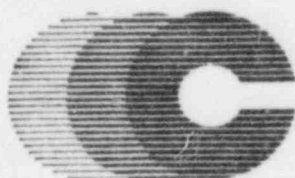


NUCLEAR ENERGY SERVICES, INC.  
CONAM INSPECTION DIVISION

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# **RADIATION SAFETY**

## **OPERATING & EMERGENCY**

### **PROCEDURES MANUAL**

8508290336 850611  
REG4 LIC30  
42-16559-01 PDR

AN AUTOMATION INDUSTRIES, INC., COMPANY



CONAM OPERATING & EMERGENCY MANUAL

REVISIONS

ALL ORIGINAL PAGES DATED 8-1-81

REVISION # 1 DATED 4-30-82 PAGES 68,14,45

REVISION # 2 DATED 7-7-82 PAGES 26,41,41(a),41(b),48  
59,60

DATED 8-18-82 PAGES 52,53

DATED 9-8-82 PAGE 22

DATED 10-8-82 PAGE APPENDIX "S"

DATED 10-8-82 PAGE 1

REVISION # 3 DATED 6-3-83 PAGES 7,8,59,60,68,72,73,74,71

REVISION # 4 DATED 10-21-83 PAGES 26,28,29,30,31,32,48,  
49,59

REVISION # 5 DATED 4-15-85 PAGES 7,59,60,64,74,75,76,77  
78,79,80,81



CONAM INSPECTION DIV.

OPERATING AND EMERGENCY PROCEDURE MANUAL

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OPERATING AND EMERGENCY PROCEDURE MANUAL  
(for the use of byproduct material)

1.0 PURPOSE AND SCOPE

- 1.1 The purpose of this manual is to establish mandatory procedures for CONAM Inspection Div., personnel who handle or use byproduct materials for performing industrial radiography. These procedures implement the requirements of C.F.R. Title 10, Parts 19-20-21 and 34 and thereby assure the safety of all personnel in the vicinity of radiation areas.
- 1.2 CONAM employees shall have a copy of this manual in their possession when handling or using byproduct materials.
- 1.3 Every CONAM employee must comply with these procedures. Failure to comply will be cause for immediate disciplinary action.

2.0 REFERENCES

- 2.1 The following references form a part of this manual.
  - (a) CONAM Inspection Div., Administrative Procedures Manual
  - (b) Byproduct Material License No. 42-16559-01

3.0 DEFINITIONS

For the purpose of these procedures, the following definitions apply:

- 3.1 "Radiography" means the examination for the structure of materials by nondestructive methods, utilizing sealed sources by byproduct materials.
- 3.2 "Radiographer" means any individual who performs or who, in attendance at the site where the sealed source or sources are being used, personally supervises radiographic operation and who is responsible to the licensee for assuring compliance with the requirements of N.R.C. regulations and the conditions of the license.
- 3.3 "Radiographer's Assistant" means any individual who, under the personal supervision of a radiographer, uses radiographic exposure devices, sealed sources or related handling tools, or radiation survey instruments in radiography.
- 3.4 "Radiographic exposure device" means any instrument containing a sealed source fastened or contained therein, in which the sealed source or shielding thereof may be moved, or otherwise changed, from a shielded to unshielded position for purposes of making a radiographic exposure.

- 3.5 "Sealed Source" means any byproduct material that is encased in a capsule designed to prevent leakage or escape of the byproduct material.
- 3.6 "Storage Container" means a device in which sealed sources are transported or stored.
- 3.7 "Radiation Area" means any area, accessible to personnel, in which there exists radiation, originating in whole or in part within licensed material, at such levels that a major portion of the body could receive in any one hour a dose in excess of 5 millirem, or in any 5 consecutive days a dose in excess of 100 millirems. (See Par. 9.0 for posting requirements).
- 3.8 "High Radiation Area" means any area, accessible to personnel, in which there exists radiation originating in whole or in part within licensed material in such levels that a major portion of the body could receive in any one hour a dose in excess of 100 millirem. (See Par. 9.0 for posting requirements).
- 3.9 "Rem" is a measure of the dose of any ionizing radiation to the body tissue in terms of its estimated biological effect relative to a dose of one roentgen (r) of x-rays. One r of x-rays equals one rem. One mr of x-rays equals one mrem (0.001 rem).

#### 4.0 REQUIREMENTS FOR REPORTS

- 4.1 Radiation Report - This form is shown in Appendix A. It serves as a record of the location of an exposure device containing a sealed source, as a utilization log and as a record of physical radiation surveys, dosimeter readings, and daily inspection of the radiographic equipment which must be made when a source is transported or used. It is to be signed by the radiographer in the space provided to certify that he has performed the required daily inspection of the radiographic equipment. It must be completed by the radiographer each day the source is assigned to him.
- 4.2 The radiation report is a three part form. The original and pink copy shall be forwarded to the regional office each day from local jobs and each week from out-of-town jobs. The yellow copy shall be retained by the radiographer so that a record of his activities are available for inspection at the job site.

4.3 Weekly Report - This form is shown in Appendix B. ( A form similar to Appendix B may be used if it contains spaces for the same dosimeter readings on the same daily basis). It includes space where the radiographer or assistant radiographer shall enter his dosimeter readings daily. The radiographer is responsible for checking the weekly report of his assistant to verify that dosimeter readings have been entered correctly.

4.3.1 The weekly report is a four part form. The original yellow and pink copies are forwarded to the regional office weekly from both local and out-of-town jobs. The goldenrod copy shall be retained by the radiographer and assistant radiographer so that a record of dosimeter readings are available for inspection at the job site.

4.3.2 On projects where radiography is performed under the direction of a site manager who is a member of the Radiation Safety Program (See Appendix "A" CONAM RSAM), weekly dosimeter reports may be submitted on a form as shown in Appendix B-1. The dosimeter readings shall be entered daily and verified by the site manager. One copy shall be retained at the job site and two copies forwarded to the regional office weekly.

## 5.0 PERSONNEL MONITORING REQUIREMENTS

### 5.1 Personnel Monitoring Equipment

5.1.1 Radiographers and radiographer's assistants shall wear a film badge and a pocket dosimeter at all times when working with ionizing radiation or transporting byproduct materials. The pocket dosimeter must be capable of measuring doses from zero to at least 200 milliroentgens.

5.1.2 A film badge shall be assigned to, and worn by, only one person, as it is the legal media for making the determination of an over exposure. Used film badges must be returned to the regional office immediately upon receipt of a replacement badge for the next badge period.

5.1.3 Badges not being worn shall be stored in a radiation free area.

5.1.4 Pocket dosimeters shall be recharged at the beginning of each work shift and periodic readings taken throughout the work shift. Such checking will give immediate indication of radiation exposure and work procedures shall be corrected if excessive exposure is noted. At the end of each work shift final readings will be taken and recorded.

5.1.5 Any individual whose pocket dosimeter goes off scale (over 200 mr), while using a source of radiation, shall immediately stop productive work, recharge his dosimeter and make a complete radiation survey of the area, making certain that no additional radiation exposure is received.

- (a) If the source of radiation is in the shielded position, immediately notify the Radiation Safety Officer, Assistant Officer, Manager or an Assistant Manager about the condition of the dosimeter.
- (b) If the source is in the exposed position, make certain the area is restricted and access is controlled to prevent a radiation hazard and notify the regional office about the condition of the source and your dosimeter. The individual's film badge shall be processed immediately. He shall not work in areas where he can receive additional exposure until the results reported show that his total exposure is not in excess of allowable limits.

## 5.2 Permissible Dose Levels

5.2.1 An individual may receive a dose to the whole body of 3 rems per calendar quarter provided that:

- (a) The dose to the whole body, when added to the accumulated occupational dose to the whole body shall not exceed 5 (N-18) rems when "N" equals the individual's age in years at his last birthday.
- (b) CONAM has on file his accumulated occupational dose to the whole body on a clear and legible record containing all the necessary information specified in Parts 20,20.102, Title 10, Code of Federal Regulations.

5.2.2 An individual may receive a dose to the whole body of only 1.250 rems per calendar quarter when the requirements of Paragraph 5.2.1 above cannot be met.

5.2.3 Even though the above doses are permitted, any dose is excessive if it could have been reduced by developing safer working procedures. Furthermore, CONAM considers continued doses over 100 mr per week as excessive and the individual will be notified of the amount of the exposure using CONAM'S "High Exposure Report" and an explanation for the high exposure will be required.

If continued excessive doses are caused by careless and negligent working procedures, disciplinary action will be taken.



- 5.2.4 An individual who receives a dose in excess of 3 rems per calendar quarter or 1.250 rems per calendar quarter, when applicable, will be notified of the amount of the exposure using CONAM'S "Over-Exposure-Report". The notice will be made in duplicate form and will contain the statement required in 10-CFR Part 19.13, Code of Federal Regulations. The individual must acknowledge receipt of the report by signing and returning one copy to the regional office, and shall submit a written explanation of the circumstances causing the overexposure.

#### 6.0 RADIATION SURVEY INSTRUMENT REQUIREMENTS

- 6.1 A calibrated and operable radiation survey instrument having a range such that two milliroentgens per hour through one roentgen per hour can be measured shall be available and used to make physical radiation surveys. Specific procedures for making radiation surveys will be found under each appropriate section hereafter in this document.
- 6.2 Each radiation survey instrument shall be calibrated at intervals not to exceed three months and after each repair. Records shall be maintained of calibrations. The calibration void date shall be with each instrument.
- 6.3 If a radiation survey instrument becomes inoperative or its beyond its required date of recalibration, the radiographer shall suspend all activities using sealed sources until it is replaced with a properly calibrated and operable instrument.
- 6.4 Radiation survey instruments transported in company vehicles should be carried in the driver's compartment.
- 6.5 Operating instructions for approved instruments are as follows:
- (a) Eberline Instrument - Model E-120G, E130, E130A and 510G
1. Turn switch to the battery check position. The meter should indicate in the battery OK area. (E130G push button)
  2. Turn switch to:  
E120 (X 0.1 x 1 or x 10)  
E510, E130 and 130A (x 1, x 10 or x 100)  
Position according to radiation intensity field being surveyed. Meter reading must be multiplied by this switch position.
  3. Response control- control response time of meter to the most desirable compromise between speed and fluctuation for the particular usage.
  4. Reset-Discharges instrument bringing meter reading to zero rapidly.

(b) G.E. Smith Model 1000A, M1000, M2000, Ludlum #4 & #6

1. Turn switch to the battery check position. The meter should indicate in the battery OK area.
2. Turn switch to X1, X 10 or X 100 position according to radiation intensity field being surveyed. Meter reading must be multiplied by this switch position.

(c) Ludlum #5

1. Turn switch to (X 0.1 X 1 X 10 X 100 X 1000) Position according to radiation intensity field being surveyed. Meter reading must be multiplied by this switch position.
2. Push battery check button. The meter should indicate in battery OK area.

(d) Victoreen Instruments - Models 492 and 592B

1. Turn on/off switch to zero position.
2. Allow minimum 30 seconds warm up time.
3. Adjust indicator to zero.
4. Turn on/off switch to X-100 position.
5. Check radiation area with switch in this position. (On/off switch can be turned to lower radiation recording level once it has been ascertained a lower level exists).

Recording scale reads 0 to 10 MR/HR

1. When on/off switch is set on X-1 read scale direct. This will register MR/HR.
2. When on/off switch is set on X-10, read scale direct and multiply by 10, this will give you MR/HR.
3. When on/off switch is set on X-100, this will give you MR/HR.

(e) Canadian Admiral - Model 5016C

1. Turn switch to battery check position. The meter should indicate in the battery OK area.
2. Turn switch to desired high or low position. High position - Read upper scale .1R/HR to 10 R/HR  
Low position - Read lower scale 0MR/HR to 100 MR/HR.

(f) Gamma Products - Gamma Grabber

1. Press toggle switch to "on position.
2. Press battery check switch; the meter should indicate in the battery OK area.
3. Turn range switch to X 1, X 10 or X 100 position according to radiation intensity field being surveyed.
4. When range switch is in the:  
X 1 position meter reads 0 to 10 mr/hr.  
X 10 position meter reads 0 to 100 mr/hr.  
X 100 position meter reads 0 to 1 R/hr.

(g) Gamma Industries - Model 252B SMAC, 250 & 200

1. Turn switch to battery check position the battery should indicate above the check position.
2. Turn switch to the desired range, meter reading must be multiplied by this range number.

(h) Bicron Corporation - Model Radiographer

1. Turn switch to battery check position. The check should indicate battery OK.
2. Turn switch to the desired range. Meter reading must be multiplied by this range number.



## 7.0 SECURITY OF SEALED SOURCES

- 7.1 Each radiographic exposure device shall be provided with a lock designed to prevent unauthorized or accidental removal or exposure of a sealed source and shall be kept locked at all times except when in use and under the direct surveillance of a radiographer or radiographer's assistant.
- 7.2 Each radiographic exposure device shall be stored in a container or place (such as a room, area, or truck) which is provided with locks and such other safeguards as may be needed to protect against unauthorized or accidental removal.
- 7.3 A physical radiation survey shall be made to the outside surfaces of the storage container or place, and the radiation levels shall not exceed 2 mr per hour at 12" inches from the surface.
- 7.4 A sign bearing the radiation caution symbol (magenta on yellow background) with the words "CAUTION - RADIOACTIVE MATERIAL" must be posted on the outside of the container or place.
- 7.5 Sealed sources, not assigned to job sites, will not remain in a vehicle overnight. Sources must be secured in storage areas designated for each CONAM office location.

## 8.0 TRANSPORTATION OF SEALED SOURCES

- 8.1 Whenever a radiographic exposure device containing a sealed source is transported, it must be secured in a storage compartment of the transporting vehicle to prevent shifting or loss. The device and the compartment must be posted with a sign bearing the radiation caution symbol (Magenta on yellow background) with the words "CAUTION-RADIOACTIVE MATERIAL."
- 8.2 A physical radiation survey shall be made of the storage compartment and the levels of radiation shall not exceed the levels referenced in paragraph 7.3. The radiation level at the driver's location shall not exceed two (2) mr per hour. A record of the survey shall be made on the Radiation Report (See Appendix A).
- 8.3 The transporting vehicle must be posted in accordance with Department of Transportation regulations, with radiation warning signs stating "RADIOACTIVE." The signs shall be posted on all four (4) sides of the vehicle.

8.4 Emergency procedures to be followed in the event of a road accident are detailed in Paragraph 11.1

9.0 INSTRUCTIONS FOR RESTRICTING AND CONTROLLING ACCESS TO RADIOGRAPHIC AREAS

9.1 Each Radiographic Area must be barricaded or roped off and posted with a minimum of four signs, one at each 90 degrees at the perimeter (2mr/hr) reading "CAUTION-RADIATION AREA." The perimeter of the high radiation area (100 mr/hr calculated) shall be conspicuously posted with "CAUTION-HIGH RADIATION AREA " signs. These are defined in paragraph 3.7 and 3.8. The approximate perimeter of the high radiation and radiation areas can be determined by referencing the Radiation Level/Distance Charts (see Appendix D). A radiation survey shall be made to adjust the boundaries of the radiation area as soon as the source has been exposed. The total quantity of radiation in any one hour shall not exceed 2 mr at the barrier. The radiographer and/or assistant radiographer shall keep the area under constant surveillance to protect against unauthorized entry, except where areas are equipped with control devices, locks or alarm systems to protect against unauthorized or accidental entry.

9.1.1 The radiographer must complete a radiation report (see Appendix A) each time a temporary radiographic area is erected.

