector with the survey meter. Survey the projector on all sides, survey the guide tubes, and survey the source changer on all sides to ensure the source has been properly transferred.
- l. Lock the projector.
- m. Disconnect the source guide tube from the source changer.
- n. Affix the identification plate of the new source to the projector and attach the identification plate of the old source to the source changer chamber in which the source has been installed.
- o. Again insure that the old source is secured in the source changer, the selector ring is in the LOCK position and the key operated plunger lock is engaged.
- p. Bolt the source changer cover plates in place and seal wire.
- q. Survey all exterior surfaces of the source changer to ensure that the radiation level does not exceed 200 milliroentgens per hour at contact.
- r. Measure the radiation level three feet from all exterior surfaces of the source changer and ensure that the radiation level is less than 10 milliroentgens per hour. The maximum radiation level measured three feet from any exterior surface is the Transport Index. (Example: With a maximum radiation level of 2.2 milliroentgens per hour, the Transport Index is 2.2).
- s. Complete the appropriate "RADIOACTIVE" shipping labels. For contents, list the radioisotope contained Cobalt 60 or Iridium 192. Indicate the activity as the number of Curies. Record the Transport Index as determined above.
- t. Apply the "RADIOACTIVE" shipping labels, properly completed, to two opposite sides of the container.
- u. Return the container to Technical Operations, Inc.

#### 4.5 Operation of the Technical Operations Model 527 Ray Guide Directional-Panoramic Gamma Ray Collimator.

##### 4.5.1 Operation of Directional Beam

- a. Insert the panoramic collimator in the face recess of the

SECTION II  
SOURCE HANDLING AND EQUIPMENT OPERATION  
PAGE 6

shield. When properly inserted the knurled nuts fit the recesses provided. Tighten the knurled nuts snugly. Tools are not necessary.

- b. Locate the collimator so that the focal spot is at the desired distance. Focal distance is measured from the conical point of the source stop.

#### 4.2.2 Operation of Panoramic Beam

- a. Insert the panoramic collimator in the face recesses of the shield and tighten the knurled nuts. With this collimator in place the radiation emerges through the yellow band around the shield. The emergent beam is  $20^\circ$  wide through a full circle.
- b. Fasten the source tube of the gamma ray projector to the fitting on the collimator. To minimize radiation during source movement use as few source tube sections as the set-up permits.

## SECTION III

### PHYSICAL RADIATION SURVEYS

#### A. Survey Meters:

1. The manufacturer's recommended operating and maintenance procedures for the survey meters used are contained in the manufacturer's brochure. The Victoreen 492 has three scales: the 1X scale measures 0-10 mr/hr, the 10X scale measures 0-100 mr/hr, and 100X scale measures 0-1000 mr/hr. A source of undetermined activity should be approached first on the 1X scale. If the meter swings all the way to the right (10 mr/hr), then the 10X scale should be used next, and after that, the 100X scale, if necessary.
2. This survey meter should be protected from cold and moisture. If the outside temperature is below 32 Degrees F, either use alkaline batteries, or keep the meter indoors and use only for limited periods of time outdoors. Protect meter from rain by putting it inside a clear plastic bag.
3. Survey meters will be calibrated at least every 3 months, or after any repairs have been made. Two identical meters will be employed, so that one calibrated meter will be available for use while the other is being calibrated. Each meter will bear a tag stating the last date of calibration. The meter must have been calibrated in the last 3 months or it can not be used. Survey meters are extremely delicate instruments and care must be taken to prevent severe jolts to the instrument. If an instrument is dropped or bumped, it should be checked against another meter or checked against a known radiation level on the outside of a source safe. At the beginning of each work shift, the meter should be checked for battery strength and proper operation. The battery is checked by depressing the "battery check" button. The meter operation should be checked by placing the survey meter next to the Co<sup>60</sup> source container at the designated location on the container. The meter reading will indicate whether it is in operation or not. Readings should be constant from day to day depending on source strength. This operation should be followed each morning when the source container is surveyed for the maintenance check. Any radiographer having doubt about the calibration or proper meter functioning should not use the meter and should notify the Radiation Safety Officer immediately. Under no circumstances should a source be utilized in an exposure without a calibrated, operable meter being used by the radiographer. If a meter should fail during an exposure, immediately return the source to the safe and restrict entry to the exposure vault until a calibrated and operable meter is obtained to insure the vault is safe to enter.

B. Required Physical Radiation Surveys:

I. Unrestricted Areas

NRC regulations specify that radiation levels in unrestricted areas be limited such that no individual may receive more than 2 mr in any one hour or 100 mr in any seven consecutive days. The unrestricted area consists of all areas surrounding the exposure vault and the vault entrance up to the interlocking doorway. It is the responsibility of the radiographer to survey this area to insure that these requirements are met during an exposure. The walls of the exposure vault are designed such that radiation coming through should be less than 0.5 mr/hr. Certain unpredictable conditions within the exposure vault can cause radiation scatter through the roof which could result in higher radiation levels away from the walls of the vault. It is for this reason that radiation surveys should be made in the unrestricted area. This procedure should be followed during the first exposure each morning and during any exposure when it is thought that changes in source strength, position or collimation may cause scatter outside of the vault.

The following procedures will be utilized for surveying unrestricted areas:

1. Use a survey meter on the 1X scale.
2. Hold the meter approximately 5' from the ground.
3. Check radiation levels approximately 10 feet from the vault walls on all sides of the vault.
4. Check radiation levels approximately 20 feet from the vault walls on all sides of the vault.
5. If the meter reads greater than 2 mr/hr, follow the following procedures.
  - a. Notify the Radiation Safety Officer immediately.
  - b. Keep the area around the vault under surveillance to insure that no individual can receive a dose greater than 2 mr in any 1 hour.
  - c. Determine what must be done to reduce the scatter. Consider such things as collimating or shielding source or changing the source location.
  - d. Make the changes determined in (c) then resurvey the area to be sure radiation scatter is below the 2 mr/hr level.

II. After Completion of Individual Exposures

1. Return source to safe and lock crank handle. Observe gamma alarm system to be sure it is indicating safe radiation levels within the vault.
2. Approach collimator with survey meter on 1X scale. Move survey meter along guide tube toward source container and observe for excessive radiation levels.
3. Place survey meter next to source container and change to 10X scale. Normal readings indicating source is in safe will be 10-50 mr/hr, depending on source strength..

SECTION III  
PHYSICAL RADIATION SURVEYS  
PAGE 3

III. Prior to Storage

1. Determine source is in safe position per II above.
2. Lock safe, screw in storage plugs and return safe to storage area.
3. Depending on which camera is involved, utilize the following procedures:
  - a. Place survey meter on top of Co<sup>60</sup> safe on the area designated. Radiation should measure 10 mr/hr to 100 mr/hr. If the meter reading is either above or below this range, treat it as an emergency situation and notify Radiation Safety Officer.
  - b. Place survey meter 6" from Iridium camera. Radiation should measure 2 mr/hr to 50 mr/hr. If meter reading is either above or below this range, treat it as an emergency situation and notify Radiation Safety Officer.

IV. Prior to Shipment of Source Exchange Unit

1. A survey meter should be used to insure the radiation levels at the outer surface of a source exchange unit are within allowable levels prior to shipment. The units should be in the locked position during the final check.
2. The Co<sup>60</sup> container should have a maximum of 200 mr/hr at any surface or 10 mr/hr maximum at 3 feet from the surface. All surfaces should be checked.
3. The Ir 192 container should have a maximum of 50 mr/hr at a distance of 6 inches from any surface. Check all surfaces.
4. If the radiation is greater than that specified, notify the Radiation Safety Officer and do not ship the container.