9.2 For cross-country pipeline inspection, wherein the work progress in a forward direction constantly changing with each radiograph, the radiographer shall:

- (a) Make a survey to determine the perimeter of the 2 mr/hr area.
- (b) Post "CAUTION-RADIATION AREA" signs at the 2 mr/hr perimeter. One sign to be placed to the rear and one sign forward of the weld being radiographed.
- (c) Determine that no obstruction exists which will prevent or interfere with a constant surveillance in all directions.
- (d) Maintain constant surveillance during each exposure.

9.2.1 The radiographer must complete a radiation report (see Appendix A) each shift radiography is performed under the above conditions of constantly changing pipeline locations.

9.3 The procedures specified in Paragraph 9.1, shall be followed when exchanging sealed sources between a radiography exposure device and source changer.

9.4 If any unauthorized person enters the radiation area the source will be retracted and no exposures made until the area is cleared.

#### 10.0 PROCEDURES FOR HANDLING AND USE OF LICENSED SEALED SOURCES AND RADIOGRAPHIC EXPOSURE DEVICES

10.1 General- All sealed sources used for industrial radiography by CONAM Inspection Div., are housed in remote operated, shielded camera type devices. The handling of byproduct materials using "open air" or "fish pole" techniques is prohibited. Any available natural shielding and/or a collimator shall be used when practicable.

10.2 When performing radiography, a physical radiation survey must be made at 3 points on the exposure device (rear, front and top) as follows:

- (a) After each radiographic exposure to determine that the sealed source has been returned to its shielded position. In addition to the above 3 point survey, the guide tube must be surveyed after each exposure.
- (b) Prior to securing the radiographic exposure device, to determine that the sealed source is in its shielded position. The highest reading of this survey must be recorded on the radiation report (see Appendix A).

10.2.1 In no case should the levels of radiation for the above surveys 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 50 milliroentgens per hour at six (6) inches from any exterior surface of the device.
- (b) 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 200 milliroentgens per hour at any exterior surface, and ten (10) milliroentgens per hour at one meter from any exterior surface.

- 10.3 Each licensed radiographic exposure device is described on the following pages along with specific operating procedures:

THESE PROCEDURES ARE TO BE FOLLOWED FOR MAKING A COMPLETE EXPOSURE CYCLE. RADIOGRAPHIC PROCESSES REQUIRING MORE THAN ONE EXPOSURE ARE TO FOLLOW THE PROCEDURES TO POINT XXX. EXPOSURE, SURVEYS AND RETRACTING OPERATIONS ARE TO BE REPEATED AS REQUIRED AND THE PROCEDURE CONTINUED AT THE END OF THE LAST EXPOSURE.

10. Crank source out as smoothly as possible. When you feel that source is approaching end of guide tube, slow turning speed so that pigtail does not bang into the end of guide tube.
11. Survey to determine that radiation levels do not exceed 2 mr/hr at the boundaries or perimeter of the radiographic area.
12. At end of exposure, retract source into the exposure device by reversing the crank action.
13. Survey camera and guide tube carefully to be sure that source has returned to a safe position.
14. Depress plunger lock.

(WARNING: THIS EXPOSURE DEVICE CAN BE LOCKED IN UNSAFE POSITION)

15. Disconnect source tube and insert safety plug.

or

Cause a constant survey to be performed at the camera until the source is re-exposed.

XXX

16. Disconnect control cables and replace protector cap.

The location of the source (storage safe, guide tube or exposure position) must always be determined by using a survey meter before, during and after each exposure.

- (a<sub>1</sub>) BUDD COMPANY UNITRON, MODEL 110AB, CAPACITY - 10 CURIES, COBALT 60

This unit consists of three main components (1) a head in which the source is stored, (2) a flexible guide tube, and (3) a control box and mechanical source positioner.

Size:	16" diameter (storage safe)
Weight:	580 pounds
Guide Tube:	up to 23 ft. long
Control Cables:	25 ft. long

Operation:

This unit is operated in an identical manner to Budd Company Model 52B. All procedures remain the same.

The location of the source (storage safe, guide tube, or exposure position) must always be determined by using a survey meter before, during and after each exposure.



### 10.3.1 BUDD COMPANY AND AUTOMATION INDUSTRIES CAMERAS

These procedures are to be followed for making a complete exposure cycle. Radiographic processes requiring more than one exposure are to follow the procedures to point XXX. Exposure, surveys and retracting operations are to be repeated as required and the procedure continued at the end of the last exposure.

(a) BUDD COMPANY MULTITRON, MODEL 52B, CAPACITY - 30 CURIES, COBALT 60

This unit consists of three main components:  
(1) a head in which the source is stored, (2) a flexible guide tube and (3) a control box and mechanical source positioner.

Size:	18" x 18" (storage safe)
Weight:	800 pounds
Guide Tube:	up to 23 ft. long
Control Cables:	25 ft. long

All exposure devices must be inspected at the beginning of each day that it is used. The radiographer making the inspection will sign the radiation report in the space provided, certifying the inspection was performed.  
INSPECTION PROCEDURES ARE FOUND IN SECTION 13.0

#### Operation: SURVEY CAMERA

1. Remove the protector cap from the lock box thereby exposing the pigtail connector.
2. Crank the control to a length of approximately six inches.
3. Connect control cable to source pigtail.
4. Crank control cable in so that male connecting thread can be screwed into lock box.
5. Screw control cable into lock box.
6. Remove safety plug from the out connection approximately two inches from top of unit and connect the guide tube.
7. Place free end of guide tube in desired position trying to keep it in a straight line without kinks.
8. Stretch control cable away from exposure device in as straight a line as possible.
9. Unlock exposure device.

#### BUDD COMPANY AND AUTOMATION INDUSTRIES CAMERA

These procedures are to be followed by making a complete exposure cycle. Radiographic processes requiring more than one exposure are to follow the procedures to point XXX. Exposure, surveys and retracting operations are to be repeated as required and the procedure continued at the end of the last exposure.

#### (b) BUDD COMPANY MULTITRON, MODEL 51B, CAPACITY 40 CURIES, COBALT 60

This unit consists of three main components (1) a head in which the source is stored, (2) a flexible guide tube, and (3) a control box and mechanical source positioner.

Size:	28" x 20 x 22"
Weight:	975 pounds
Guide Tube:	up to 23 ft. long
Control Cables:	25 ft. long

All exposure devices must be inspected at the beginning of each day that it is used. The radiographer making the inspection will sign the radiation report in the space provided, certifying the inspection was performed. INSPECTION PROCEDURES ARE FOUND IN SECTION 13.0

#### Operation: SURVEY CAMERA

1. Remove the protector cap from the lock box thereby exposing the pigtail connector.
2. Crank the control cable to a length of approximately six inches.
3. Connect the control cable to source pigtail.
4. Crank control cable in so that male connecting thread can be screwed into lock box.
5. Screw control cable into lock box.
6. Remove safety plug from the out connection approximately two inches from top of unit and connect the guide cable.
7. Place the free end of guide tube in desired position trying to keep in a straight line without kinks.

8. Stretch control cable away from exposure device in as straight a line as possible.
9. Unlock exposure device.
10. Crank source out as smoothly as possible. When you feel that source is approaching end of guide tube, slow turning speed so that pigtail does not bang into the end of guide tube.
11. Survey to determine that radiation levels do not exceed 2mr/hr at the boundaries or perimeter of the radiographic area.
12. At end of exposure, retract source into the exposure device by reversing the cranking action.
13. Survey camera and guide tube carefully to be sure that source has returned to a safe position.
14. Depress plunger lock.  
(WARNING- THIS EXPOSURE DEVICE CAN BE LOCKED IN AN UNSAFE POSITION)
15. Disconnect source tube and insert safety plug.  
OR  
Cause a constant survey to be performed at the camera until the source is exposed.

XXX

16. Disconnect control cables and replace protector cap.

The location of the source (storage safe, guide tube or exposure position) must always be determined by using a survey meter before, during and after each exposure.

#### BUDD COMPANY AND AUTOMATION INDUSTRIES CAMERAS

These procedures are to be followed for making a complete cycle. Radiographic processes requiring more than one exposure are to follow the procedures to point XXX. Exposure, surveys and retracting operations are to be repeated as required and the procedure continued at the end of the last exposure.



(c) BUDD COMPANY IRIDITRON, MODELS 100A and 100A-1,  
CAPACITY - 100 CURIES, IRIIDIUM 192.

This is a special light weight unit using depleted uranium for shielding material.

This unit consists of three main components (1) a head in which the source is stored, (2) a flexible guide tube, and (3) a control box and mechanical source positioner.

All exposure devices must be inspected at the beginning of each day that it is used. The radiographer making the inspection will sign the radiation report in the space provided, certifying the inspection was performed.

INSPECTION PROCEDURES ARE FOUND IN SECTION 13.0

Operation: SURVEY CAMERA

1. Remove the protector cap from the lock box thereby exposing the pigtail connector.
2. Crank the control cable to a length of approximately six inches.
3. Connect control cable to source pigtail.
4. Crank control cable in so that male connecting thread can be screwed into lock box.
5. Screw control cable into lock box.
6. Remove safety plug from the out connection approximately two inches from top of unit and connect the guide tube.
7. Place free end of guide tube in desired position trying to keep it in a straight line without kinks.
8. Stretch control cable away from exposure device in as straight a line as possible.
9. Unlock exposure device.
10. Crank source out as smoothly as possible. When you feel that source is approaching end of guide tube, slow turning speed so that pigtail does not bang into the end of guide tube.

11. Survey to determine that radiation levels do not exceed 2 mr/hr at the boundaries or perimeter of the radiographic area.
12. At end of exposure, retract source into the exposure device by reversing the cranking action.
13. Survey camera and guide tube carefully to be sure that source has returned to a safe position.
14. Depress plunger lock.  
(WARNING- THIS EXPOSURE DEVICE CAN BE LOCKED IN AN UNSAFE POSITION)

XXX

15. Disconnect source tube and insert safety plug.
16. Disconnect control cables and replace protector cap.

The location of the source (storage safe, guide tube or exposure position) must always be determined by using a survey meter before, during and after each exposure.

#### BUDD COMPANY AND AUTOMATION INDUSTRIES CAMERAS

These procedures are to be followed for making a complete exposure cycle. Radiographic processes requiring more than one exposure are to follow the procedures to point XXX. Exposure, surveys and retracting operations are to be repeated as required and the procedure continued at the end of the last exposure.

(d) AUTOMATION INDUSTRIES IRIDITRON MODEL 520  
CAPACITY 100 CURIES IRIIDIUM 192

This is a special light weight unit using depleted uranium for shielding material.

This unit consists of three parts (storage safe, control cables, and guide tube).

Size:	10" 1x 5 $\frac{1}{4}$ " W x 7" H
Weight:	40 pounds
Guide Tube:	up to 23 ft. long
Control Cables:	25 ft. long

All exposure devices must be inspected at the beginning of each day that it is used. The radiographer making the inspection will sign the radiation report in the space provided, certifying the inspection was performed.

INSPECTION PROCEDURES ARE FOUND IN SECTION 13.0

Operation: SURVEY CAMERA

1. Remove the protector cap from the lock box thereby exposing the pigtail connector.
2. Crank the control cable to a length of approximately six inches.
3. Connect control cable to source pigtail.
4. Crank control cable in so that male connecting thread can be screwed into lock box.
5. Screw control cable into lock box.
6. Remove safety plug from the out connection approximately two inches from top of unit and connect the guide tube.
7. Place free end of guide tube in desired position trying to keep it in a straight line without kinks.
8. Stretch control cable away from exposure device in as straight a line as possible.
9. Unlock exposure device.
10. Crank source out as smoothly as possible. When you feel that source is approaching end of guide tube, slow turning speed so that pigtail does not band into the end of guide tube.
11. Survey to determine that radiation levels do not exceed 2 mr/hr at the boundaries or perimeter of the radiographic area.
12. At end of exposure, retract source into the exposure device by reversing the cranking action.
13. Survey camera and guide tube carefully to be sure that source has returned to a safe position.

14. Depress plunger lock.  
(WARNING - THIS EXPOSURE DEVICE CAN BE LOCKED IN UNSAFE POSITION)

XXX

15. Disconnect source tube and insert safety plug.
16. Disconnect control cables and replace protector cap.

The location of the source (storage safe, guide tube or exposure position) must always be determined by using a survey meter before, during and after each exposure.

#### BUDD COMPANY AND AUTOMATION INDUSTRIES CAMERAS

These procedures are to be followed for making a complete exposure cycle. Radiographic processes requiring more than one exposure are to follow the procedures to point XXX. Exposure, surveys and retracting operations are to be repeated as required and the procedure continued at the end of the last exposure.

- (e) AUTOMATION INDUSTRIES MULTITRON MODEL 151 H,  
CAPACITY - 100 CURIES COBALT 60

This unit consists of three main components (1) a head in which the source is stored, (2) a flexible guide tube, and (3) a control box and mechanical source positioner.

Size:	22" x 20" polygon (storage safe)
Weight:	2,000 lbs. wheel mounted
Guide Tube:	up to 23 ft. long
Control Cables:	25 ft. long

All exposure devices must be inspected at the beginning of each day that it is used. The radiographer making the inspection will sign the radiation report in the space provided, certifying the inspection was performed.

INSPECTION PROCEDURES ARE FOUND IN SECTION 13.0

#### Operation: SURVEY CAMERA

1. Remove the protector cap from the lock box thereby exposing the pigtail connector.

2. Crank the control cable to a length of approximately six inches.
3. Connect control cable to source pigtail.
4. Crank control cable in so that male connecting thread can be screwed into lock box.
5. Screw control cable into lock box.
6. Remove safety plug from the out connection approximately two inches from top of unit and connect the guide tube.
7. Place free end of guide tube in desired position trying to keep it in a straight line without kinks.
8. Stretch control cable away from exposure device in as straight a line as possible.
9. Unlock exposure device.
10. Crank source out as smoothly as possible. When you feel that source is approaching end of guide tube, slow turning speed so that pigtail does not bang into the end of guide tube.
11. Survey to determine that radiation levels do not exceed 2 mr/hr at the boundaries or perimeter of the radiographic area.
12. At end of exposure, retract source into the exposure device by reversing the cranking action.
13. Survey camera and guide tube carefully to be sure that source has returned to a safe position.
14. Depress plunger lock.  
(WARNING - THIS EXPOSURE DEVICE CAN BE LOCKED IN AN UNSAFE POSITION)
15. Disconnect source tube and insert safety plug.  
OR  
Cause a constant survey to be performed at the camera until the source is re-exposed.

XXX

The location of the source (storage safe, guide tube or exposure position must always be determined by using a survey meter before, during and after each exposure).

### 10.3.2 GAMMA INDUSTRIES AND GULF NUCLEAR CAMERAS

These procedures are to be followed for making a complete exposure cycle. Radiographic processes requiring more than one exposure are to follow the procedure to point XXX. Exposure, surveys and retracting operations are to be repeated as required and the procedure continued at the end of last exposure.

- (a) GAMMA "CENTURY" AND GULF NUCLEAR 20V  
CAPACITY - 100 CURIES IRIDIUM 192
- (b) GULF NUCLEAR 40V  
CAPACITY - 200 CURIES IRIDIUM 192

These are special light weight units using depleted uranium for shielding material.

These units consists of three parts (storage safe, control cables, and guide tube).

	<u>Century</u>	<u>20V / 40V</u>
Size:	5¼ diameter, 8" high	9-3/8"x6"x4-3/4
Weight:	32 pounds	37 pounds/39 pounds
Guide Tube:	up to 23 ft. long	up to 23 ft. long
Control Cables:	25 ft. long	25 ft./50 ft. long

All exposure devices must be inspected at the beginning of each day that it is used. The radiographer making the inspection will sign the radiation report in the space provided, certifying the inspection was performed.

INSPECTION PROCEDURES ARE FOUND IN SECTION 13.0

#### Operation: SURVEY CAMERA

1. Remove the protector cap from the lock box thereby exposing the pigtail connector.
2. Crank the control cable to a length of approximately six inches and connect to the pigtail.
3. Crank the control cable in so that male connection thread can be screwed into lock box.
4. Screw control cable into lock box.
5. Remove safety plug from protruding nipple at the source exit port and connect the guide tube.



6. Place free end of guide tube in desired position trying to keep it in a straight line without kinks.
7. Stretch control cable away from exposure device in as straight a line as possible.
8. Unlock exposure device.
9. Crank source out as smoothly as possible. When you feel that source is approaching end of guide tube, slow turning speed so that pigtail does not bang end of guide tube.
10. Survey to determine that radiation levels do not exceed 2mr/hr at the boundaries or perimeter of the radiographic area.
11. At end of exposure, retract source into exposure device by reversing the cranking action.
12. Survey camera and guide tube carefully to be sure that source has returned to a safe position.
13. Depress plunger lock.  
(WARNING - THIS EXPOSURE DEVICE CAN BE LOCKED IN UNSAFE POSITION)

XXX

14. With CONAM locking device.
  - (a) Depress plunger lock
  - (b) Lock standard hasp lock in plunger mechanism
15. Disconnect control cables and replace protector cap.
16. Disconnect source tube and insert safety plug.

The location of the source (storage safe, guide tube, or exposure position) must always be determined by using a survey meter before, during and after each exposure.

## GAMMA INDUSTRIES CAMERAS

These procedures are to be followed for making a complete exposure cycle. Radiographic processes requiring more than one exposure are to follow the procedures to point XXX. Exposure, surveys and retracting operations are to be repeated as required and the procedure continued at the end of the last exposure.

(b) GAMMA INDUSTRIES MODEL 35, CAPACITY- 35 CURIES,  
IRIDIUM 192

This is a special light weight unit using depleted uranium for shielding material. This unit consists of three parts (storage safe, control cables, and guide tube).

Size:	5¼" diameter, 7 1/8" high
Weight:	25 pounds
Guide Tube:	up to 23 ft. long
Control Cables:	25 ft. long

All exposure devices must be inspected at the beginning of each day that it is used. The radiographer making the inspection will sign the radiation report in the space provided, certifying the inspection was performed.

INSPECTION PROCEDURES ARE FOUND IN SECTION 13.0

Operation: SURVEY CAMERA

1. Remove the protector cap from the lock box thereby exposing the pigtail connector.
2. Crank the control cable to a length of approximately six inches and connect to the pigtail.
3. Crank the control cable in so that male connection thread can be screwed into lock box.
4. Screw control cable into lock box.
5. Remove safety plug from protruding nipple approximately one inch from top of unit and connect the guide tube.
6. Place free end of guide tube in desired position trying to keep it in a straight line without kinks.



7. Stretch control cable away from exposure device in as straight a line as possible.
8. Unlock exposure device.
9. Crank source out as smoothly as possible. When you feel that source is approaching end of guide tube slow turning speed so that pigtail does not bang end of guide tube.
10. Survey to determine that radiation levels do not exceed 2 mr/hr at the boundaries or perimeter of the radiographic area.
11. At end of exposure, retract source into the exposure device by reversing the cranking action.
12. Survey camera and guide tube carefully to be sure that source has returned to safe position.
13. Depress plunger lock.  
(WARNING - THIS EXPOSURE DEVICE CAN BE LOCKED IN AN UNSAFE POSITION).

XXX

14. With CONAM locking device:
  - (a) Depress plunger lock
  - (b) Lock standard hasp lock in plunger mechanism
15. Disconnect control cables and replace protector cap.
16. Disconnect source tube and insert safety plug.

The location of the source (storage safe, guide tube, or exposure position) must always be determined by using a survey meter before, during and after each exposure.

(c) PIPELINER CAMERAS-

GAMMA PIPELINER MODEL 1 AND GULF NUCLEAR 10X  
CAPACITY - 100 CURIES, IRIIDIUM 192

GAMMA PIPELINER MODEL 201 -  
CAPACITY - 200 CURIES, IRIIDIUM 192

SPEC CHECK II  
CAPACITY - 150 CURIES, IRIIDIUM 192

These are special light weight units using depleted uranium for shielding material.

These units are completely self-contained exposure devices and the Iridium 192 source never leaves the shield.

Size: 4½" to 9" diameter, 5½" to 7" High-exclusive of handle

Weight: 30 to 40 pounds

Remote flexible positioning device-optional

OPERATION

The radiographer must enter a strong field of scattered radiation to operate these devices and his positioning and quickness of operation are important factors to stay within permissible dosage limits. Therefore, each radiographer selected to use these devices must be issued a copy of the Manufacturer's detailed operating instructions.\* His ability to use these devices safely must also be tested before he is allowed to perform any radiography.

(d) GAMMA INDUSTRIES GAMMATRON 50 AND 100  
CAPACITY - 50 CURIES, CO60 AND 100 CURIES, CO60

Procedures are identical to those for Budd Model 52-B found on Page 13.

10.3.3 TECHNICAL OPERATIONS CAMERAS

These procedures are to be followed for making a complete exposure cycle. Radiographic processes requiring more than one exposure are to follow the procedure to point XXX. Exposure, surveys and re-tracing operations are to be repeated as required and the procedure continued at the end of the last exposure.

(a) TECHNICAL OPERATIONS MODEL 446, CAPACITY - 75 CURIES,  
COBALT 60.

This unit is mounted on large tires and can be rolled to the inspection area. The control cables and guide tube can be packed inside the unit. The storage s fe itself is mounted over the axle in the forward end of t ie trundle unit.

\* SEE APPENDIX "S" FOR INSTRUCTIONS

Size:	50" x 28" x 26"
Weight:	1,400 pounds
Guide Tube:	21 ft. long (three 7 ft. sections)
Control Cable:	25 ft. long

All exposure devices must be inspected at the beginning of each day that it is used. The radiographer making the inspection will sign the radiation report in the space provided, certifying the inspection was performed.

INSPECTION PROCEDURES ARE FOUND IN SECTION 13.0

Operation: SURVEY CAMERA

The radioactive source itself is sealed in a stainless capsule securely fastened to the end of the steel cable. A remote control hand crank propels the cable and the source out of the storage safe through the guide tube until the source reaches the exposure position. This cranking action requires three or four seconds to complete. When the exposure is ended, reverse the cranking action until the source is returned to the storage safe.

1. Move the storage container to the approximate operating location.
2. Position the exposure end to the guide tube as desired and extend the guide tube in as near a straight line as possible without kinking.
3. Position the storage container so that guide tube can be connected.
4. Stretch control cables away from exposure device in as straight line as possible.
5. Unlock and remove safety plug.

NOTE: Survey the opening to make certain the sealed source has not moved from the safe position.

6. Connect guide tube. Unit is ready to operate.
7. Crank out as smoothly as possible. When you feel the source approaching end of tube, slow turning speed so that pigtail does not bang end.
8. Survey to determine that radiation levels do not exceed 2 mr/hr at the boundaries or perimeter of the radiographic area.
9. At end of exposure, retract source into unit.
10. Survey camera and guide tube carefully to be sure that source has returned to safe position.

11. Disconnect guide tube, replace the lock safety plug  
OR  
Cause a constant survey to be performed at the camera until the source is re-exposed.

XXX

The location of the source (storage safe, guide tube, or exposure position) must always be determined by using a survey meter before, during and after each exposure.

This unit may be equipped with a flashing light on the remote hand crank to indicate when the radiation source is safely stored. This light does not eliminate the use of the survey meter. A physical survey of the exposure device must be made to definitely establish that the source is safely stored.

(b) TECHNICAL OPERATIONS MODEL 533, CAPACITY 100 CURIES, IRIDIUM 192

This unit has a light weight portable storage safe using depleted uranium for a shielded material. The control unit which includes control cables and guide tubes, is a removable storage reel.

These procedures are to be followed for making a complete exposure cycle. Radiographic processes requiring more than one exposure are to follow the procedures to point XXX. Exposure, surveys and retracting operations are to be repeated as required and the procedure continued at the end of the last exposure.

Size:	14" x 14½" x 9¼"
Weight:	38 pounds
Guide tube:	21 ft. long (three 7 ft. sections)
Control Cable:	25 ft. long

All exposure devices must be inspected at the beginning of each day that it is used. The radiographer making the inspection will sign the radiation report in the space provided, certifying the inspection was performed.

INSPECTION PROCEDURES ARE FOUND IN SECTION 13.0

OPERATION: SURVEY CAMERA

1. Remove the protector cap from the lock box thereby exposing the pigtail connector.
2. Crank the control cable to the length of approximately six inches.
3. Connect control cable to pigtail.
4. Crank control cables in until connecting studs engage with the lock box.

5. Remove safety plug from the "out" connection of the exposure device and connect the guide tubes.
6. Extend guide tube and control cables in as near a straight line as possible and place free guide tube at the exposure position.
7. Unlock exposure device. Unit is ready to operate.
8. Survey to determine that radiation levels do not exceed 2 mr/hr at the boundaries or perimeter of the radiographic area.
9. At end of exposure, retract source into unit.
10. Survey camera and guide tube carefully to be sure that source has returned to safe position.
11. Depress plunger lock.  
(WARNING - THIS EXPOSURE DEVICE CAN BE LOCKED IN AN UNSAFE POSITION)

XXX

12. Disconnect source tube and insert safety plug.
13. Disconnect control cables and replace protector cap.

The location of the source (storage safe, guide tube or exposure position) must always be determined by using a survey meter before, during and after each exposure.

(c) TECHNICAL OPERATIONS MODEL 616, CAPACITY 200 CURIES, IRIDIUM 192

This unit is a light weight, high capacity (200 curies Iridium 192), vacuum operated, remotely controlled system utilizing a manually/mechanically established vacuum with an on-off/exposed-stored source control.

These procedures are to be followed for making a complete exposure cycle. Radiographic processes requiring multiple exposures are to follow the procedure to point XXX. Exposures, surveys and retracting operations are to be repeated as required and the procedure continued at the last exposure.

Projector:

Size: 6¼" diameter, 11½" long  
Weight: 45 lbs.

Control Unit:

Size: 10½" wide, 10½" high, 7½", deep  
Weight: 16 lbs.  
Control Cable  
Length: 25 ft. with optional length to 50 ft.

All exposure devices must be inspected at the beginning of each day that it is used. The radiographer making the inspection will sign the radiation report in the space provided, certifying the inspection was performed.

INSPECTION PROCEDURES ARE FOUND IN SECTION 13.0

OPERATION: SURVEY CAMERA

1. Position the vacuum control unit, with the hose attached, and the camera as far apart from each other safely possible.
  2. Remove the protective stopper from the source actuator and remove foreign matter, if any, from the opening.
  3. Uncoil and attach the flexible vacuum hose to the source actuator, having insured that the control unit is in the "OFF" position.
  4. Approach the camera while observing the survey meter.
  5. Unlock the camera by turning the key lock in the source actuator housing. The lock cylinder will pop up.
  6. At the control unit, manually/mechanically create a vacuum so the gage reads between 20-25 inches.
  7. To begin the exposure move the control valve to the "EXPOSE" position. The vacuum will drop from 8-10 inches\*. Any decrease after the initial drop indicates a vacuum leak.
  8. Survey to determine that radiation levels do not exceed 2 mr/hr at the perimeter of the radiographic area.
  9. At the end of the exposure, press the control valve to the "OFF" position. Hold the valve down to release the vacuum and observe that the gage reads zero ("0").
  10. Approach the camera observing the survey meter. Perform the survey of the camera on all sides to insure the source is STORED.
  11. Depress the lock cylinder to lock the source.
- XXX
12. With the vacuum hose disconnected from the actuator and the camera locked, install the protective stopper in the source actuator housing.

The location of the source must always be determined by using a survey meter before, during and after each exposure.

\*When the vacuum control hose exceeds 50 ft. a proportionately greater vacuum drop may be initially experienced. If so, the vacuum should be increased to 12-15 inches.



#### 10.3.4 CALIBRATION INSTRUMENTS

Technical Operation Model 571 - Gamma survey meter calibration unit, capacity 15 - millicuries, Cobalt 60.

Gulf Nuclear Model IC 50 and IC 51 Cesium calibration units.

Capacity: 200 millicuries and 300 millicuries Cesium 137 respectively.

##### OPERATION:

In accordance with Manufacturer's Procedures and Section eighth in CONAMS Administrative Manual.

#### 10.3.5 SOURCE CHANGERS

##### (a) Automation Industries Changers

Models 500 SU, 43866, 41026, 43859, 43868  
43867, 60273, and I-563

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

Survey the Source Changer (Storage Container), all storage containers for sealed sources shall have no Radiation Level in excess of 200 milliroentgens per hour at any exterior surface or 10 milliroentgens per hour at one meter from any exterior surface. If the readings exceed these limits, immediately discontinue source transfer and notify the Radiation Safety Office.

1. After opening the access cover plate, proceed as follows:
2. Locate the source changer within 2 feet of the camera.
3. Remove the safety plug from the camera outlet.
4. Remove the ROUND plug from the source changer, save the new source number plate.
5. Connect the short exchange tube supplied between the camera outlet and the source changer outlet.
6. Join the disconnects on control and source cable.
7. Connect the source crank assembly to camera lock box and extend control so that operator is positioned the maximum distance from the camera.

(NOW UNLOCK THE CAMERA)

8. Crank decayed source into source changer by turning control handle clockwise until source stops in the changer.
9. At this point, the survey meter should be employed to insure that the source has been safely located in the shielded position. (If the limits of 200 milliroentgens per hour at one meter are exceeded, return the decayed source to the camera and notify the radiation safety office).

10. Disconnect short source tube at source changer and disengage the disconnect, being careful not to pull out the source.
11. Replace the round plug securing decayed source in changer.
12. Remove Hex Head Plug from source changer being careful not to pull out source cable inside.
13. Carefully pull the source cable disconnect only enough to allow joining of disconnect.
14. Join disconnects on control and source cable.
15. Connect short source tube to source changer outlet.
16. Pull source into machine by turning control handle counterclockwise. Check radiation level at the camera (50 milliroentgens per hour at 6 inches from any surface for cameras who measure less than four inches from the source to any outside surface and 200 milliroentgens per hour at any surface of any camera four inches or more to any outside surface maximum) lock your camera. If your survey indicates a higher reading discontinue operations and notify the Radiation Safety Office.
17. After the survey has been made remove the short source tube.