## SECTION IV

### PERSONNEL MONITORING

#### A. General Monitoring Requirements

1. Film badges and dosimeters will be worn by all radiographic personnel and any other person who for any reason may exceed the dose limit of 2 mr in any 1 hour.
2. The film badge and dosimeter should be worn at all times during the work shift on the main body between the neck and the hips.
3. Each film badge and dosimeter will be assigned to only one person and will be worn only by that person. Do not take the film badge or dosimeter home with you. All film badges and dosimeters should be stored in a common place (preferably in the radiographer's office.)

#### B. Dosimeters

1. The direct reading dosimeters shall be capable of reading from 0-200 mr. These instruments will drift slightly in normal operation and are delicate instruments. Handle with care. Be sure they are clipped on to the pocket to prevent dropping. If the dosimeter is suspected of malfunction, notify the Radiation Safety Officer.
2. Dosimeters are to be charged at the beginning of each day and the hairline brought as close to zero as possible.
3. The reading on the dosimeter should be made with the scale in the horizontal position and the dosimeter level. A reading should be taken and recorded in the daily log both at the start and at the end of the day. Also dosimeters shall be read frequently during work shift. Dosimeters should also be read immediately if it is suspected that the body was subject to a large exposure.
4. If the dosimeter is found to be discharged, i.e. on or beyond the 200 mr mark, notify the Radiation Safety Officer immediately. NRC regulations require your film badge to be returned for immediate processing at that time.
5. Reasons or causes of high dosimeter readings should be investigated immediately and noted in the daily log book.

#### C. Film Badges

1. The Chief Radiographer will send the film badges to be processed at one month intervals. Records of exposures will be kept on forms NRC-4 and NRC-5.
2. The Chief Radiographer will be the person who communicates with the film badge service and keeps the radiation exposure records. He will review all results of film badge readings monthly and take action appropriate to high exposure records.
3. Causes of high film badge readings should be determined in investigation and noted in the log book.

SECTION V  
CONTROLLING ACCESS TO VAULT

1. The interior of the exposure vault beyond the interlocking door will be considered the restricted "radiation area." All areas beyond the confines of the vault will be considered as unrestricted areas.
2. It is the responsibility of the radiographer to insure that no person enters the restricted area of the vault during an exposure.
3. The exposure vault has many features which will aid the radiographer in controlling access to the "Radiation Area" and the "High Radiation Area."
  - a. The vault will be posted with NRC warning signs denoting the boundaries between the restricted and unrestricted areas. The location and description of these signs is detailed in Section 6(a) of the License Application.
  - b. A gamma alarm system set at radiation levels of 2 mr/hr will activate red oscillating warning beacons on the inside and outside walls of the vault and in the radiographer's office. This system will also control an interlock on the door to the vault such that any entry to the vault during exposure will energize an audible alarm above the doorway.
  - c. The doorway to the vault can be securely locked by bolt action. This bolt can be operated from the inside of the vault to permit exit at any time. The door should be locked securely to prevent unauthorized entry during the times the radiographer is not present to control access to the vault. With the above systems in operation, the radiographer need not maintain direct surveillance over the vault during exposure. The radiographer should check the gamma alarm, warning beacon and door interlock system for proper functioning daily.
4. If at any time, there is an unauthorized entry to the vault during exposure, return the source to the safe position immediately. The Radiation Safety Officer should be notified immediately if it is determined that a non-monitored person received a dose greater than 2 mr in one hour. The Radiation Safety Officer will determine future action in this case.
5. Three sets of exposure vault door keys will be issued. The plant security guard will have access to one set and radiographers, two sets. The plant security and the local fire department will be notified of the presence of radioactive materials within the vault. The plant security will be told to allow no entry unless authorized by the Radiation Safety Officer. Holders of keys will not allow any other person to borrow the keys unless authorized by the Radiation Safety Officer.

## SECTION VI

### LOCKING AND SECURING EXPOSURE DEVICES

1. The cameras containing the sealed sources will be stored within the exposure vault. The exposure vault door will be bolted and padlocked when the sources are stored inside. Security of keys to the lock is detailed in Section V, Paragraph 5.
2. The Automation Industries Model 520 has push button lock at the point where the source drive cable connects to the camera. Difficulty in engaging the lock indicates the source is not in the proper position. The camera should be locked securely during storage. The radiographers will have the only two keys which will operate this equipment and will not give them to any other persons unless authorized by the Radiation Safety Officer.
3. The Tech-Ops Model 500 camera is equipped with a locking bracket which locks the shipping plug in position during storage. This plug should be inserted and the lock secured before storing the camera in the vault. Only two keys will be issued for this lock; both will be kept by the radiographers. These keys should be kept safe from theft or loss and should not be used by any other person unless authorized by the Radiation Safety Officer.
4. The handle of the crank mechanism on Tech-Ops Model 500 camera and Auto-Industries Model 520 camera which are located outside the vault are locked after each exposure. The source tubes and exposure devices are then surveyed to insure source is withdrawn into safe position.

## SECTION VII

### EMERGENCY PROCEDURES AND MINIMIZING EXPOSURE IN EMERGENCIES

#### I. Loss of Source or Equipment Malfunction

1. An emergency situation exists when during an exposure the source cannot be returned to the camera by ordinary means without exposure to the radiographer. There can be many causes of emergency situations such as equipment malfunction or carelessness in operation. All situations out of the ordinary are to be treated as emergencies until it is shown that no danger of exposure to any individual exists. Any survey meter reading either higher or lower than expected at the source container after exposure should be considered as an emergency situation.
2. The first rule to follow in an emergency situation is this:  
  
CLEAR THE EXPOSURE VAULT IMMEDIATELY AND LOCK THE DOOR TO  
  
TO THE VAULT.
3. If you suspect you received exposure, check your dosimeter immediately. If the dosimeter is discharged, notify the Radiation Safety Officer immediately - then try to analyze the problem and calculate your possible maximum dosage based on your distance from the source, time of exposure and shielding.
4. Some of the common problems encountered in the manually operated types of cameras such as we use are cable run off, kinked cables or jammed control consoles. These can be corrected by the radiographer without any danger of exposure. NEVER ATTEMPT ANY TYPE OF SOURCE RECOVERY OR EQUIPMENT REPAIR THAT WILL RESULT IN EXPOSURE TO YOU. NEVER HANDLE OR TOUCH A LOOSE SOURCE!!! You are not trained in source recovery nor are you expected to do so as part of your duties as a radiographer. Any emergency situation should be handled by clearing the exposure vault and locking the door, then NOTIFY THE RADIATION SAFETY OFFICER IMMEDIATELY.
5. If the camera equipment is damaged or malfunctions during use and it is found that the source can be retrieved, you should retrieve the source, survey the source container, lock the camera and the exposure vault and notify the Radiation Safety Officer. Do not attempt to use the equipment again until the cause of malfunction has been corrected, and the equipment has been inspected by the Radiation Safety Officer and is approved for use.

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II. Plant Emergency in Exposure Vault Area

1. A plant emergency such as fire or tornadoes in the exposure area which could result in damage to or loss of the source or exposure to non-monitored individuals should be treated as an emergency situation.
2. In the event of a plant emergency, return the source immediately to the safe and survey the safe as in Section III prior to storage. Lock the source container and the exposure vault as in Section VI. Notify the Radiation Safety Officer immediately.
3. If the exposure device needs to be removed from the exposure area in an emergency situation, notify the Radiation Safety Officer and post guards to prevent possible radiation exposure of personnel to the exposure vault. Maintain surveillance of the area and notify the authorities of the presence of radioactive materials. The Radiation Safety Officer will decide on further course of action.