SEE APPENDIX "E" FOR SHIPPING INSTRUCTIONS

(b) Gamma Industries Changers  
Models C-10 and C-8

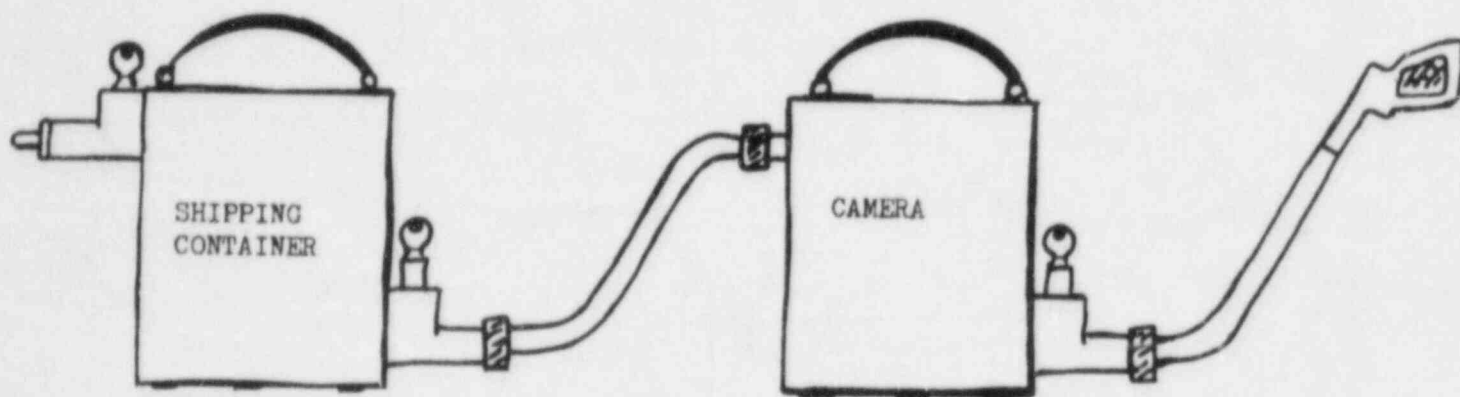
ALWAYS HAVE A PROPERLY OPERATING SURVEY METER AT HAND WHEN  
CHANGING SOURCES!

Survey the source changer (Storage Container) all storage containers for sealed sources shall have no Radiation Level in excess of 200 milliroentgens per hour at any exterior surface or 10 milliroentgens per hour at one meter from any exterior surface. If the readings exceed these limits immediately discontinue source transfer and notify the Radiation Safety Office. The container has two lock boxes - one on each side. The upper box is labeled "NEW SOURCE" and the upper tube contains the new source. The lower lock box and tube contain a safety plug when shipped to you. The lower tube will be used to return the decayed source.



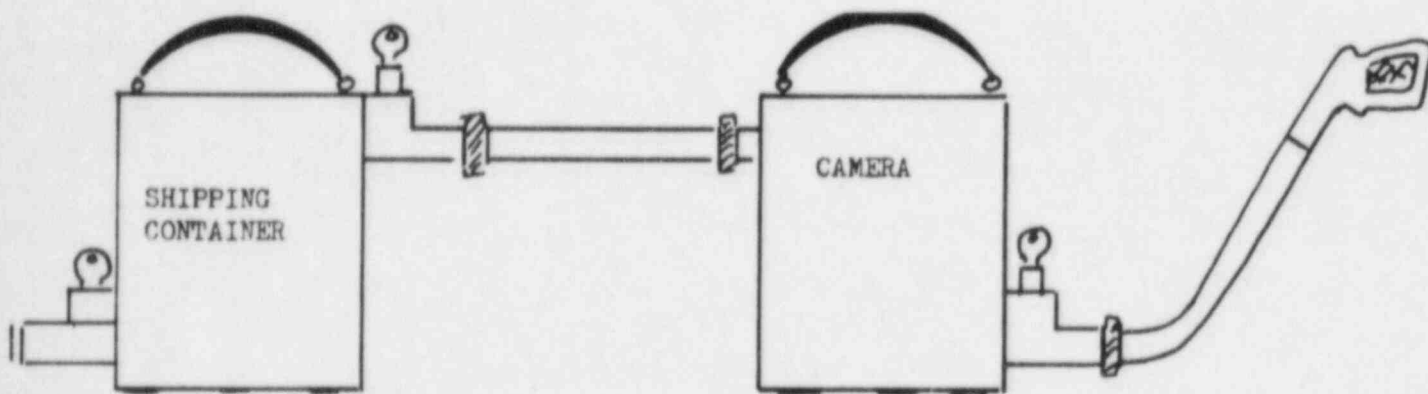
1. Locate the source changer within 2 feet of the camera.
2. Open the lower lock of the shipping container. Remove the safety plug.
3. Remove the safety plug from the camera outlet.
4. Connect one end of short exchange tube (provided in the shipping barrel) to the lower lock box of the shipping container. Attach the other end of the short exchange tube to your camera.
5. Join the disconnects on control and old source cable.
6. Connect the source crank assembly to camera lock box and extend control so that operator is positioned the maximum distance from the camera.

(NOW UNLOCK THE CAMERA)



7. Crank decayed source into source changer by turning control handle clockwise until source stops in the changer.
8. At this point, the survey meter should be employed to insure that the source has been safely located in the shielded position. (If the limits of 200 milliroentgens per hour at the surface or 10 milliroentgens per hour at one meter are exceeded, return the decayed source to the camera notify the radiation safety office). If the limits have not been exceeded proceed.

9. Lock the lower lock of the C-10 shipping container onto the old pigtail locking ball. You must be aware that the source could be removed from the open end of the lock box is not locked.
10. Remove the short exchange tube from the shipping container. Disconnect the control cable from the old pigtail. (Attempt to move the pigtail into and out of the shipping container to assure the lock is depressed upon the pigtail locking ball. If the pigtail can be moved, then open the lower lock, carefully move the pigtail and lock the lock upon the pigtail locking ball. This will assure that the old source will remain properly locked and shielded during the return shipment).
11. Remove the source protector cap from the upper lock box and attach over the old source pigtail in the lower lock box.
12. Attach the control cable to the new pigtail which is in the upper lock box.
13. Attach the short exchange tube to the C-10 shipping container upper lock box.



14. Unlock the upper lock from the new source.
15. Standing as far away as possible, crank the new source from the shipping container into your camera.

16. Survey. Camera limits are 50 milliroentgens per hour at 6 inches from any surface for cameras who measure less than four inches from the source to any outside surface and 200 milliroentgens per hour at any surface of any camera four inches or more to any outside surface if this is exceeded, notify the Radiation Safety Office.
17. Lock you camera lock.
18. Remove the short exchange tube from your camera. Remove the short exchange tube from the shipping container.
19. Insert the safety plug into the upper tube of the shipping container. Lock the upper lock of the shipping container.
20. Survey. Source changer limits are 200 milliroentgens per hour at any surface or 10 milliroentgens per hour at one meter from any surface. If this is exceeded, notify the Radiation Safety Office.
21. Place the C-10 into the barrel in the same orientation which it was received. Place the short exchange tube into the barrel. Place the top on the barrel and secure the locking ring.
22. Insert the safety seal into the barrel locking ring.
23. Survey. (The radiation intensity should not exceed 200 milliroentgens per hour at any barrel surface or 10 milliroentgens per hour at one meter from any barrel surface). If your survey indicates a higher reading discontinue operations and notify your Radiation Safety Office.

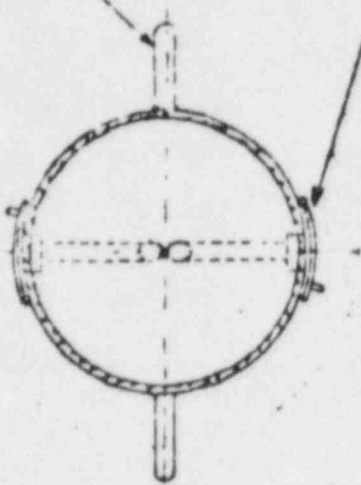
SEE APPENDIX "E" FOR SHIPPING INSTRUCTIONS

Model C-4

Enclosed herewith is a cross sectional view of the shipping container used for transporting your pigtail source. As you can see, the container consists of two tubes---one of which is labelled "NEW SOURCE" immediately above the opening in the side wall of the container. The second tube is empty and is for your decayed source.

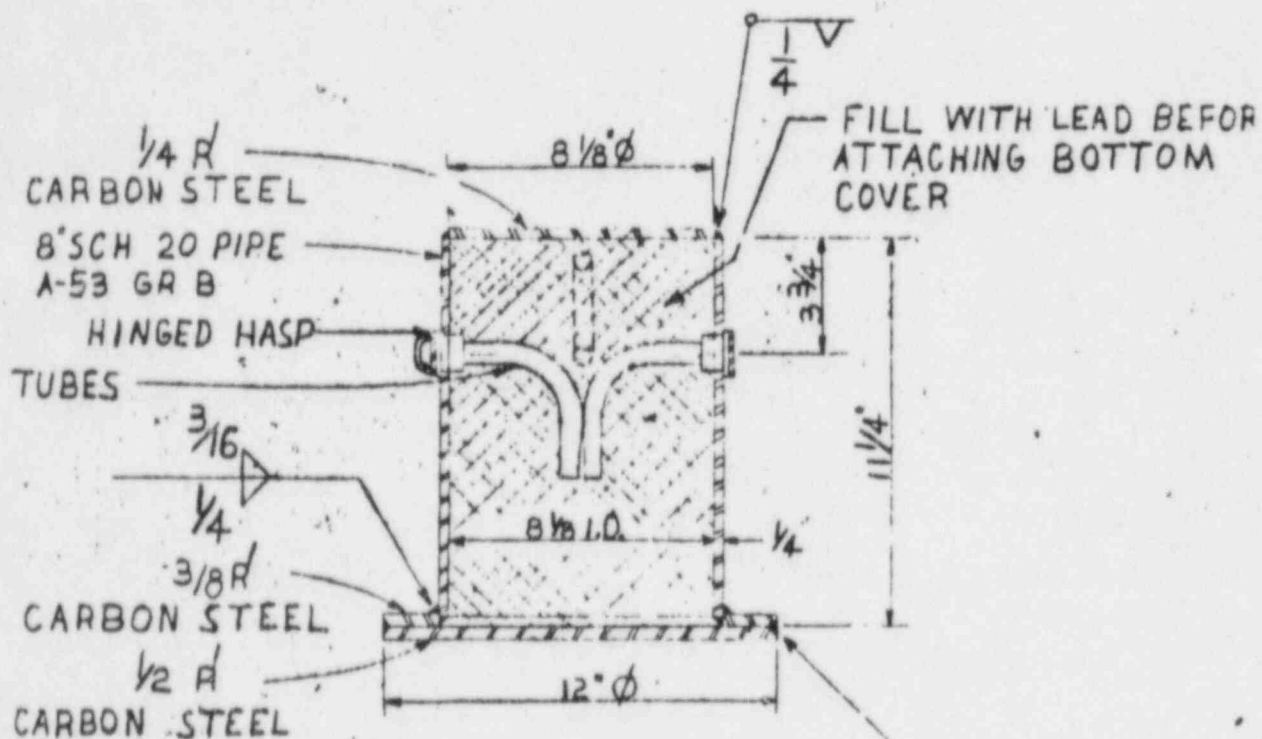
LIFT LUG

4 1/2 STEEL HINGED  
FORM TO FIT OUTSIDE  
CENTER OVER TUBE  
OPENING AND ATTACH  
BY WELDING  
(2) REQ'D



PLAN

C-4



SECTIONAL ELEVATION

SCALE 4" = 1' 0"

MATERIAL CARBON STEEL  
LEAD FILLED

FINISH AND COLOR

TITLE GAMMA INDUSTRIES MODEL C-4

DRAWN BY DRAWING NO. 120

DATE 6/14/65

SCALE 4" = 1' 0"

The following procedure should be followed in the source changing operation:

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

Survey the source changer (Storage Container) all storage containers for sealed sources shall have no Radiation Level in excess of 200 milliroentgens per hour at any exterior surface or 10 milliroentgens per hour at one meter from any exterior surface. If the readings exceed these limits immediately discontinue source transfer and notify the Radiation Safety Office.

1. Locate the source changer within 2 feet of the camera.
2. Connect the short exchange tube provided to the old source hole with the other end attached to your camera.
3. Join the disconnects on control and source cable.
4. Connect source crank assembly to camera lock box and extend control so that operator is positioned the maximum distance from the camera.

(NOW UNLOCK THE CAMERA)

5. Crank decayed source into source changer by turning control handle clockwise until source stops in the changer.
6. At this point, the survey meter should be employed to insure that the source has been safely located in the shielded position. (If the limits of 200 milliroentgens per hour at the surface or 10 milliroentgens per hour at one meter are exceeded, return the decayed source to the camera and notify the radiation safety office). If the limits have not been exceeded proceed.
7. Disconnect short exchange tube to source changer and disengage disconnect being careful not to pull out the source.
8. Swing hasp cover over hold and lock.



9. Unlock new source side.
10. Connect control cable to pigtail.
11. Screw exchange tube into coupling of container.
12. Standing as far away as possible, retract control cable which will pull source out of shipping container and into your camera.
13. Survey. Camera limits are 50 milliroentgens per hour at 6 inches if this is exceeded notify your radiation safety office.
14. Lock the camera.
15. Disconnect control cable from pigtail.
16. Unscrew the short exchanger tube from your camera and from the shipping container.

SEE APPENDIX "E" FOR SHIPPING INSTRUCTIONS

(c) Technical Operations Changers  
Models 414, 650 and 488

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

Survey the source changer (Storage Container) all storage containers for sealed sources shall have no Radiation Level in excess of 200 milliroentgens per hour at any exterior surface or 10 milliroentgens per hour at one meter from any exterior surface. If the readings exceed these limits immediately discontinue source transfer and notify the Radiation Safety Office.

2. After setting up the projector as for an exposure. omitting the terminal source tube, place source changer nearby and remove the cover by cutting the seals and unscrewing the 4 bolts.
3. Unscrew and remove the cap (and hold rod) from the empty channel. Open the coupler assembly to make a positive visual check before continuing.
4. Screw on the source tube from your projector and crank the old source all the way into the empty channel. NOTE:

At this point, the survey meter should be employed to insure that the source has been safely located in the shielded position. (If the limits of 200 milliroentgens per hour at the surface or 10 milliroentgens per hour at one meter are exceeded, return the decayed source to the camera and notify the radiation safety office). If the limits have not been exceeded proceed.

5. Open the coupler assembly and disengage, the connectors with the spring release tool, separating the drive cable from the source cable.
6. Unscrew the source tube, replace the cap (and hold down rod) and tape the coupler assembly shut to complete this operation. Mark or tag the channel containing the old source to avoid a possible mix-up.

#### Installing the New Source in Your Projector

1. Unscrew cap (and hold rod) from source channel containing the new source.
2. Screw on the source tube from the projector.
3. Open the coupler assembly and snap the drive cable connector into the female source cable connector and close the coupler assembly.
4. Return to the projector control unit and retract the source into the camera until the radiation monitor indicates a safe level of activity. Camera limits are 50 milliroentgens per hour at 6 inches from any surface for cameras who measure less than four inches from the source to any outside surface and 200 milliroentgens per hour at any surface of any camera four inches or more to any outside surface if this is exceeded, notify your radiation safety office.
5. Unscrew the source tube, screw on your terminal source tube, and replace the cap (and hold down rod) on the now empty source channel. Close, bolt, and seal the source changer.

SEE APPENDIX "E" FOR SHIPPING INSTRUCTIONS

(d) Gulf Nuclear Changers  
Model U-110

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

Survey the source changer (Storage Container) all storage containers for sealed sources shall have no Radiation Level in excess of 200 milliroentgens per hour at any exterior surface or 10 milliroentgens per hour at one meter from any exterior surface. If the readings exceed these limits immediately discontinue source transfer and notify the Radiation Safety Office.

INSTRUCTIONS FOR REMOVING SPENT SOURCE FROM RADIOGRAPHY CAMERA  
AND TRANSFERRING IT TO SOURCE CHANGER

1. Remove the exchanger from the drum.
2. Set up radiography camera for normal operation with changer tube attached. Attach end of tube to empty side of source changer.
3. Standing as far away as possible from camera and source changer, crank spent source into source changer. Lock source in place. Remove key.
4. At this point, the survey meter should be employed to insure that the source has been safely located in the shielded position. (If the limits of 200 milliroentgens per hour at the surface or 10 milliroentgens per hour at one meter are exceeded, return the decayed source to the camera and notify the radiation safety office). If the limits have not been exceeded proceed.
5. Unscrew coupling connecting changer tube to source changer. Connector of spent source should protrude about 1/2 inches from port (Radiation Levels should be monitored during this operation with a meter placed near the exchanger).
6. Disconnect the source from the drive cable.
7. Remove safety cap from new source and install on the spent source.

INSTRUCTIONS FOR INSTALLING NEW SOURCE IN RADIOGRAPHY  
CAMERA

1. Position radiography camera with drive cable protruding about 1/2 inches beyond end of changer tube. Avoid kinks. Tube should be laid out as straight as possible.
2. Connect new source to drive cable.
3. Screw coupling at end of changer tube onto source changer. Unlock changer.
4. Standing as far away as possible from camera and source changer, pick up reel and crank source quickly into camera.
5. Survey. Camera limits are 50 milliroentgens per hour at 6 inches from any surface, if this is exceeded, notify your radiation safety office.
6. Lock your camera.
7. After monitoring has demonstrated everything is in order, the changer tube should be unscrewed from the source changer and camera.
8. Remove metal source identification plate from source changer and fasten to camera.
9. Replace changer and changer tube in the drum.

SEE APPENDIX "E" FOR SHIPPING INSTRUCTIONS

- (e) SOURCE PRODUCTION AND EQUIPMENT CO., INC.  
SPEC MODEL C-1 SOURCE EXCHANGER

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

Survey the source changer (Storage Container) all storage containers for sealed source shall have no Radiation Level in excess of 200 milliroentgens per hour at any exterior surface or 10 milliroentgens per hour at one meter from any exterior surface. If the readings exceed these limits immediately discontinue source transfer and notify the Radiation Safety Office.

1. Open both top and side doors to their fully extended positions exposing the outlet tubes on top and the lock plungers on the side.
2. Pull the lock plunger on the blue side and turn to the left. This unlocks the plunger by holding it in the retracted position.
3. Connect one end of the source exchanger tube provided in the container to the uncapped tube in the top of the container. Connect the other end of the exchanger tube to the outlet of the exposure device.

4. Properly connect drive cable to the depleted source in the "camera" and hook up controls to the exposure device.
5. With a correctly functioning survey meter in view, next to the source exchanger tube, crank the depleted source into the C-1 changer until the source reaches a definite stop and the survey meter indicates that the source has reached a shielded position.
6. At this point, the survey meter should be employed to insure that the source has been safely located in the shielded position. (If the limits of 200 milliroentgens per hour at one meter are exceeded, return the decayed source to the camera and notify the radiation safety office). If the limits have not been exceeded proceed.
7. Lock the container by turning plunger  $\frac{1}{4}$  turn to the right and release. The plunger will lock down on the source. The knurled knob of the plunger has to seat on the barrel of the plunger housing. If it doesn't jiggle the source with the control cable crank, until it does seat.
8. Detach the source exchange tube from the container tube.
9. Gently pull the pigtail to be sure it is locked in.
10. CAUTION-- If you can withdraw the pigtail more than  $1\frac{1}{2}$  inches, it probably is not locked in. In this case, pull the lock plunger out and shove the pigtail down into the tube and reseal the plunger.
11. Disconnect control cable from pigtail.
12. Remove protector outlet cap from outlet on the red side of container.
13. Place protector cap on tube and blue side.
14. Secure source exchanger tube to camera and crank control cable thru it until approximately 8 inches of cable protrudes from loose end of source exchange tube. Connect drive cable to new source.
15. Attach loose end of source exchange tube to shipping container outlet on the red side.
16. Pull the lock plunger on the new source side of the container and turn  $\frac{1}{4}$  turn to the left. This unlocks the plunger and the new source is free to be extracted from the container.
17. With a correctly functioning survey meter in view next
18. Carefully survey the exposure device to ascertain that the source is in the safe position limits are 50 milliroentgens per hour at 6 inches. Lock exposure device.



19. Remove source exchange tube from both exposure devices and outlet tube.
20. Turn the lock plunger in the empty red tube  $\frac{1}{4}$  turn and release. This allows the side door to be closed.
21. If side door is prevented from closing by either lock plunger, the plunger is not properly seated.
22. Place source exchange tube in top of container.
23. Close the top door and affix lock.
24. Survey container to determine if D.O.T. requirements are met. Radiation level should not exceed 200 mr/hr, at surface of container.

SEE APPENDIX "E" FOR SHIPPING INSTRUCTIONS

## 11.0 EMERGENCY PROCEDURES

11.1 For sealed sources being transported. In the event of a road accident involving the transporting vehicle, the radiographer must immediately conduct a radiation survey to determine if the sealed source is exposed. If the source is exposed, the following steps must be taken:

- (a) Restrict and post the area in accordance with Paragraph 9.1.
- (b) The radiographer or radiographer's assistant must remain at the scene of the restricted area and, as soon as possible, notify the nearest Radiation Safety Manager or Supervisor (see Appendix C) and the local civil authorities.

11.1.1 In the event the radiation survey instrument is damaged, the established restricted area shall be maintained. No one shall be allowed in the area until the sealed source has been secured using an operable radiation survey instrument.

11.1.2 In the event the radiographer is injured and is unable to physically perform the required surveys, and area restrictions, he should assist the civil authorities by direction and by presenting them with a copy of this manual.

11.2 For sealed sources being used for radiography. In the event of an accident to the device containing a sealed source, immediately take the following steps:

- (a) Try to retract the source into the exposure device, following the standard operating procedures.
- (b) Make a radiation survey to ascertain that the source has been returned to the shielded position, and lock the device.
- (c) Do not use the device until you have made an inspection of the device to make certain that it is operating properly. If it does not operate properly, report the malfunction to the nearest Radiation Safety Manager or Supervisor immediately (See Appendix C). Do not continue using the device unless instructed to do so by your regional office.
- (d) In the event the source cannot be returned to the device:
  - 1. Restrict and post the area in accordance with Paragraph 9.1 MAINTAIN CONSTANT SURVEILLANCE.
  - 2. Contact the nearest Radiation Safety Manager or Supervisor immediately (see Appendix C). Do not attempt a recovery of the source until you have been instructed to do so.

11.3 For lost or stolen devices containing sealed sources

In the event a device has been stolen or lost, immediately take the following steps:

- (a) Notify the local civil authorities.
- (b) Notify the nearest Radiation Safety Manager or Supervisor (see Appendix C). He will advise the N.R.C. through the proper channels.

## 12.0 LEAK TESTING SEALED SOURCES

### 12.1 Requirements

Leak testing shall be conducted at intervals not to exceed six months, or more often if reasonable cause exists, by a procedure capable of detecting the presence of .005 microcuries of contamination of the exposure device, storage container, or sealed source.

Leak tests of radioactive sources not returned to the manufacturer shall be conducted in the following manner utilizing CONAM KIT LT-2.

Only employees that have received instructions in leak testing shall be allowed to perform the test.

### 12.2 Procedures- Survey Meter Calibration Kits

The test shall be conducted in the following manner.

12.2.1 Place the directional shield in a restricted area.

12.2.2 Remove the lock and locking bar from the top of the source shield.

12.2.3 Wet the swab with Alconox solution. Shake off the excess and wipe around the top of the source rod.

12.2.4 Raise the source rod to open position and wipe the exposed source rod thoroughly.

12.2.5 Place the swab in the plastic envelope.

12.2.6 Follow procedures listed below from Paragraph 12.3.5 thru 12.3.8.

### 12.3 Procedures Radiographic Devices

The test shall be conducted in the following manner.

12.3.1 Use the survey meter to be sure the source is fully retracted into the safe shielded position.

12.3.2 Remove the shipping plug from the face of the shield.

12.3.3 Wet the swab with Alconox solution, shake off the excess and insert the swab in the hole of the shield. Wipe the interior of the hole thoroughly by rotating the swab holder.

- 12.3.4 Withdraw the swab and place in the plastic envelope.
- 12.3.5 The swab should now be monitored by the survey meter set on its most sensitive range. Place the meter in a low background area and move the swab in its plastic envelope to the meter - not the meter to the swab.
- 12.3.6 If there is no indication on the meter above background, put the plastic envelope with the swab in the mailer supplied and mail to the division office.
- 12.3.7 Repeat the procedures outlined above with the second swab. DO NOT MOISTEN the second swab.

Note: Be sure to fill out and return the identification sheet.

- 12.3.8 If there is an indication on the meter above background, it shall be considered as evidence of possible contamination. The individual making the test shall replace the shipping plug and lock the device. The device shall be returned to the storage area or place. Care should be taken to avoid any unnecessary contact with the equipment.

The region and radiation safety offices should be notified immediately, and no further handling of the equipment is allowed until the equipment has been proven safe.

#### 12.4 EVAULATION OF SWAB

The swab will be evaluated by the Radiation Safety Officer at Division Headquarters as follows:

The Eberline Instrument Corporation Model RM-14 with HP-190 Probe will be used to compare the activity on the wipe with a 0.005 uc 99Tc source. If the wipe sample reads higher than the source, it will be considered as leaking. The energy of the 99 Tc beta particles is 0.29MEV (mas), whereas the energies for 192 IR, 60 CO and 137Cs are higher than 0.29MEV. Thus, 0.005 uc of any of these isotope will cause a higher reading than the 99Tc source.

12.5 Records- Records of leak test results shall be kept in units of microcuries and maintained for inspection at region and division office.

13.0 REQUIREMENT FOR DAILY INSPECTION OF RADIOGRAPHIC EQUIPMENT AND SOURCE CHANGERS

13.1 All exposure devices must be inspected at the beginning of each day that it is used. The radiographer making the inspection will sign the radiation report in the space provided, certifying the inspection was performed.

13.2 Daily inspections are to be made by using applicable checklist as follows:

13.2.1 BUDD COMPANY (AUTOMATION IND.) Models 520, 100A, 100A-1, 52B, 51B, 151H and 110AB devices.  
GAMMA INDUSTRIES Model Gammatron 50 and 100 Exposure Device.

"WARNING- ALL MODELS EXPOSURE DEVICES CAN BE LOCKED IN AN UNSAFE POSITION"

1. Survey for excessive radiation levels.
2. Remove protector cap from lock box to expose the pigtail connector and wipe the connector clean.
  - (a) Inspect the connector for true elbow, straightness, excessive wear and cracks.
  - (b) Inspect the flexible cable at the connector for straightness.
  - (c) Inspect inlet for thread damage.
3. Inspect lock plunger for ease of operation. If not operating freely, clean and lubricate.

DEPRESS PLUNGER LOCK BEFORE MAKING ANY FURTHER INSPECTIONS

4. Check all labels for legibility.
5. Inspect for shifting of shield inside the device.
6. Inspect carriage, wheels, lifting lugs and handles on units, so equipped.
7. Inspect crank and indicator assembly for excessive wear or damage that may impair its operation.



8. Inspect cable conduit for excessive wear or any damage that may prevent free movement of the cable.
9. Crank drive cable out about 12 inches, inspect cable for flexibility and inspect connector for excessive wear or damage.
10. Inspect cable conduit end fitting for thread damage.
11. Inspect source tube for any damage that may affect the free movement of the source throughout the tube.
12. Make sure source tube end cap is secure.
13. Inspect source tube connector fitting for thread damage.
14. Remove safety cap from source outlet and inspect for thread damage.

The inside of the source tube and all connections parts should be free of any foreign material that may impair the operation of the device before the components are assembled for use.

13.2.2 GAMMA INDUSTRIES Models 35 and Century Exposure Devices  
GULF NUCLEAR Model 20V Exposure Device

"WARNING - ALL MODELS EXPOSURE DEVICES CAN BE LOCKED IN AN UNSAFE POSITION"

1. Survey for excessive radiation levels.
2. Remove protector cap from lock box to expose the pigtail connector and wipe the connector clean.
  - (a) Inspect the connector for true elbow, straightness, excessive wear and cracks.
  - (b) Inspect the flexible cable at the connector for straightness.
  - (c) Inspect inlet for thread damage.
3. Inspect lock plunger for ease of operation. If not operating freely, clean and lubricate.

DEPRESS PLUNGER LOCK BEFORE MAKING ANY FURTHER INSPECTIONS

4. Check all labels for legibility.

5. Inspect for shifting of shield inside the device.
6. Inspect carriage, wheels, lifting lugs and handles on units, so equipped.
7. Inspect crank assembly for excessive wear or any damage that may impair its operation.
8. Inspect conduit for excessive wear or any damage that may prevent free movement of the cable.
9. Crank drive cable out about 12 inches, inspect cable for flexibility and inspect connector for excessive wear or damage.
10. Inspect cable conduit end fitting for thread damage.
11. Inspect source tube for any damage that may affect the free movement of the source through the tube.
12. Make sure source tube end cap is secure.
13. Inspect source tube quick disconnect coupler for good working action.
14. Remove safety cap from source outlet and inspect outlet nipple for damage.

The inside of the source tube and all connection parts should be free of any foreign material that may impair the operation of the device before the components are assembled for use.

### 13.2.3 TECHNICAL OPERATIONS DEVICES

For Models 533, 446 Exposure Devices

"WARNING - ALL MODELS EXPOSURE DEVICES CAN BE LOCKED IN AN UNSAFE POSITION."

1. Survey for excessive radiation levels.
2. Inspect control and indicator assembly for loose hardware and damage.
3. Inspect control cables for cuts, breaks and broken fittings.
4. For Models with detachable controls:
  - (a) Check connector (ball and socket) for proper operation.
  - (b) Inspect lock for ease of operation. If not operating freely, clean and lubricate.

- (c) Check operation of control cable locking ring.
- 5. Inspect for shifting of shield inside the device.
- 6. Inspect carriage, wheels, lifting lugs and handles of units so equipped.
- 7. Check all labels for legibility.
- 8. Inspect source tube for cuts and kinks.
- 9. Make sure source tube end cap is secured.
- 10. Inspect source tube connector fitting for thread damage.
- 11. Check lock, hasp and shipping plug.

The inside of the source tube and all connection parts should be free of any foreign material that may impair the operation of the device before the components are assembled for use.

#### 13.2.4 TECHNICAL OPERATIONS MODEL 616 EXPOSURE DEVICE

- 1. Survey the excessive radiation (50 mr/hr at 6")
- 2. Inspect the CAMERA for damage and proper operation
  - (a) Outer shell including handles
  - (b) All fasteners for tightness and for safety wires
  - (c) Camera name plate and legible radiation labels
  - (d) Source identification tags
  - (e) Source actuator key lock for ease of operation
  - (f) Source actuator opening. Remove any foreign matter.
- 3. Inspect the CONTROL UNIT for damage and proper operation
  - (a) Insure the tubing has no visible cuts or breaks
  - (b) Insure the tubing is connected to the control unit
  - (c) Place the control valve in the "OFF" position
  - (d) Create 20-25 inches of vacuum
  - (e) Seal the open end of the tube with a finger
  - (f) Place the control valve to the "EXPOSE" position
  - (g) An initial drop of 8-10 inches should occur. The gauge should remain steady. A falling gauge indicates a leak.