III. Other Emergencies

If other situations arise which are not covered specifically in this section and which in the opinion of the radiographer constitute a safety hazard or emergency situation, take all necessary precautions to prevent exposure to personnel and then notify the Radiation Safety Officer for further instructions. Remember, do not panic. Carefully analyze the situation then take appropriate action. If you can prevent exposure to personnel, you have fulfilled your duties as a radiographer.

IV. Personnel Notification

The following named personnel are to be notified in case of emergency: (SEE ATTACHMENT)

Jim Hamilton, Radiation Safety Officer can be contacted at:

Business: 585-9285, Ext. 115  
Home: 1-865-3524

Jack Pate, the Chief Radiographer can be contacted at:

Business: 585-9285, Ext. 177  
Home: 582-6964

If the Radiation Safety Officer or Chief Radiographer cannot be reached, notify either of the three following individuals in the Tulsa area who are trained in equipment malfunction and repair and source recovery:

Mr. Bob Miller - X-Ray Supply Company  
Business: 584-4106  
Home: 234-3229

Mr. Dan Mize - Independent Inspection Service  
Business: 425-7074  
Home: 627-5450

Mr. Rod Beutell - Tech. Ops.  
Business: 369-2389  
Home: 369-2389

The Company officer who should be notified in the event of an emergency if the Radiation Safety Officer cannot be reached is:

Jim Burke - Operations Superintendent  
Business: 585-9285 Ext. 167  
Home: 396-2280

Radiation Specialist:

Dr. William Hicks - Glass-Nelson Clinic  
Business: 742-3341

## SECTION VIII

### PERIODIC SURVEYS AND RECORDS TO BE MADE PURSUANT TO PARTS 20, 30, 34 AND 170 OF TITLE 10 OF THE NUCLEAR REGULATORY COMMISSION

The Radiation Safety Officer will be responsible for the maintenance of all records as outlined below. He may delegate the actual record keeping to the Assistant Radiation Safety Officer if necessary. All records will be kept up to date and be available for inspection by the NRC.

1. All personnel will record daily at the end of each working day the radiation levels as shown on the pocket dosimeter. Film badges will be sent immediately for interpretation if it is found that the pocket dosimeter has been completely discharged.
2. All personnel using sealed sources will record such information as name of radiographer, what equipment used, exact time the storage device was unlocked and locked, length of time equipment was in use and the surface radiation of the container after being locked at the end of the work shift.
3. The Radiation Safety Officer or radiographer shall perform necessary maintenance and inspection of all exposure devices as required by the NRC, Part 34.25 through 34.29. Records of the maintenance and inspection will be maintained for a minimum of 2 years.
4. Within one week after the beginning of every calendar half, the Radiation Safety Officer will review with all operating personnel the applicable provisions of the NRC Title 10 and shall review the handling and emergency procedures as contained in the application for license.
5. The Chief Radiographer will, at the beginning and middle of every calendar quarter, send one of the radiation survey meters to a licensed person or company for calibration. This will be handled so that at least one calibrated survey meter will be present at the source location at all times and that each survey meter is calibrated every three months. Records of such calibration will be maintained.
6. An inventory will be made of all sources at the beginning of each calendar quarter by the Assistant Radiation Safety Officer and records prepared which document that all sources are within our jurisdiction. This record will state the isotope number and type, strength, location and date.

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COMMISSION

7. All film badges worn by personnel will be sent to a licensed service for interpretation at the end of each calendar month. Records will be kept on Forms NRC-4 and NRC-5 on both accumulated and periodic dosage.
8. A report will be filed by the Radiation Safety Officer within the first quarter of each calendar year with the Director of Regulations, U.S. Nuclear Regulatory Commission, Washington, D.C., 20545, detailing the total number of individuals for whom personnel monitoring was required during the previous calendar year. The report shall indicate whether the information is submitted in accordance with Sub-division (i) or (ii) of sub-paragraph 1 of Paragraph 20.407. In addition, as required by sub-paragraph 2 of the same paragraph, a report should be made for each individual whose annual radiation dose exceeded the applicable quarterly numerical values specified in Paragraph 20.101A.
9. A test for leakage will be made by the Radiographers every four months as outlined in Section 6 (i) of the license application. The record of the leakage contamination will be kept in micro curies.
10. The Chief Radiographer will maintain the exact records of when each source is received and disposed of. He will also record the approximate source strength at these times.
11. The Chief Radiographer, at least one month prior to the expiration of the license, will request for license renewal from the NRC. This must be done to insure continuity of operation of the source.
12. A copy of the NRC license and Form NRC-3 shall be posted outside the radiographer's office.

SECTION IX  
TRANSPORTATION

1. No provisions have been made in this NRC license to transport sealed sources outside the exposure vault. All sources must be kept within this vault except when shipped for source exchange.
2. Receiving, Transfer and Shipping of sealed sources  
(See next page.)



# OKLAHOMA STEEL CASTINGS COMPANY

A DIVISION OF MARMON INDUSTRIES, INC.

P.O. BOX 2709 • TULSA, OKLAHOMA 74101 ☎ 918/585-9285

A MEMBER OF THE MARMON GROUP OF COMPANIES

## 2. RECEIVING, TRANSFER AND SHIPPING OF SEALED SOURCES

These instructions are provided for the receiving, transfer and shipping of all storage containers and exposure devices containing sealed sources. THE FOLLOWING PERSONNEL ARE WHOLLY RESPONSIBLE FOR THE RECEIVING, TRANSFER AND SHIPPING OF ALL SEALED SOURCES:

1. Jack W. Pate
2. John B. Mize
3. Carl L. Cruce
4. James F. Hamilton
5. Donald R. Bersche

### A. RECEIVING INSTRUCTIONS

(A copy of the Oklahoma Steel Castings U. S. Nuclear Regulatory Commission License is to be considered a part of these instructions).

- I. Any device containing a sealed source that is shipped to Oklahoma Steel Castings Company; and is not listed for the authorized use by the Oklahoma Steel Castings U. S. Nuclear Regulatory Commission License, SHALL NOT BE ACCEPTED FOR DELIVERY.
- II. Immediately upon receiving any device containing a radioactive sealed source, inspect container for damage and Department of Transportation approval tag. If package is intact and D.O.T. tag in place, proceed with radiation survey of container.

Upon receiving any device containing a sealed source, a radiation survey shall be performed, documented, and maintained. The radiation level from the device can not exceed the following limits:

- a. Radiographic exposure devices measuring less than four (4) inches from the sealed source storage position to any exterior surface of the device shall have no radiation level in excess of fifty (50) milliroentgens per hour at six (6) inches from any exterior surface of the device.

Radiographic exposure devices measuring a minimum of four (4) inches from the sealed source storage position to any exterior surface of the device, and all storage containers for sealed sources or for radiographic exposure devices, shall have no radiation level in excess of two-hundred (200) milliroentgens per hour at any exterior surface, and ten (10) milliroentgens per hour at one meter from any exterior surface.

If the radiation level emitted from the device exceeds the specified allowable level, the device shall be immediately moved to a sealed source storage area and properly shielded to reduce the radiation level to the maximum level as specified above. If this condition exists, the U. S. Nuclear Regulatory Commission Regional Offices shall be notified immediately.