- 13.2.5 GAMMA INDUSTRIES Pipeliner Model 1 201  
Exposure Devices  
GULF NUCLEAR Pipeliner Model 10X Exposure  
Device  
SPEC Pipeliner Model Spec Check II Exposure  
Device

"WARNING - THESE MODEL EXPOSURE DEVICES CAN BE LOCKED IN  
AN UNSAFE POSITION"

1. Survey for excess radiation levels.
2. Inspect plunger lock for proper operation.
3. Check for oil leakage between face plate and outer shell.
4. Inspect control adapter plate, dust cap and control knob for thread damage.
5. Check for free movement between retaining collar and control knob.
6. Check for proper operation of rotor and shaft.
7. Check all labels for legibility.

13.2.6 SOURCE CHANGERS (SEE 10.3.5 FOR OPERATION)

1. Survey for excessive radiation levels prior to and after loading with radioactive material.
2. Prior to loading:
  - a. Check case for any damage that could create a hazard.
  - b. Check all closures for proper operation.
  - c. Check for shifting of shield inside device.
3. After loading survey changer, no surface reading should exceed 200 milliroentgens per hour or 10 milliroentgens per hour at one meter.

SEE APPENDIX E FOR SHPPING INSTRUCTIONS

## INSTRUCTIONS FOR COMPLETING RADIATION REPORTS

General: This form must be completed by the radiographer for each day a sealed source is in his possession. If more than one job is performed in a day, a separate report is required for each job except for cross-country pipeline inspection where only one report per shift is required (see Section 9.0). Examples of properly completed reports are at the end of this Appendix. Items 1 thru 9 MUST be completed before the first exposure is made.

1. Date: Show the date of which source is used, stored or is being transported.
2. Location: Show the town and state where work was performed or best available identification such as West Delta Block 182, Off-shore, etc. When town, state, project and customer does not define exact location of the radiographic operation, use remarks column to locate more exact. (see remarks in example, Page 26A). Job sites must be defined accurately enough to locate area worked on that date. Pipeline survey numbers are acceptable IF they also include the general area. Example: South of Hwy. 9, 2 miles West of Wooster, Ohio (10,900 to 11,250).
3. Project: Identify the nature of the work. Example = Refinery, 30" P/L, Power Plant, Castings or travel.
4. Customer: Show our customers name and plant number.
5. Type of Source: Make an "x" in the box for applicable source used and record the source serial number.
6. Activity of Source: Record the curie strength for the date of the report.
7. Exposure Device: Record the model number or identification and the serial number of the exposure device.
8. Survey Instrument: Record the model number or identification, the serial number and the void date of the survey instrument.
9. Isotope Equipment Inspection: Equipment is to be inspected in accordance with Section 13, of CONAM's Radiation Safety Operating and Emergency Procedures. Signature of the radiographer certifies that the inspection was performed and found to be acceptable for use.
- 9A. Days When Isotope Equipment is Not Used: Enter not used or NA in the area provided for the signature.
10. Results of Physical Survey (sketch): 1. Record the radiation readings at the boundaries of the radiographic area you establish. These readings must be such that a person standing at the boundaries would be far enough from the source so that the exposure (dose rate) is 2 mr/hr or less. If this is not possible, the exposure time in any one hour must be reduced accordingly and noted under



"Remarks." For example: If the dose rate is 4 mr/hr only 30 minutes exposure per hour is allowed (see Section 9.0 of O&E). 2. Record the approximate distance from the source to the barricade.

- 10A. Days when isotope and equipment is not used, enter not used or NA in the space provided for the survey.
- 11. Barricade Equipment: Indicate the barricade equipment used. Additional information on the restricting of the area is to be noted.
- 11A. Days when isotope equipment is not used enter not used or NA in the space provided for the barricading information.
- 12. Record of Physical Survey made to determine if the source is in shielded position prior to securing exposure device. Record the dose rate (mr/hr) applicable for the exposure device being used. The exposure device is to be locked as soon as it is determined that the source is in the shielded position. Control cables and source tubes are NOT to be removed or stored until the exposure device has been surveyed and locked.
- 12A. Days when isotope equipment is not used, enter not used or NA in the space provided for survey.
- 13. Total Exposure Time for This Date: Record the total exposure time that the source was used this date. Hours to minutes.
- 13A. Days when isotope equipment is not used, enter none in this space.
- 14. Contractor Personnel Informed: Show the title and if possible the name of the person responsible for security of non-monitored personnel that was notified that a restricted area exists.
- 14A. Days when isotope equipment is not used, enter none or NA in the space.
- 15. Radiographers and Radiographer's Assistant/s: Print your first and last name (do not use nicknames). If an assistant is not used, print none in the space.
- 16. Serial Number of Dosimeters: Record the serial numbers for the radiographer and each assistant.
- 17. Dosimeter Readings: Record at the end of each shift the total exposure received by the radiographer and assistant/s. When exposure is received from more than one source of radiation, total exposure for the shift is to be recorded.

18. Film Badge Serial Number: Record the serial number (employee number) of the film badge for the radiographer and assistant/s.
19. Remarks: Show any additional information pertinent to the radiographic operation that would assist anyone reviewing the report. Show general area job location and pipeline survey number if instruction # 2 does not identify sufficiently.
20. Survey of Transporting Vehicle: This must be recorded for any day that the source is used or transported or when the vehicle is used to store the radioisotope source.
- 20A. Days when isotope equipment is not used or transported, enter not used or NA in all spaces in the vehicle survey. Days when the radioisotope source is stored in the vehicle, enter the proper vehicle survey readings and initial the vehicle survey section.
21. Vehicle Limits Driver: Not to exceed 2 mr/hr. Outside surface: not to exceed 2 mr/hr. Additional shielding must be added if levels exceed limits set. Use definite readings, do not use "less than" statements (Example - Less than 2 mr/hr).



## CONAM INSPECTION DIV.

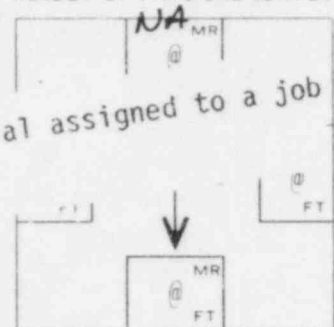
## RADIATION REPORT

WARNING - INTENTIONAL FAILURE TO RECORD  
INFORMATION ACCURATELY ON THIS FORM CAN RESULT  
IN A FINE AND OR DISCIPLINARY ACTION.

DATE JAN 11, 1973 CITY PRATT STATE KANSAS  
PROJECT 24" P/L CUSTOMER KANSAS P/L Co.  
SOURCE OF RADIATION  
IR-192 ☒ CO-60 ☐ X-RAY ☐  
S/N 2930 S/N S/N  
ACTIVITY OF SOURCE 30 CURIE  
SURVEY INSTRUMENT MODEL NO. E120G  
EXPOSURE DEVICE MODEL NO. G. CENTURY S/N 10092 S/N 211 VOID DATE 3/1/73

RADIOGRAPHIC EQUIPMENT INSPECTED  
IN ACCORDANCE WITH CONAM O AND E  
PROCEDURE DAILY CHECK LIST.

## RESULT OF PHYSICAL SURVEY



## BARRICADE EQUIPMENT

☐ SIGNS ☐ ROPE  
☐ CONSTANT SURVEILLANCE  
☒ STORED

TOTAL EXPOSURE TIME FOR THIS DAY NONE HRS. MINS.

PERSONNEL INFORMED NA

RADIOGRAPHER BILL HARRIS RADIOGRAPHER'S ASSISTANT JACK PAGE

SERIAL NO. OF DOSIMETER 21939 AND 21934

TOTAL MR RECORDED START 0 FINISH 0 MR AND START 0 FINISH 0 MR

FILM BADGE AND SERIAL NO. 1291 AND 1424

REMARKS: STAND BY - NO EXPOSURES THIS

DATE

## SURVEY OF TRANSPORTING VEHICLE

MR/HR @ DRIVER NA MR/HR @ OUTSIDE SURFACE NA MR/HR @ 1 FT. FROM SURFACE NA

RADIATION SAFETY OFFICE



## CONAM INSPECTION DIV.

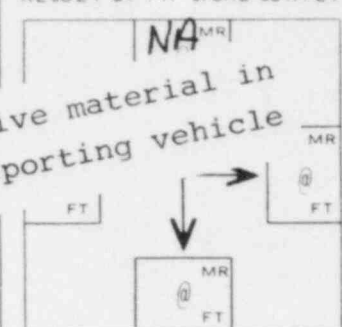
## RADIATION REPORT

WARNING - INTENTIONAL FAILURE TO RECORD  
INFORMATION ACCURATELY ON THIS FORM CAN RESULT  
IN A FINE AND OR DISCIPLINARY ACTION.

DATE 8/18/82 CITY Houston STATE Texas  
PROJECT 20" Pipeline CUSTOMER H.L. & P.  
SOURCE OF RADIATION  
IR-192 ☒ CO-60 ☐ X-RAY ☐  
S/N 15306 S/N S/N  
ACTIVITY OF SOURCE 95 CURIE  
SURVEY INSTRUMENT MODEL NO. E130G  
EXPOSURE DEVICE MODEL NO. AI 520 S/N 339 S/N 6533 VOID DATE 11/10/82

RADIOGRAPHIC EQUIPMENT INSPECTED  
IN ACCORDANCE WITH CONAM O AND E  
PROCEDURE DAILY CHECK LIST.

## RESULT OF PHYSICAL SURVEY



## BARRICADE EQUIPMENT

☐ SIGNS ☐ ROPE  
☐ CONSTANT SURVEILLANCE

☒ Source stored in vehicle

TOTAL EXPOSURE TIME FOR THIS DAY NONE HRS. MINS.

PERSONNEL INFORMED

RADIOGRAPHER Robert J. Scott RADIOGRAPHER'S ASSISTANT NA

SERIAL NO. OF DOSIMETER 601423 AND NA

TOTAL MR RECORDED START 0 FINISH 0 MR AND START 0 FINISH NA MR

FILM BADGE AND SERIAL NO. 1897 AND NA

REMARKS: Source Stored in vehicle

## SURVEY OF TRANSPORTING VEHICLE

MR/HR @ DRIVER 1 MR/HR @ OUTSIDE SURFACE 2 MR/HR @ 1 FT. FROM SURFACE 1

RADIATION SAFETY OFFICE

APPENDIX "A"

53

CONAM O&E

8-18-82



## CONAM INSPECTION

## RADIATION REPORT

WARNING - INTENTIONAL FAILURE TO RECORD  
INFORMATION ACCURATELY ON THIS FORM CAN RESULT  
IN A FINE AND/OR DISCIPLINARY ACTION.

DATE Jan 11, 1973 CITY Greenville STATE Miss.

PROJECT Travel CUSTOMER Delta Gas Co.

SOURCE OF RADIATION  
IR-192 ☒ CO-60 ☐ X-RAY ☐  
S/N 2900 S/N          S/N           
ACTIVITY OF SOURCE 95 CURIE  
SURVEY INSTRUMENT MODEL NO. RD 5016 C

EXPOSURE DEVICE MODEL NO. G. Cent. S/N 10090 S/N 641 VOID DATE 2-28-73

RADIOGRAPHIC EQUIPMENT INSPECTED  
IN ACCORDANCE WITH CONAM O AND E  
PROCEDURE DAILY CHECK LIST.

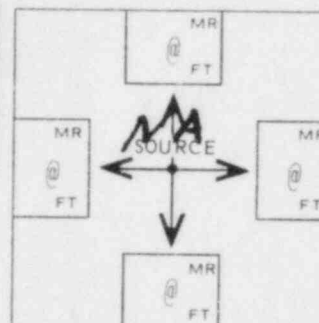
NA  
INSPECTION COMPLETED BY

RECORD OF PHYSICAL SURVEY MADE TO DETERMINE  
SOURCE IS IN SHIELDED POSITION PRIOR TO  
SECURING EXPOSURE DEVICE.  
IR-192 NA MR/HR @ 6" FROM SURFACE  
CO-60          MR/HR @ SURFACE OF EXPOSURE DEVICE

TOTAL EXPOSURE TIME FOR THIS DAY None HRS.          MINS.

PERSONNEL INFORMED NA

## RESULT OF PHYSICAL SURVEY



## BARRICADE EQUIPMENT

☐ SIGNS ☐ ROPE  
☐ CONSTANT SURVEILLANCE  
☒ Truck Posted  
per D.O.T. Regs.

RADIOGRAPHER Luke Jones RADIOGRAPHER'S ASSISTANT Ray Jones

SERIAL NO. OF DOSIMETER 00724 AND 41370

TOTAL MR RECORDED START 0 FINISH 10 MR AND START 0 FINISH 15 MR

FILM BADGE AND SERIAL NO. 999 AND 1420

REMARKS: Travel; Tulsa to Greenville. Source

in D.O.T Shipping Container. Locked in  
SURVEY OF TRANSPORTING VEHICLE Truck

MR/HR @ DRIVER 1.0 MR/HR @ OUTSIDE SURFACE 1.5 MR/HR @ 1 FT. FROM SURFACE 1.2

RADIATION SAFETY OFFICE

Sample report for radioactive material being transported  
on company truck.



# CONAM INSPECTION

## RADIATION REPORT

**WARNING - INTENTIONAL FAILURE TO RECORD  
INFORMATION ACCURATELY ON THIS FORM CAN RESULT  
IN A FINE AND/OR DISCIPLINARY ACTION.**

DATE 1-17-73 CITY Rahway STATE N.J.

PROJECT Castings CUSTOMER Eastern Foundry

SOURCE OF RADIATION  
IR-192 ☐ CO-60 ☒ X-RAY ☐  
S/N \_\_\_\_\_ S/N 1699 S/N \_\_\_\_\_

ACTIVITY OF SOURCE 65 CURIE

SURVEY INSTRUMENT MODEL NO. Vic 592 B

EXPOSURE DEVICE MODEL NO. TO 446 S/N 60

S/N 1735 VOID DATE 4-1-73

**RADIOGRAPHIC EQUIPMENT INSPECTED  
IN ACCORDANCE WITH CONAM O AND E  
PROCEDURE DAILY CHECK LIST.**

INSPECTION COMPLETED BY Ralph Stone

RECORD OF PHYSICAL SURVEY MADE TO DETERMINE  
SOURCE IS IN SHIELDED POSITION PRIOR TO  
SECURING EXPOSURE DEVICE.  
IR-192 \_\_\_\_\_ MR/HR @ 6" FROM SURFACE  
CO-60 175 MR/HR @ SURFACE OF EXPOSURE DEVICE

RESULT OF PHYSICAL SURVEY

BARRICADE EQUIPMENT  
☒ SIGNS ☐ ROPE  
☒ CONSTANT SURVEILLANCE  
☒ Rahway vault  
Surface readings  
Normal

TOTAL EXPOSURE TIME FOR THIS DAY 6 HRS. 30 MINS.

PERSONNEL INFORMED C Poppell - Shop MGR.

RADIOGRAPHER Ralph Stone RADIOGRAPHER'S ASSISTANT NONE

SERIAL NO. OF DOSIMETER 19374 AND \_\_\_\_\_

TOTAL MR RECORDED START 0 FINISH 5 MR AND START 0 FINISH \_\_\_\_\_ MR

FILM BADGE AND SERIAL NO. 1921 AND \_\_\_\_\_

REMARKS: 3 - 2hr : 10 min exposures. Vault

Warning system in use Gate Secured  
SURVEY OF TRANSPORTING VEHICLE

MR/HR @ DRIVER NA MR/HR @ OUTSIDE SURFACE NA MR/HR @ 1 FT. FROM SURFACE NA

RADIATION SAFETY OFFICE

Example report for radioactive material being used in  
approved exposure vault.





# CONAM INSPECTION

## RADIATION REPORT

WARNING - INTENTIONAL FAILURE TO RECORD  
INFORMATION ACCURATELY ON THIS FORM CAN RESULT  
IN A FINE AND/OR DISCIPLINARY ACTION.

DATE Jan 10, 1973 CITY Canton STATE Ohio

PROJECT 10" Pipeline CUSTOMER Canton Gas Co.

SOURCE OF RADIATION  
IR-192 ☒ CO-60 ☐ X-RAY ☐  
S/N 1044 S/N            S/N             
ACTIVITY OF SOURCE 24 CURIE  
SURVEY INSTRUMENT MODEL NO. E 120 G

EXPOSURE DEVICE MODEL NO. G P/L S/N 109  
S/N 920 VOID DATE 3-14-73

RADIOGRAPHIC EQUIPMENT INSPECTED  
IN ACCORDANCE WITH CONAM O AND E  
PROCEDURE DAILY CHECK LIST.

INSPECTION COMPLETED BY Richard Parks

RECORD OF PHYSICAL SURVEY MADE TO DETERMINE  
SOURCE IS IN SHIELDED POSITION PRIOR TO  
SECURING EXPOSURE DEVICE.  
IR-192 10 MR/HR @ 6" FROM SURFACE  
CO-60            MR/HR @ SURFACE OF EXPOSURE DEVICE

TOTAL EXPOSURE TIME FOR THIS DAY 1 HRS. 30 MINS.

PERSONNEL INFORMED Weld Inspector

RADIOGRAPHER Richard Parks RADIOGRAPHER'S ASSISTANT None

SERIAL NO. OF DOSIMETER 17221 AND NA

TOTAL MR RECORDED START 0 FINISH 10 MR AND START 0 FINISH            MR

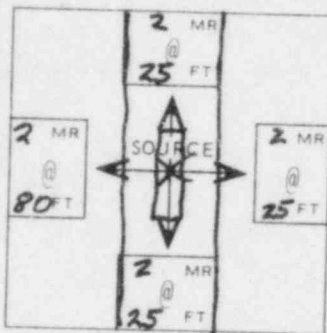
FILM BADGE AND SERIAL NO. 1421 AND           

REMARKS: Worked: Rd. Crossing Ohio #9, 2 mile East of Wooster Ohio shot 6 welds

MR/HR @ DRIVER .5 MR/HR @ OUTSIDE SURFACE 1.0 MR/HR @ 1 FT. FROM SURFACE .5

RADIATION SAFETY OFFICE

### RESULT OF PHYSICAL SURVEY



### BARRICADE EQUIPMENT

☒ SIGNS ☐ ROPE  
☒ CONSTANT SURVEILLANCE  
☒ Exposures in Ditch. 2 Mr/hr at 80' Exposure Side

Example report for a radiographic area on a cross-country pipeline.

CONAM INSPECTION WEEKLY REPORT										JOB LOCATION		CONAM JOB NO		PAYROLL WEEK ENDING DATE			
<div style="border: 2px solid black; padding: 10px; display: inline-block;"> <b>NOTICE - THIS INFORMATION MUST BE COMPLETE</b> </div> <div style="font-size: 2em; vertical-align: middle;">➔</div>										EMPLOYEE NAME (NO NICKNAME) FIRST MIDDLE INITIAL LAST							
										EMPLOYEE ADDRESS FOR RECEIVING PAYCHECK (IF DIFFERENT FROM BELOW)							
										EMPLOYEE FIELD ADDRESS FOR RECEIVING FILM BADGES AND OTHER MAIL							
										DOSIMETER NO		FILM BADGE NO					
DATE AND DAY	TIME REPORT			PER DIEM	CAR ALLOW- ANCE	EXPENSE RECORD		CASH RECEIPTS MUST BE ATTACHED			NO OF WELDS INSPECTED	MILES TRUCK DRIVEN	IF TRUCK SERVICED SHOW SPEEDOMETER READING	REMARKS	DOSIMETER READING		
	HOURS WORKED	EXPLANATION OF HOURS NOT SHOWN ON DAILY LOG				* MILES DRIVEN	AMOUNT	TRUCK REPAIR	GAS, OIL, SERVICE FOR TRUCK	TOLLS & MISC					X RAY	GAMMA	
WED																	
THUR																	
FRI																	
SAT																	
SUN																	
MON																	
TUES																	
TOTALS																	
CHEMICALS ON HAND				FILM ON HAND				GRAND TOTAL OF COLUMNS 1 - 2 - 3		GRAND TOTAL OF COLUMNS 4 - 5 - 6		SUPPLIES					
								\$		\$		NEEDED		RECEIVED		DATE	
APPROX JOB COMPLETION DATE				* EXPLAIN PERSONAL AUTO MILES DRIVEN - REMARKS													
				EMPLOYEE SIGNATURE													
				APPROVED BY													
DAILY LOGS MUST BE IN DIVISION OFFICE BEFORE THIS REPORT CAN BE PROCESSED.																	

## INSTRUCTIONS FOR USING POCKET DOSIMETERS

1. Dosimeters must be worn at all times when working with ionizing radiation or transporting by-product materials.
2. Dosimeters must be recharged at the beginning of each work shift.
3. Readings must be taken and recorded at the end of each work shift. (Readings should be recorded to the high five (5) side of the scale indication, ie; 1, 2, 3, 4mr record 5 mr, 6, 7, 8, 9 mr record 10mr, etc.)

 SEND THESE TWO COPIES TO THE DIVISION OFFICE  
DO NOT MAIL WITH CARBON ATTACHED!

APPENDIX "B-1"

JOB LOCATION

MON.

TUES.

WED.

THURS.

FRI.

SAT

SUN.

VERIFY

NAME \_\_\_\_\_

58

CONAM O &amp; E

8-1-81

## X-RAY READINGS

1. Dosimeters must be worn at all times when working with ionizing radiation or transporting by-product materials.
2. Dosimeters must be recharged at the beginning of each work shift.
3. Readings must be taken and recorded at the end of each work shift (readings should be recorded to the high (5) side of the scale indication, readings of 1,2,3,4,5MR as recorded as 5MR, etc.)

Quality Control Manager

CONAM'S RADIATION SAFETY PERSONNEL

<u>NAME</u>	<u>RADIATION SAFETY TITLE</u>	<u>ASSIGNED TITLE</u>	<u>BUSINESS PHONE</u>	<u>HOME PHONE</u>
O. GAMBLE	RADIATION SAFETY OFFICER	HOUSTON, TEXAS	774-9657 (713)	723-7441
R. SLACK	ASST. RADIATION SAFETY OFFICER	HOUSTON, TEXAS	774-9657 (713)	852-2240
R. MACHA	ASST. RADIATION SAFETY MGR.	HOUSTON, TEXAS	774-9657 (713)	545-8037
N. JAROCH	RADIATION SAFETY MANAGER	ROSEVILLE, MINN.	636-5040 (612)	426-2755
J. ARVESON	ASST. RADIATION SAFETY MGR.	ROSEVILLE, MINN.	636-5040 (612)	780-9612
M. HOLMES	ASST. RADIATION SAFETY MGR.	ROSEVILLE, MINN.	636-5040 (612)	492-2618
M. CREECH	RADIATION SAFETY MANAGER	ITASCA, ILLINOIS	773-9400 (312)	
R. MOMSEN	RADIATION SAFETY SUPERVISOR	ITASCA, ILLINOIS	773-9400 (312)	349-8675
S. BALES	RADIATION SAFETY SUPERVISOR	ITASCA, ILLINOIS	773-9400 (312)	289-0290
D. SCHMITZ	RADIATION SAFETY SUPERVISOR	ITASCA, ILLINOIS	773-9400 (312)	
G. MAYBEERY	RADIATION SAFETY MANAGER	FOLCROFT, PA.	237-1500 (215)	637-7619
A. MURPHY	ASST. RADIATION SAFETY MGR.	FOLCROFT, PA.	237-1500 (215)	
E. ZABILOWICZ	RADIATION SAFETY SUPERVISOR	FOLCROFT, PA.	237-1500 (215)	532-8673
R. MARLOW	RADIATION SAFETY MANAGER	RICHMOND, CA.	233-9668 (415)	758-2811
W. BROYLES	ASST. RADIATION SAFETY MGR.	RICHMOND, CA.	233-9668 (415)	
D. FISTER	RADIATION SAFETY MANAGER	COLUMBUS, OHIO	491-3000 (614)	885-5279
J. KELKER	ASST. RADIATION SAFETY MGR.	COLUMBUS, OHIO	491-3000 (614)	279-9004
D. TOTMAN	RADIATION SAFETY SUPERVISOR	COLUMBUS, OHIO	491-3000 (614)	882-8218
R. CAMERON	RADIATION SAFETY MONITOR	COLUMBUS, OHIO	491-3000 (614)	866-7465
R. BURNS	RADIATION SAFETY MGR.	DANBURY, CONN.	796-5277 (203)	794-9044
L. LUDWIG	ASST. RADIATION SAFETY MGR.	DANBURY, CONN.	796-5225 (203)	792-6296
G. HAMILTON	RADIATION SAFETY MONITOR	DANBURY, CONN.	796-5224 (203)	928-3346
C. TALBOTT	ASST. RADIATION SAFETY MGR.	DANBURY, CONN.	796-5139 (203)	744-0511
R. KAER	ASST. RADIATION SAFETY MGR.	DANBURY, CONN.	796-5289 (203)	743-5539
R. ZIEBER	ASST. RADIATION SAFETY MGR.	OSWEGO, N.Y.	342-5812 (315)	342-2020
B. DYCUS	ASST. RADIATION SAFETY MGR.	MONROE, MICHIGAN	586-1634 (313)	586-2691
D. JACKSON	ASST. RADIATION SAFETY MGR.	POTTSTOWN, PA.	327-3690 (215)	(717)367-0589
S. PROVOST	ASST. RADIATION SAFETY MGR.	DANBURY, CONN.	796-5341 (203)	355-0739
R. SAUNDERS	RADIATION SAFETY SUPERVISOR	CARY, N.C.	467-8972 (919)	
R. KAY	RADIATION SAFETY SUPERVISOR	MIDDLETOWN, PA.	948-8194 (717)	653-9160

- RESERVED -



RADIATION LEVEL/DISTANCE CHART A  
Iridium-192 (unshielded)

<u>5 curies</u>		<u>10 curies</u>		<u>15 curies</u>		<u>20 curies</u>	
feet	mr/hr	feet	mr/hr	feet	mr/hr	feet	mr/hr
1.0	29500	1.0	59000	1.0	88500	1.0	118000
16.0	100	24.3	100	29.7	100	34.4	100
*35.0	24.1	*35.0	48.2	*35.0	72.2	*35.0	96.3
76.8	5	108.6	5	133.0	5	153.6	5
121.5	2	171.6	2	210.4	2	242.9	2
<u>25 curies</u>		<u>30 curies</u>		<u>35 curies</u>		<u>40 curies</u>	
feet	mr/hr	feet	mr/hr	feet	mr/hr	feet	mr/hr
1.0	147500	1.0	177000	1.0	206500	1.0	236000
*35.0	120.4	*35.0	144.5	*35.0	168.6	*35.0	192.6
38.4	100	38.4	100	45.4	100	48.6	100
171.7	5	188.1	5	203.2	5	217.2	5
271.6	2	297.5	2	321.3	2	343.5	2
<u>45 curies</u>		<u>50 curies</u>		<u>55 curies</u>		<u>60 curies</u>	
feet	mR/hr	feet	mR/hr	feet	mR/hr	feet	mR/hr
1.0	265500	1.0	295000	1.0	324500	1.0	354000
*35.0	216.7	*35.0	240.8	*35.0	264.7	*35.0	289.0
51.5	100	54.3	100	57.0	100	59.5	100
230.4	5	242.8	5	254.7	5	266.1	5
364.3	2	384.0	2	402.8	2	420.7	2
<u>65 curies</u>		<u>70 curies</u>		<u>75 curies</u>		<u>80 curies</u>	
feet	mR/hr	feet	mR/hr	feet	mR/hr	feet	mR/hr
1.0	383500	1.0	413000	1.0	442500	1.0	472000
*35.0	313.1	*35.0	337.1	*35.0	361.2	*35.0	385.3
61.9	100	64.3	100	66.5	100	68.7	100
276.9	5	287.4	5	297.5	5	307.2	5
437.9	2	454.4	2	470.4	2	485.8	2
<u>85 curies</u>		<u>90 curies</u>		<u>95 curies</u>		<u>100 curies</u>	
feet	mR/hr	feet	mR/hr	feet	mR/hr	feet	mR/hr
1.0	501500	1.0	531000	1.0	560500	1.0	590000
*35.0	409.4	*35.0	433.5	*35.0	457.5	*35.0	481.6
70.8	100	72.8	100	74.9	100	76.8	100
316.7	5	325.9	5	334.8	5	343.5	5
500.7	2	515.3	2	529.4	2	543.1	2
<u>105 curies</u>		<u>110 curies</u>		<u>115 curies</u>		<u>120 curies</u>	
feet	mR/hr	feet	mR/hr	feet	mR/hr	feet	mR/hr
1.0	619500	1.0	649000	1.0	678500	1.0	708000
*35.0	505.7	*35.0	529.8	*35.0	553.9	*35.0	557.9
78.7	100	80.6	100	82.4	100	84.1	100
352.0	5	360.3	5	368.4	5	376.3	5
556.5	2	569.6	2	582.4	2	595.0	2

Average cranking distance (control box to free end of guide tube)

RADIATION LEVEL/DISTANCE CHART "B"  
Cobalt-60 (unshielded)

5 curies	
feet	mR/hr
1.0	72000
26.8	100
*40.0	45
120.0	5
189.9	2

10 curies	
feet	mR/hr
1.0	144000
37.9	100
*40.0	90
169.7	5
268.3	2

20 curies	
feet	mR/hr
1.0	288000
*40.0	180
53.7	100
240.0	5
379.5	2

30 curies	
feet	mR/hr
1.0	432000
*40.0	270
65.7	100
293.9	5
464.7	2

40 curies	
feet	mR/hr
1.0	576000
*40.0	360
75.9	100
339.4	5
536.6	2

50 curies	
feet	mR/hr
1.0	720000
*40.0	450
84.5	100
379.4	5
600.0	2

60 curies	
feet	mR/hr
1.0	864000
*40.0	540
92.9	100
415.7	5
657.3	2

70 curies	
feet	mR/hr
1.0	1008000
*40.0	630
100.4	100
449.1	5
709.9	2

80 curies	
feet	mR/hr
1.0	1152000
*40.0	720
107.3	100
480.0	5
758.9	2

90 curies	
feet	mR/hr
1.0	1296000
*40.0	810
113.8	100
509.1	5
805.0	2

100 curies	
feet	mR/hr
1.0	1440000
*40.0	900
120.0	100
536.6	5
848.5	2

110 curies	
feet	mR/hr
1.0	1584000
*40.0	990
125.8	100
562.8	5
890.7	2

\*Average cranking distance (control box to free end of guide tube)

SHIPPING OF RADIOACTIVE MATERIAL

1. No CONAM employee will offer a package of radioactive material to a carrier for transportation unless the following requirements are met.
2. Only shipping containers authorized by CONAM's license are to be used.
  - (a) Properly packaged exposure devices are classified as shipping containers.
  - (b) Authorized shipping containers are listed on Page 31 of CONAM's Radiation Safety Operating and Emergency Procedures Manual, Paragraph 10.3.5 Source Exchangers.
3. The step-by-step instructions issued by the manufacturer of the container are followed in detail and in the sequence presented.
4. The source is securely locked in the fully shielded position as confirmed by carefully performed and recorded radiation surveys.
  - (a) The outside of each radioactive materials package must incorporate a feature such as a seal or lock which is not readily breakable and which, while intact, will be evidence that the package has not been illicitly opened.
  - (b) The survey of the shipping container and survey meter information will be recorded on CONAM Inspection's requisition form.
  - (c) A visual inspection shall be made of the shipping container for damage that could cause a radiation hazard.
5. No package with radiation levels in excess of 200 milliroentgens per hour at the package surface, or 10 milliroentgens per hour at three feet, shall be released for shipment.