B. TRANSFER INSTRUCTIONS

- I. The step-by-step instructions that are issued by manufacturers for the operation of storage containers and exposure devices shall be followed in detail by the individual performing any transfer of sealed sources.  
A SURVEY INSTRUMENT SHALL BE USED DURING TRANSFER OF SEALED SOURCES TO ASSURE RADIATION SAFETY.
- II. After transferring the sealed source from a storage container to an exposure device, or from any exposure device to a storage container, the sealed source will immediately be securely locked in its fully shielded position.
- III. Immediately after locking the sealed source in its full shielded position, a radiation survey shall be performed, documented and maintained on the storage container and, or exposure device.

C. SHIPMENT

1. Immediately prior to the shipment of any sealed source, the following instructions will be followed in detail:
  - a. Shipping papers shall be properly completed. They shall include at least the following items:
    1. Name and address of the consignee and the consignor.
    2. Type, curie strength and serial number of the sealed source.
    3. Storage container or exposure device model number and serial number.

- b. Caution labeling shall be properly completed. This labeling will include at least the following items:
1. A legible CAUTION RADIOACTIVE MATERIAL label.
  2. A type of radioactive material label.
  3. D.O.T. (RADIOACTIVE III) labels; showing type, curie strength and maximum transport index number.
- c. A radiation survey shall be performed, documented and maintained on the storage container or exposure device immediately prior to shipment.

NO PACKAGE WITH RADIATION LEVELS IN EXCESS OF TWO-HUNDRES (200) MILLIROENTGENS PER HOUR AT THE PACKAGE SURFACE, OR TEN (10) MILLIROENTGENS PER HOUR AT THREE (3) FEET WILL BE RELEASED FOR SHIPMENT.

A storage container or exposure device emitting radiation levels in excess of these specified limits will be immediately moved to a shielded exposure vault and inspected to determine if the sealed source is in its fully shielded position. If the source is found to be in its fully shielded position, the storage container or exposure device shall be immediately moved to a sealed source storage area, shielded to reduce the radiation level to the maximum specified level and the U. S. Nuclear Regulatory Commission Region IV office to be notified immediately.



RADIATION SURVEY OF SOURCE CHANGER

BACK

MRH AT SURFACE \_\_\_\_\_

MRH AT 6" \_\_\_\_\_

MRH AT 3' \_\_\_\_\_

SIDE 1

MRH AT SURFACE \_\_\_\_\_

MRH AT 6" \_\_\_\_\_

MRH AT 3' \_\_\_\_\_

TOP

MRH AT SURFACE \_\_\_\_\_

MRH AT 6" \_\_\_\_\_

MRH AT 3' \_\_\_\_\_

SIDE 2

MRH AT SURFACE \_\_\_\_\_

MRH AT 6" \_\_\_\_\_

MRH AT 3' \_\_\_\_\_

LOCK

FRONT

MRH AT SURFACE \_\_\_\_\_

MRH AT 6" \_\_\_\_\_

MRH AT 3' \_\_\_\_\_

## SECTION X

### INSPECTION AND MAINTENANCE OF RADIOGRAPHIC EXPOSURE DEVICES AND STORAGE CONTAINERS

GENERAL: This program is a part of the company's operation procedure manual. It will be accomplished under two headings:

Section I - Operator's daily equipment maintenance check.

Section II - Periodic equipment inspection and maintenance.

Records of inspections will be maintained as described. Instructions to operators and maintenance personnel for these programs are:

Section I Operators daily equipment and maintenance check. Each camera will be inspected by the radiographer prior to operation on each shift. The radiographer will check at least the following items. Any defective components or abnormalities will be reported before operation to the Radiation Safety Officer. Should the defect be deemed hazardous proper repairs or replacement of component parts will be affected before operating the camera. A record of each daily inspection for each camera will be maintained. Signature of the radiographer to the daily inspection record will signify that the following inspection steps have been taken and the camera is in safe operating condition. This inspection does not relieve the radiographer from malfunctions due to improper operation of the camera. It is still the responsibility of the radiographer to operate the camera within the limits of its capabilities

#### DAILY CHECK LIST "A" - CAMERA

1. General appearance. No missing parts. All components required are present including: Source shield, drive mechanism, drive cable and drive cable housing, source guide tubes, stands, collimators, blockers if required and safety devices such as warning signs, barricades, blinkers, etc.
2. Source Shield.
  - A. Is key operating properly and normally.
  - B. Is shield properly labeled and labels in place.
  - C. Conduct Radiation Survey. Exposure devices measuring less than four (4) inches from the sealed source storage position to any exterior surface, shall have no radiation level in excess of fifty (50) mr per hour at six (6) inches from any exterior surface of the device. Radiation exposure measuring a minimum of four (4) inches from storage position and

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DEVICES AND STORAGE CONTAINERS

- C. all storage containers or radiation devices shall have no radiation in excess of two-hundred (200) mr at any exterior surface, and ten (10) mr per hour at any one meter from any exterior surface.
3. Source Guide Tubes.  
Are guide tubes free from kinks, dents and are connectors operable and not service worn or cracked. Are guide tubes free from cuts, abrasions or wear to the point they could cause a malfunction. Are screw threads and coupling fittings clean, undamaged, and not excessively worn.
4. Control.  
Does crank control look and operate normally. Is it clean and free from grease and dirt. Are bearings and fittings tight or abnormally loose. Report sloppy or unusual operations. Are cable connectors tight, and mountings intact. Are control cables free from cuts and dents or kinks. Does Source Indicator read correctly.
5. Radiographer should report to the Radiation Safety Officer:  
A. Any damage to the camera or accessories which might impair its operation. Any wear to camera or components which in his opinion would impair safety in operating the device. Daily record of inspection will record these complaints.

DAILY CHECK LIST "B"

1. Collimators.  
Collimators or beam directing devices will be inspected to see that they are operable and will not malfunction. They will be properly labeled, fittings and adjusting levers or knobs will be inspected to ascertain they are free in operation, not frayed or worn or damaged. They will be free from cracks, worn or damaged parts which might prevent their normal operation.

DAILY CHECK LIST "C"

1. Storage or Shipping containers.  
Storage or shipping containers shall be inspected, when used, to insure that:
- A. There are no defects which would impair their use such as cracks, dents, worn areas or evidence of shielding material having been shifted from mechanical jar or wear. Radiation surveys will be conducted when any storage or shipping device is used to assure its proper function.
- B. Above devices will be inspected for proper labeling and sealing.
- C. Damage to connectors due to abuse, accident or fair wear and tear which would impair its use.

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SECTION II Periodic Inspection and Maintenance, Performed by Radiographer:

After three (3) months service, storage or operation under severe conditions such as sand or dust storms, accidents such as immersion in water, dropped and damage has possibly occurred each camera will be subject to the following maintenance which will include cleaning, lubrication and replacement of worn or damaged parts or components. Records of periodic inspections and maintenance will be kept by model number and serial number of each camera. Should any damage be so apparent that the company maintenance procedures, as described, would not put the unit in serviceable condition, it will be sent to the manufacturer for proper maintenance and repair. Each camera will be labeled time and date of last service inspection.

1. Materials Required:

- A. Lubricant
- B. Syringe
- C. Compressed Air
- D. Source changer (Periodic maintenance can be accomplished when changing sources.)
- E. Solvent (Perchloroethylene or equivalent grease remover.)
- F. Receptacle, bucket or basin.

2. Procedure.

- A. Remove source from unit and store in source changers. (Follow instructions for use of source changer.)
- B. Cables: Detach source drive cables, inspect for worn, frayed and/or broken parts. Make sure there are no bent, kinked or cracked cables. Blow cable out with compressed air. Should cable contain dirt, sand or foreign particles inside the cable it must be flushed out with compressed air. Make certain fittings are clean and operate freely.
- C. Source drive cable: Drive the cable out of shield into bucket, basin or wire basket. Clean with solvent, dry and lubricate with recommended lubricant. Cable should be inspected for wear, kinks or frayed parts. Should there be any question as to its serviceability, replace cable. Particular attention must be made to connector ends. Gauge connectors use Technical Operations 550 Connector gauge.

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- D. Control Crank: Remove crank unit from its mounting, disassemble and clean with solvent. Examine for excessive wear of all parts. Replace worn bearings, gears, housings or any part which shows excessive wear. Assemble and lubricate.
- E. Control Cable Housing: Remove cables. Examine for kinks, bends, ruptures or excessive wear. Replace fittings if worn or damaged. Blow out with compressed air. Should cables contain dust, dirt or foreign matter inside they should be cleaned as described for source drive cables.
- F. Shield Assembly: Examine for loose or worn outside parts, name plates, signs, etc. Remove shield cover, clean with solvent, examine all moving parts and replace any parts which appear to have excessive wear. Guide tubes inside shield should be free and clear. Flush with solvent if in doubt. Reassemble shield assembly.
- G. Final Inspection: Reassemble camera assembly. Make certain unit operates free and easy before installing live source. Check shield assembly with survey meter. Radiation levels should not exceed ten (10) mr per hour at one meter from shield cover.

Tag or label source shield of date of inspection and service. SIGN INSPECTION LOG RECORD. Record of repairs including parts replaced should be maintained.

6F TRAINING PROGRAM FOR RADIOGRAPHERS AND ASSISTANT RADIOGRAPHERS

THIS IS A LIMITED LICENSE, EACH RADIOGRAPHER IS LISTED ON THE LICENSE, THE TRAINING PROGRAM IS PROVIDED AS A GUIDE FOR OUR USE.

A. Assistant Radiographers

Before an employee is eligible for a position of Assistant Radiographer at Oklahoma Steel Castings Company, he will have completed the following requirements:

1. Has received copies of and instruction in the Emergency and Operating Procedures.
2. Has demonstrated competence to use, under the personal supervision of a radiographer, the radiographic exposure devices, sealed sources, related handling tools and radiation survey instruments that the assistant will use. His on-the-job training will be as in Paragraph C below.
3. Has demonstrated understanding of the instructions by successfully completing a written or oral test and a field examination on the subjects covered.

B. Radiographer

Before an employee is eligible for a position of Radiographer at Oklahoma Steel Castings Company, he will have complied with the requirements of an Assistant Radiographer and:

1. Has been instructed in the subjects outlined in Appendix A of Part 34;
  - A. He will have on-the-job training as in Paragraph C below.
  - B. Will have completed a course in Radiography and Safety offered by Picker Isotope Safety School, Louisiana State University "Industrial Isotope Radiography" or their equivalent.
2. Has received copies of and instruction in NRC regulations contained in Parts 19, 20 and 34, NRC license under which the radiographer will perform radiography and the Operating and Emergency Procedures.
3. Has demonstrated competence to use of radiographic exposure devices, sealed sources, related handling tools and survey instruments.
4. Has demonstrated understanding of the instruction by successful completion of a written test and a field examination on the subjects covered.

C. On the Job Training

C.1. Safety in Operating (8 hours)

1. Operating and Emergency Procedures, other applicable parts of the NRC License Application and applicable parts of the NRC regulations, Parts 19, 20, 30 and 34.
  - A. Determining and restricting unsafe area.
  - B. Establishing and correcting cause of trouble.
  - C. Personnel monitoring.
  - D. Notifications in case of emergency.
  - E. Limiting exposure to radiation
    1. Time.
    2. Distance.
    3. Shielding.
    4. Expected levels of radiation from licensed sources.

5. Use of survey meters. Explanation and demonstration of use, battery changes, calibration, records, reports and limitations.
6. Plant personnel safety. Impress participants in need for strict surveillance and limiting access to radiation area.
7. Survey of camera after each exposure.
8. Leak Test - Allow participants to perform leak test on empty camera.

C.2 Handling of Isotopes and Operating Equipment (16 hours)

1. Identification of parts and explanation of operation.
2. Disassembly and re-assembly with emphasis on maintenance.
3. Discussion: Allow participants to operate camera, assemble and re-assemble.
4. Install "dummy" source, using source changer. Allow participants to install "dummy" sources. Discussion on the proper and safe use of source changer.
5. Storage - Discuss storage of units and records to be kept.
6. Source guide tubes. Demonstrate various ways to employ, and care, in using to avoid malfunction.
7. Control Assembly. Demonstrate methods of use. Disassemble for maintenance and explanation of points of wear, retrieving control cable, etc.
8. Use of accessories. Demonstrate use of collimators, blockers, and stands with emphasis on safety and technique.

ACCESSORY AND EQUIPMENT LIST

1. 2 Victoreen 492 Survey Meters
2. 1 Victoreen 2000 A Dosimeter Charger
3. 1 Victoreen 541/A Dosimeter Pencil per student
4. 1 Exposure Calculator
5. 1 Film Badge per student
6. 1 Iridium Projector (less source)
7. 1 Source Changer (less source)
8. 4 Leak Test Kits
9. 1 Collimation Assembly

C.3 Critique (16 hours)

Open discussion of all phases of operation, recovering of any areas of unclear understanding, and covering of all applicable regulations relating to operation and safety.

D. Periodic Training

The Radiation Safety Officer will conduct training for Radiographers and Assistant Radiographers semi-annually and will cover the following:

1. New regulations, procedures, policies and equipment.
2. Continuing proficiency with present equipment and procedures.
3. Case histories of accidents with use of isotopes
4. Oklahoma Steel's safety record.

E. Sample Test to be given to Radiographers and Assistant Radiographers

RADIOGRAPHER'S EXAMINATION

1. Who must maintain direct surveillance of a radiographic operation?
2. In the event of an accident involving sealed sources at OSC, what should you do?
3. If a survey meter being used becomes inoperable, what are the procedures to be followed.
4. What are the three principal ray emissions from radioactive material?
5. A Curie of any radioisotope is defined as how many disintegrations per second?
6. What are the emission constants of the following radioisotopes?
  - 1) Co<sup>60</sup>
  - 2) Ir 192
7. What are the three principal means that must be applied for controlling body exposure to radioactive materials?
8. What does a survey instrument measure?
9. What does a film badge measure?
10. What does a dosimeter measure?
11. When should a survey instrument be Calibrated?
12. When should a film badge be checked?
13. When should a dosimeter be checked?
14. Who keeps a record of dosimeter readings?
15. When should surveys be taken of the unrestricted area of our facility?
16. When should the Cameras in the exposure vault be surveyed?
17. Can film badges and dosimeters be transferred from one person to another?
18. At what interval must a radiographic source be leak tested?
19. The REM & M-REM are measures of what?
20. Define Restricted Area
21. What are the documents that the employer must supply to each radiographer and assistant radiographer?
22. Can we calibrate our own survey meters? Give reason for your answer.
23. The following is required to be posted in or near the exposure area.
24. You must notify the NRC within 24 hours upon whole body exposure to \_\_\_\_\_ REM'S.
25. Define Radiographer.
26. What are the two (2) rules of most importance when operating a source?
27. Is Oklahoma on NRC Licensing agreement State Yes - No
28. The vault walls are poured concrete but what thickness?
  - a) 36"
  - b) 48"
  - c) 42"

29. What should you do if you suspect the limitations of the license are exceeded by a source in our possession?
  - a) Notify the manufacturer
  - b) Notify the Radiation Safety Officer
  - c) Notify the NRC
30. The maximum permissible dosage while operating the source crank handle is 2 mr in any 1 hour or 200 mr in any seven consecutive days. True or False
31. Survey meters are to be calibrated
  - a) At least every 45 days or after any repairs are made
  - b) At least every 2 months or after any repairs are made
  - c) At least every 3 months or after any repairs are made
32. A physical survey of the unrestricted area of radiation will be made
  - a) Once each day, or when source positions warrant
  - b) Once each week, or when source positions warrant
  - c) Once each month, or when source positions warrant
33. The rules to follow are: Use survey meter on 1X scale, about 5' from ground, at about 10' from vault on all sides and if reading is greater than 2 mr/hr, notify the Radiation Safety Officer and secure the area, while determining necessary changes to be made. True or False.
34. The gamma alarm system is set at:
  - a) 1 mr/hr
  - b) 2 mr/hr
  - c) 2 r/hr
35. There are 3 sets of keys issued to the exposure vault door. True or False
36. There are only 2 keys issued for each isotope camera. True or False.
37. In the event of fire or tornadoes in the exposure area the Radiation Safety Officer should be contacted. True or False
38. Every six months the Radiation Safety Officer will review the applicable provisions of NRC Title 10 with operating personnel. True or False
39. The 2 forms required for employee accumulated dosages and periodic dosages are:
  - a) NRC-3 and NRC-4
  - b) NRC-4 and NRC-5
  - c) NRC-5 and NRC-6
40. The actual cleaning and lubrication, after three months of service (care) will be performed by:
  - a) Radiographer
  - b) Camera Sales Representative
  - c) Chief Radiation Safety Officer

4. What should you do if you suspect the limitations of the license are exceeded by a source in our possession?
  - a) Notify the manufacturer
  - b) Notify the Radiation Safety Officer
  - c) Notify the NRC
5. The maximum permissible dosage while operating the source crank handle is 2 mr in any 1 hour or 200 mr in any seven consecutive days True or False.
6. Survey meters are to be calibrated
  - a) At least every 45 days or after any repairs are made
  - b) At least every 2 months or after any repairs are made
  - c) At least every 3 months or after any repairs will be made
7. A physical survey of the unrestricted area of radiation will be made
  - a) Once each day, or when source positions warrant
  - b) Once each week, or when source positions warrant
  - c) Once each month, or when source positions warrant
8. The rules to follow are: Use survey meter on LX scale, about 5' from ground, at about 10' from vault and about 20' from vault on all sides and if reading is greater than 2 mr/hr, notify the Radiation Safety Officer and secure the area, while determining necessary changes to be made. True or False.
9. The gamma alarm system is set at:
  - a) 1 mr/hr
  - b) 2 mr/hr
  - c) 2 r/hr
10. There are three (3) sets of keys issued to the exposure vault door. True or False.
11. There are only two (2) keys issued for each isotope camera. True or False
12. In the event of fire or tornadoes in the exposure area the Radiation Safety Officer should be contacted.
  - a) True
  - b) False
13. Every six months the Radiation Safety Officer will review the applicable provisions of NRC Title 10 with operating personnel.
  - a) True
  - b) False
14. The two (2) forms required for employee accumulated dosages and periodic dosages are:
  - a) NRC-3 and NRC-4
  - b) NRC-4 and NRC-5
  - c) NRC-5 and NRC-6
15. The actual cleaning and lubrication, after three months of service (cameras) will be performed by:
  - a) Radiographer
  - b) Camera Sales Representative
  - c) Chief Radiation Safety Office

16. Should a record of repairs, including parts, of this service be maintained? Yes or No
17. Our Co<sup>60</sup> camera was manufactured by:
  - a) Automation Industries
  - b) Technical Operations
18. In an extreme emergency would it be permissible for us to compile radiation levels, rope off or seal off an area to safe limitations and made an "open field" exposure?
  - a) Yes
  - b) No
19. Why should an unshielded source never be positioned more than six (6) feet from the ground while making an exposure in the vault
  - a) Danger of damage to equipment
  - b) Set up time involved
  - c) Danger of radiation and sky-shine on exterior of vault
20. The reasons to check for actual source location after each exposure is:
  - a) It is a good safety habit
  - b) Oklahoma Steel's license requires this
  - c) This is a requirement set forth by NRC
  - d) All of the above
21. Who must maintain direct surveillance of a radiographic operation?
22. What are the three (3) principal ray emissions from radioactive material?
23. What does a survey instrument measure?
24. When should surveys be taken of the unrestricted area of our facility?
25. What does a dosimeter measure?

F. Instructor's Qualifications

The final determination of adequacy of trainee's knowledge and competency is made by the recommendation of the Chief Radiographer, who is responsible for on-the-job training, and to the Radiation Safety Officer who will evaluate all phases of training both in plant and school before approving.

G. Records

A copy of tests given each trainee, records showing trainee performance in each examination and the examiner's overall evaluation will be maintained for a period of three (3) years.

1. The internal inspection system used to insure compliance with NRC regulations and license provisions is based on a supervision structure as outlined and enumerated in Section 6 (h) of the license application. The entire license application and along with applicable NRC regulations and NRC approved written procedures are considered to be a manual to be used by respective levels on management in performing their applicable duties.
2. The qualifications of each individual involved in the radiography program is listed as a part of Section 6 (h).
3. Internal inspections are made by the Radiation Safety Officer every 90 days. Once a year a member of the staff performs a management audit. Both of these audits are included on the following pages. Records of the audits are maintained a minimum of two years.
4. Corrective Action reports are made on any deficiency noted during an audit. Both the audit and corrective action must be approved by the Radiation Safety Officer. A copy of the Corrective Action Form is included as part of this section. Deficiencies, depending upon the type of problem, are assigned as part of the training program and will be audited by the responsible supervisor and the members of management responsible for the area involved.
5. The Radiation Safety Officer is responsible for reviewing quarterly inventories, utilization logs, records of receipt and disposal of licensed material, personnel monitoring results, and surveys.

## OKLAHOMA STEEL QUALITY AUDIT

DATE OF AUDIT \_\_\_\_\_

BY \_\_\_\_\_

## Nuclear Department - Radiography

Yes	No	Comments
-----	----	----------

- |      |  |  |
|------|--|--|
| 1    | Are radiography procedures followed?   |  |
| 2    | Are radiographs indentifiable as to  |  |
| 2.1  | Casting pattern number?  |  |
| 2.2  | Customer?  |  |
| 2.3  | Area of interest?  |  |
| 3    | Is the dark room clean and in good order?  |  |
| 4    | Is the vault clean and in good order?  |  |
| 5    | Are correct penes used?  |  |
| 6    | Are film reading facilities clean and in good order  |  |
| 7    | Are reference radiographs in good order and available to film reviewers?                     |  |
| 8    | Have previous license number and "Renewals" or "Amendments" been included where appropriate? |  |
| 9    | Is the following equipment displayed or in working order                                     |  |
| 9.1  | Locks on vault and equipment?  |  |
| 9.2  | Signs required by NRC?   |  |
| 9.3  | Warning lights?  |  |
| 9.4  | Interlocking systems?  |  |
| 10   | Is the following correct for the survey meters?  |  |
| 10.1 | Make and model number available?   |  |
| 10.2 | Calibration current?   |  |
| 10.3 | Calibration sheet attached?  |  |
| 11   | Personnel monitoring   |  |
| 11.1 | Have film badge reports been received and kept up to date?                                   |  |
| 11.2 | Are film badges properly worn by radiographers?  |  |



## OKLAHOMA STEEL ANNUAL INTERNAL MANAGEMENT AUDIT

Checklist for Internal, Annually, Management and Independent Audit.

COPE: This is a checklist for conducting an internal audit of Oklahoma Steel Castings to see if procedures set forth in the Quality Assurance Manual are followed and is an overview of the processes used to make "Nuclear Quality" castings. This checklist supplants OS-1ACA-X.

DATE OF AUDIT \_\_\_\_\_ BY \_\_\_\_\_

	YES	NO	COMMENTS
1. Heat Treat Department			
1.1 Is calibration current on the following equipment?			
1.1.1 Master Thermocouple Board?			
1.1.2 Brinell Hardness Testers?			
1.1.3 Qualified Furnaces?			
1.2 Are Heat Treat personnel familiar with Heat Treating Procedures?			
1.3 Are Procedures followed?			
1.4 Is there a periodic check made on the following?			
1.4.1 Daily on individual furnace control units?			
1.4.2 Weekly on Brinell machines?			
1.5 Are Heat Treat charts kept on all Nuclear castings?			
1.6 In your opinion, do Nuclear castings obtain a proper heat treatment?			
1.7 Comments:			





YES	NO	COMMENTS
6.7		Are adequate records kept to trace a casting?
6.8		Are route cards attached to all nuclear castings?
6.9		Comments:
<b>7. Nuclear Department - Radiography</b>		
7.1		Are radiography procedures followed?
7.2		Are radiographs identifiable as to
		7.2.1 Casting pattern number?
		7.2.2 Customer?
		7.2.3 Area of interest?
7.3		Is the dark room clean and in good order?
7.4		Is the vault clean and in good order?
7.5		Are correct penes used?
7.6		Are film reading facilities clean and in good order?
7.7		Are reference radiographs in good order and available to film reviewers?
7.8		Have previous license number and "Renewals" or "Amendments" been included where appropriate?
7.9		Is the following equipment displayed or in working order
		7.9.1 Locks on vault and equipment?
		7.9.2 Signs required by NRC ?
		7.9.3 Warning lights?
		7.9.4 Interlocking systems?







CORRECTIVE ACTION

DATE OF AUDIT: \_\_\_\_\_

RECOMMENDED CORRECTIVE ACTION: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

ACTION TO BE TAKEN: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

CORRECTIVE ACTION ASSIGNED TO: \_\_\_\_\_

ACTION TO BE COMPLETED BY: \_\_\_\_\_

ACTION COMPLETED: \_\_\_\_\_

SIGNATURE OF RESPONSIBLE INDIVIDUAL UPON COMPLETION OF CORRECTIVE  
ACTION: \_\_\_\_\_

REVIEWED CORRECTIVE ACTION BY  
RADIATION SAFETY OFFICER

\_\_\_\_\_

DATE \_\_\_\_\_

ORGANIZATIONAL STRUCTURE  
OKLAHOMA STEEL CASTINGS RADIOGRAPHY DEPT.

Structure

A chart of the overall management structure of Oklahoma Steel Castings Company is included in this Section. The Radiation Safety Officer will be responsible for the operations of the radiography department and shall report to the General Manager. All radiographers and assistant radiographers will report directly to the Radiation Safety Officer in matters pertaining to the radiography department.

The Radiation Safety Officer and Radiographers shall meet the following requirements:

1. They must be thoroughly knowledgeable of the applicable parts of the NRC regulations, Parts 20, 30, 34 and trained in the subjects of Part 34, Appendix A of NRC Title 10.
2. They must be thoroughly familiar with the Operating and Emergency Procedures and have demonstrated competence in the safe handling of isotopes.
3. Attained ASNT level I in radiography. The Qualifications and Resumes of each Radiographer and assistant radiographer is included in this section.

Job Description

Radiation Safety Officer:

The employee in this position is responsible for all matters pertaining to the safe operation of radioactive sources. He will be responsible for enforcing the regulations of the Nuclear Regulatory Commission and insuring that all radiographic operations are done in accordance with these rules and with the NRC license. He will be a qualified radiographer with training in the use of the types of equipment used in this facility. He is appointed to his position by the General Manager.

The Radiation Safety Officer is responsible for the following duties, some of which he may delegate to persons of lesser authority:

1. Serving as the licensee's liaison officer with the Nuclear Regulatory Commission on license matters.
2. Maintaining control of procurement and disposal of licensed material.
3. Developing and maintaining up-to-date operating and emergency procedures.
4. Establishing and maintaining a personnel monitoring program.
5. Procuring and maintaining radiation survey instruments.
6. Establishing and conducting the training program for radiographers and radiographers' assistants.

ORGANIZATIONAL STRUCTURE  
OKLAHOMA STEEL CASTINGS RADIOGRAPHY DEPT.  
PAGE 2

7. Examining and determining competence of radiographic personnel.
8. Establishing and maintaining storage facilities.
9. Maintaining exposure devices, radiography facilities, and associated equipment.
10. Establishing and maintaining the leak-testing program.
11. Establishing and maintaining the internal inspection system.
12. Performing source replacement and source tagging operations.
13. Conducting quarterly inventories and maintaining utilization logs.
14. Establishing and conducting a survey instrument calibration program.
15. Establishing and maintaining the licensee's recordkeeping system.
16. Reviewing and ensuring maintenance of those records kept by others.
17. Assuming control and instituting corrective action in emergency situations.
18. Investigating the cause of incidents and determining necessary preventive action.
19. Acting in an advisory capacity to the licensee's management and radiography personnel.
20. Establishing a procedure for evaluating and reporting defects and noncompliance pursuant to 10 CFR Part 21.

#### Radiographer

The radiographers report directly to the Radiation Safety Officer. The radiographers are responsible for the actual operation of exposure devices, film development, and interpretation. Their duties incident to producing radiographs include the following:

1. Maintaining safe operating conditions as instructed by the Radiation Safety Officer, the applicable sections of the NRC regulations and the Oklahoma Steel Operating and Emergency Procedures.
2. Maintain supervision of the radiographic exposure vault at all times during exposure.
3. Maintenance of personnel monitoring equipment per Section 6 (d) of the NRC license application.
4. Instrument calibration per 6 (c) of the NRC license application.
5. Maintenance and inspection of exposure devices on a routine basis as outlined in the Emergency and Operating Procedures.
6. Leak testing per Section 6 (i) of the NRC license application.
7. Keeping appropriate records as instructed by the Radiation Safety Officer.

#### Assistant Radiographer

The assistant radiographers are to be supervised by the radiographer and will perform such tasks as instructed by the radiographer.

ORGANIZATIONAL STRUCTURE  
OKLAHOMA STEEL CASTINGS RADIOGRAPHY DEPT.  
PAGE 3

Assistant radiographers will handle isotopes only when under the direct supervision of the radiographer.

OKLAHOMA STEEL CASTINGS  
STAFF CHART

GENERAL MANAGER  
LOU ENGLEBAUGH

TECHNICAL DIRECTOR  
RADIATION SAFETY OFFICER  
JIM HAMILTON

MANUFACTURING  
MANAGER  
JIM BURKE

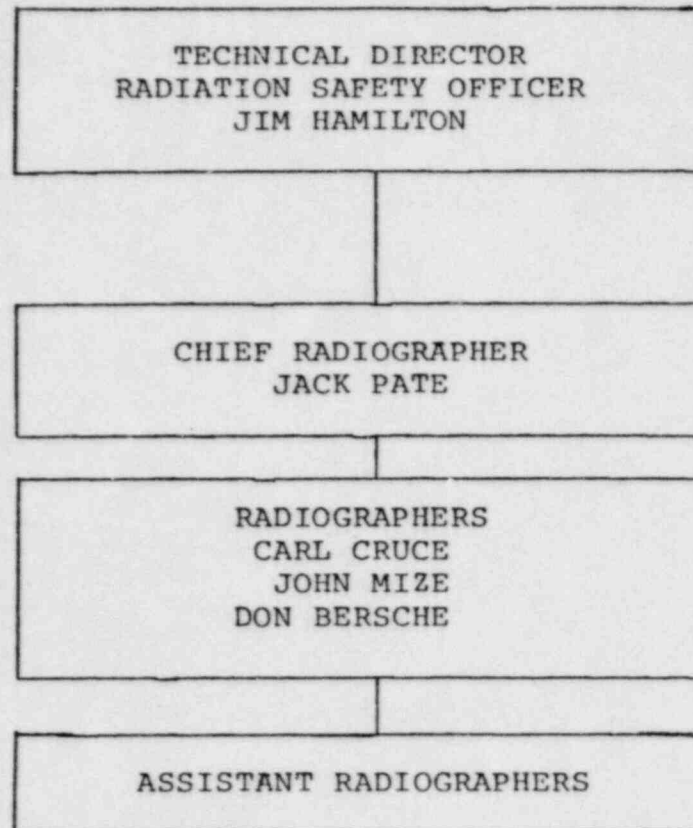
COMPTROLLER  
GORDON SASS

MARKETING  
MANAGER  
JIM HOWARD

PRODUCTION CONTROL  
MANAGER  
JERRY CHISHOLM

PERSONNEL  
DIRECTOR  
CHARLES  
SCRITCHFIELD

OKLAHOMA STEEL CASTINGS  
RADIOGRAPHY ORGANIZATIONAL CHART



Qualifications and Resumes of Personnel involved in Oklahoma Steel Castings Company Radiographic Program.

JIM HAMILTON - Radiation Safety Officer

Qualifications: BS Metallurgy, University of Missouri at Rolla. Fourteen (14) years experience in all phases of steel foundry including Radiation Safety Officer at Missouri Steel Castings. Graduate of LSU course on Radiation Safety, 1972. Four (4) years experience in nuclear safety requirements in U.S. Army. Presently Technical Director at Oklahoma Steel Castings.

Equipment Used: 250 KV General Electric X-Ray Unit; 100 Curie I-192 and 100 Curie Co<sup>60</sup> in Gamma Industries; Utility Twin Camera. Also has received instruction and is familiar with standard operating procedures of Oklahoma Steel Castings facilities.

JACK W. PATE - Chief Radiographer

Qualifications: Graduate of Hickory High School, Hickory, Oklahoma; Radar Training and Experience - U.S. Navy three (3) years; Blueprint Reading Course, Tulsa, Vocational Technical School, 1971; Graduate of Kodak School of Industrial Radiography, November, 1973, with ASNT Level II; Graduate Diano (Picker) Isotope for Industrial Radiography School, December 1973.

Equipment Used: 250 KV General Electric X-Ray Unit; 250 KV Picker X-Ray Unit; 300 KV Norelco X-Ray Unit; 300 KV Phillips X-Ray Unit; 10 Curie Cobalt with Tech-op Model 500 Camera; 33 Curie Iridium with Tech-op Model 660 Camera; 886 Curie Cobalt 60 Cyclops Unit; 26 Curie Iridium Tech-op 660 Camera; 99 Curie Cobalt 60 with Tech-op Model 500 Camera; 100 Curie Ir. 192 with Automation Industries Model 520 Camera.

Experience: Oklahoma Steel Castings Company, thirteen (13) years, Code Welder, including nine (9) years welder on Nuclear and X-Ray; four (4) years Liquid Penetrant Inspection; two (2) years Magnetic Particle Inspection; and nine (9) years Radiographic Film Review. Chief Radiographer since September, 1975.

JOHN B. MIZE - Radiographer

Qualifications: Graduate of Bixby High School, Bixby, Oklahoma; Radiological Defense Training School, University of Oklahoma, February 6, 1962; Graduate Diano (Picker) Isotope for Industrial Radiography School, February, 1974.

Equipment Used: 250 KV General Electric X-Ray Unit; 886 Curie Cobalt 60 Cyclops Unit; 99 Curie Cobalt 60 with Tech-op Model 500 Camera; 100 Curies Ir. 192 with Automation Industries Model 520 Camera.

Experience: Oklahoma Steel Castings Company twenty-four (24) years, seven (7) years Laboratory Clerk and Chemist, eight (8) years X-Ray with use of 250 KV General Electric Unit; one (1) year as assistant radiographer with Cobalt 60 and Ir. 192 and ten (10) years radiographer.

DONALD R. BERSCHE - Radiographer

Qualifications: Graduate of Blackwell High School, Blackwell, Oklahoma. Graduate of Kodak School of Industrial Radiography, October, 1975. Had in-house safety program at Globe X-Ray Service, Inc.

Equipment Used: 250 KV Picker X-Ray Unit, 350 KV Norelco X-Ray Unit, 10 Curie Co. 60 with Tech-op Model 500 Camera, 30 Curie Ir. 192 with Tech-op Model 683 Camera.

Experience: Employed at Globe X-Ray Service, Inc. from October 1975 to December 1976 as a radiographer, at Oklahoma Steel Castings Company six (6) years.

CARL L. CRUCE - Radiographer

Qualifications: Graduate of Depew High School, Depew, Oklahoma.

Equipment Used: 99 Curie Cobalt 60 with Tech-op Model 500 Camera, 100 Curie Ir. 192 with Automation Industries Model 520 Camera.

Experience: Oklahoma Steel Castings Company, twenty-one (21) years; fourteen (14) years Inspections, two (2) years of film review and working in dark room at Nuclear Department, eight (8) months as assistant radiographer with Cobalt 60 and Ir. 192, seven (7) years as radiographer.

NOTE: All personnel above have received instruction by the Radiation Safety Officer as outlined in Oklahoma Steel Castings Radiography Training Program. This instruction included complete review of applicable sections of Parts 19, 20, 30, and 34 of Title 10, Nuclear Regulatory Commission. In addition, all personnel have received instructions of information contained in Operation and Emergency Procedures for Radioactive Isotopes at Oklahoma Steel Castings Company.

## LEAK TEST PROCEDURE

Leak tests of all source containers and guide tubes will be made every four (4) months as outlined in Emergency and Operating Procedures.

The following named radiographers perform leak testing:

DONALD R. BERSCHE  
CARL CRUCE  
JOHN B. MIZE  
JACK PATE  
JIM HAMILTON

Briefly, the procedure consists of the following:

A swab wet with water will be inserted into the exit port of the source container and in one or two positions inside each source guide tube. This swab will then be metered and if found to contain less than .2 mr per hour, the swab will be sent to David Gooden for interpretation. If the swab is found to contain over .2 mr per hour, the source and equipment will be removed from operation and the manufacturer of the equipment contacted immediately. Records of these tests will be kept in micro curies as illustrated in the attached sample.

Leak test kits will be supplied by the following:

1. David S. Gooden, Model 1000
2. Technical Operations, Model 518
3. Automation Industries, Model LT-100

The samples are sent to:

David S. Gooden, Ph.D.  
Radiological Physicist  
6161 South Yale Avenue  
Tulsa, Oklahoma 74177  
License Number 35-13797-01