6. Package labeling and accompanying shipping papers shall be properly completed.

- (a) Two appropriate radioactive materials warning labels must be affixed to opposite sides of the package. These labels and application are shown on Page 71 of CONAM'S Radiation Safety Operating and Emergency Procedures Manual.
- (b) The warning label shall indicate:
  - (1) Contents (Iridium 192, Cobalt 60, etc.)
  - (2) Number of curies
  - (3) Transport index number (Transport index number is equal to the radiation level in millirem per hour at three feet from the package).
- (c) Remove all old shipping labels and apply a new labels apply a new label that indicates:
  - (1) Shipper (Company name, address and phone number).
  - (2) Consignee (Company name, address, phone number and the name of the individual to be notified upon delivery).

RADIOACTIVE MATERIAL IS GENERALLY LIMITED TO TWO (2) MODES OF TRANSPORTATION MOTOR FREIGHT AND AIR FREIGHT. ALL RADIOACTIVE MATERIAL USED BY CONAM IS INDUSTRIAL TYPE AND CANNOT BE SHIPPED BY PASSENGER CARRYING AIRCRAFT.

- (d) Air freight shipments require two (2) documents:
  - (1) Air bill (see appendix "N" for example and instructions).
  - (2) Shippers Certification (see appendix "O" for example and instructions).
- (e) Motor freight shipments require one (1) document:
  - (1) Bill of Lading (see appendix "P" for example and instructions).

THE FACE OF THE WAYBILL WILL SHOW IDENTIFICATION # UN2974

## APPENDIX "F"

### PROCEDURE FOR PICKING UP, RECEIVING AND OPENING PACKAGES

When ordering radioactive material to be delivered, give detailed instructions to the shipper, covering mode of transportation, delivery instructions, and name of individual who will be notified at time of delivery.

When ordering radioactive material that will be picked up at carrier's terminal, give detailed instructions to the shipper, covering mode of transportation, person to be notified, and a phone number where that person can be contacted.

When notified of the arrival of a shipment of radioactive material (that is to be picked up), the person notified shall see that the shipment is picked up at the earliest practical opportunity.

Survey the shipping container as soon as practical after receipt, but no later than three hours if received during working hours, or eighteen hours if received after normal working hours.

If readings are found that exceed the requirements -- 200 mr at any surface or 10 mr at three feet -- immediately notify by telephone and telegraph the final delivering carrier, the appropriate N.R.C. regional office, and Radiation Safety Officer.

The procedures specified in Paragraph 9.1 of CONAM's Radiation Safety Operating and Emergency Procedures Manual shall be followed when opening packages of radioactive material.

The above information shall be recorded on CONAM's Requisition Form (Appendix "G").



NO EXPOSURE DEVICE IS TO BE LOADED IN EXCESS OF LIMITS SPECIFIED IN 10 CFR PART 34-21

## REQUISITION

Division \_\_\_\_\_ Ordered By \_\_\_\_\_  
Type of Isotope: IR 192 ☐ CO 60 ☐ No. Curies Ordered \_\_\_\_\_  
Ordered From \_\_\_\_\_ Shipped VIA \_\_\_\_\_

## RECEIVING

Date \_\_\_\_\_ Time \_\_\_\_\_ AM/PM Received By \_\_\_\_\_  
Curies Received \_\_\_\_\_ Serial No. \_\_\_\_\_  
In Shipping Container Model No. \_\_\_\_\_ Shipping Container Serial No. \_\_\_\_\_  
In Camera \_\_\_\_\_ Model No. \_\_\_\_\_ Camera Serial No. \_\_\_\_\_  
Survey: Date \_\_\_\_\_ Time \_\_\_\_\_ AM/PM  
Reading At Surface \_\_\_\_\_ MR/HR Reading at 3 feet \_\_\_\_\_ MR/HR

## TRANSFERS AND/OR DISPOSALS

Date \_\_\_\_\_ Source No. \_\_\_\_\_ Curie Strength \_\_\_\_\_  
Transferred from SHP/CON No. \_\_\_\_\_ to Camera Model \_\_\_\_\_ Serial No. \_\_\_\_\_  
Reading at 6 inches \_\_\_\_\_ MR/HR Reading at 1 meter \_\_\_\_\_ MR/HR  
Transferred from Camera Model Number \_\_\_\_\_ Serial Number \_\_\_\_\_  
To Camera Model Number \_\_\_\_\_ Serial Number \_\_\_\_\_  
Reading at 6 inches \_\_\_\_\_ MR/HR Reading at 1 meter \_\_\_\_\_ MR/HR  
Source No. \_\_\_\_\_ Transferred to Shipping Cont. No. \_\_\_\_\_  
For Disposal To \_\_\_\_\_  
Survey of Shipping Container \_\_\_\_\_ Surface \_\_\_\_\_ MR/HR 3 feet \_\_\_\_\_ MR/HR

## ALL SURVEYS MADE WITH THE FOLLOWING SURVEY INSTRUMENT

Meter Model No. \_\_\_\_\_ Serial No. \_\_\_\_\_ Calibration Date \_\_\_\_\_  
Transfer and Survey Made By \_\_\_\_\_

COPY OF THIS REPORT IS TO BE ATTACHED TO ALL DECAY CHARTS FOR  
ALL SOURCES INVOLVED IN THIS TRANSACTION

INSTRUCTORS FOR THE USE OF THE RADIOGRAPHIC EXPOSURE VAULTS

1. Entrance:
  - a. No person will be permitted to enter the vault area unless he has monitored the area with a gamma survey meter to determine that the area is safe to enter.
2. Limitations:
  - a. The exposure vault will be used only under the supervision of the CONAM qualified radiographer.
  - b. The exposure vault will be limited to quantities of radioactivity, makes and models of exposure devices as listed under items 6,7,8 and 9 of the U.S.N.R.C. Byproduct Material License number 42-16559-01 and Paragraph 6 of these instructions.
  - c. Exposures will not be conducted with the source any closer than 2' from any inside wall.
  - d. All operations of radiographic exposure devices in radiographic exposure vaults shall be conducted in accordance with instructions found in CONAM'S OEPM Section 10.0 for the respective device.
3. Set Up:
 

No person will establish a high radiation area in the vault unless he first:

  - a. Secures the vault entry with the warning light and radiation area signs.
  - b. Sets warning light system in operation.
  - c. Ascertains the perimeter of the radiation area is posted with radiation area signs at the calculated 2 MR/HR level.
  - d. Inspects the exposure device to be used as per instructions outlined in CONAM'S Radiation Safety Operating and Emergency Procedures, Part 13.0
  - e. Verifys the operation of the visible and audible warning signals by placing the source in the exposed position, noting the operation of the red light and then opening the vault entrance door slightly while the source is in the exposed position and verify the operation of the audible device.

## 4. Use:

After a high radiation area has been established the radiographer will:

- a. Have the exposure vault under constant surveillance.
- b. Permit NO ONE to enter the radiation area.
- c. Monitor the perimeter of the radiation area to ascertain that the level of radiation does not exceed 2 MR/HR (Exposure procedures are to be altered by the use of a collimator and/or shielding if the level of radiation exceeds 2 MR/HR at the perimeter).
- d. Survey the area, exposure device and guide tube to determine that the source is in the shielded position after each exposure.

## 5. Securing:

After the completion of the radiographic procedure the radiographer will:

- a. Survey the area and exposure device to determine that the source has returned to the shielded position.
- b. Lock, disassemble and store exposure device.
- c. Complete radiation report and log total time of use for the vault usage log.
- d. Secure high radiation warning light system and secure vault entry in open position.

## 6. Utilization:

Due to the different dimensions, thickness, density and type of shielding materials of exposure areas in CONAM radiographic labs, exposures will be restricted to the following quantities:

	Cobalt 60	Iridium 192
a. Itasca, Illinois		
Area #1	50 Curies	120 Curies
Area #2 and #3	-----	120 Curies
b. Columbus, Ohio	110 Curies	120 Curies
c. Folcroft, PA.	82.5 Curies	120 Curies
d. Roseville, Minnesota		
Area #1	110 Curies	120 Curies
Area #2	55. Curies	120 Curies

NOTICE TO ALL RADIOGRAPHERS  
using x-ray equipment

The CONAM Operating and Emergency Procedure Manual is written to provide radiation safety to the general public and occupational personnel alike. The safety precautions therein shall apply to operations with x-ray generators where applicable. The several and individual states have provisions regulating the use of any radiation producing device. Enforcement measures are vested in their Departments of Public Health, with penalties for violations provided.

The following items are mandatory to use of x-ray generators in addition to those applicable to CONAM'S Operating and Emergency Procedure Manual.

1. Survey meters shall be used in the same manner as when utilizing Byproduct Material. They shall be used to determine that the x-ray unit is off except in cases where the main power source is disconnected.
2. No x-ray until shall be left unattended wherein any unauthorized or unqualified person might cause the unit to be energized resulting in a hazard. The control panel and/or power cables shall be stored or locked if it is necessary to leave the generator in position unattended.
3. All necessary instructions for operating x-ray units are detailed in your Field Radiographers Manual, Section D, including warm-up, exposures and trouble shooting information.

The preceding, although brief, does not relieve the radiographer of any of the other detailed requirements of CONAM'S Operating and Emergency Manual which are applicable. Violations involving x-ray generators carry the same disciplinary penalties as those pertaining to radioisotopes.

Radiation Safety Department  
CONAM Inspection Div.

Addendum to CONAM  
Radiation Safety O&E Procedure Manual



## APPENDIX "I"

### NOTICE TO ALL RADIOGRAPHERS using x-ray equipment

The CONAM Operating and Emergency Procedure Manual is written to provide radiation safety to the general public and occupational personnel alike. The safety precautions therein shall apply to operations with x-ray generators where applicable. The several and individual states have provisions regulating the use of any radiation producing device. Enforcement measures are vested in their Departments of Public Health, with penalties for violations provided.

The following items are mandatory to use of x-ray generators in addition to those applicable to CONAM'S Operating and Emergency Procedure Manual.

1. Survey meters shall be used in the same manner as when utilizing Byproduct Material. They shall be used to determine that the x-ray unit is off except in cases where the main power source is disconnected.
2. No x-ray until shall be left unattended wherein any unauthorized or unqualified person might cause the unit to be energized resulting in a hazard. The control panel and/or power cables shall be stored or locked if it is necessary to leave the generator in position unattended.
3. All necessary instructions for operating x-ray units are detailed in your Field Radiographers Manual, Section D, including warm-up, exposures and trouble shooting information.

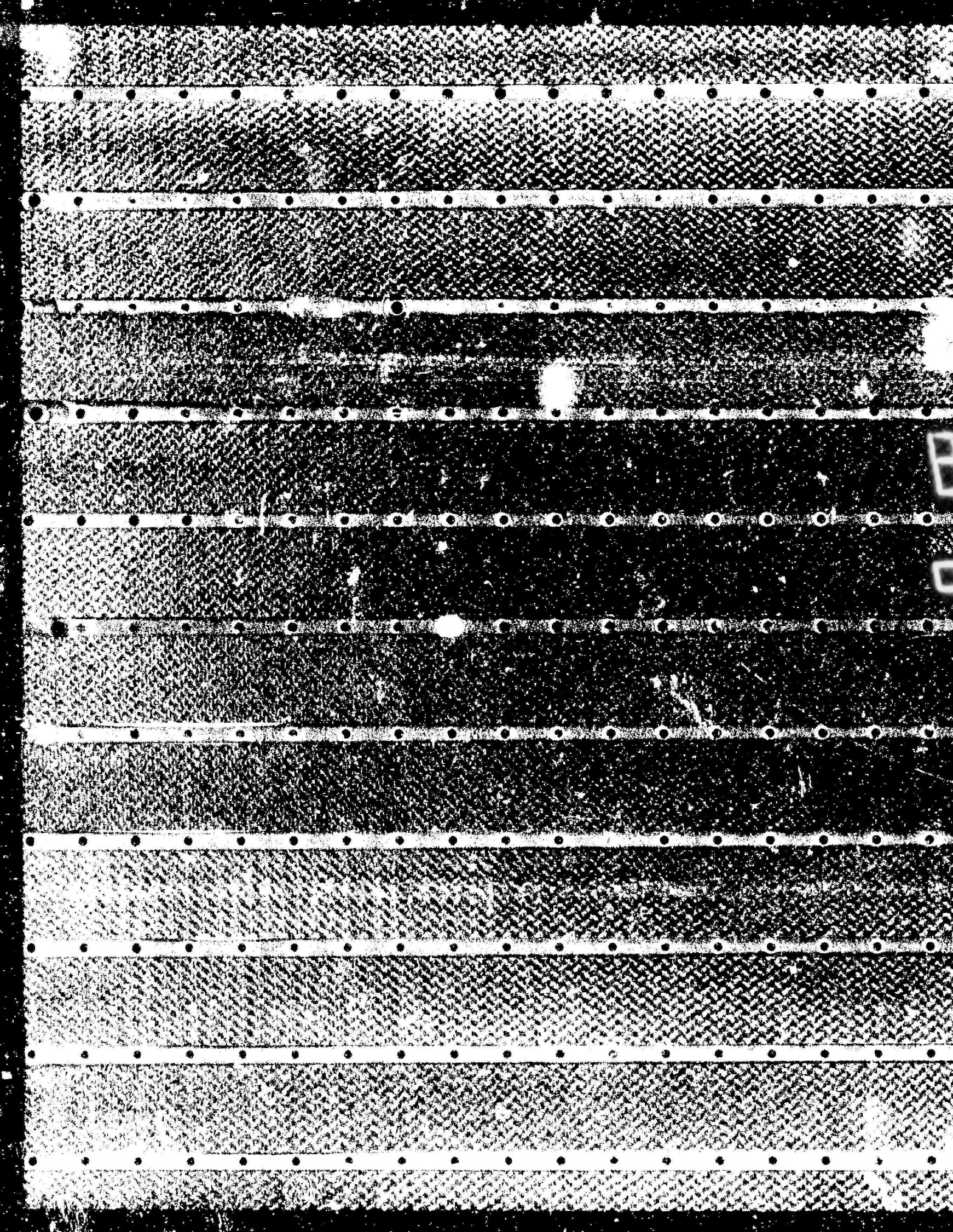
The preceding, although brief, does not relieve the radiographer of any of the other detailed requirements of CONAM'S Operating and Emergency Manual which are applicable. Violations involving x-ray generators carry the same disciplinary penalties as those pertaining to radioisotopes.

Radiation Safety Department  
CONAM Inspection Div.

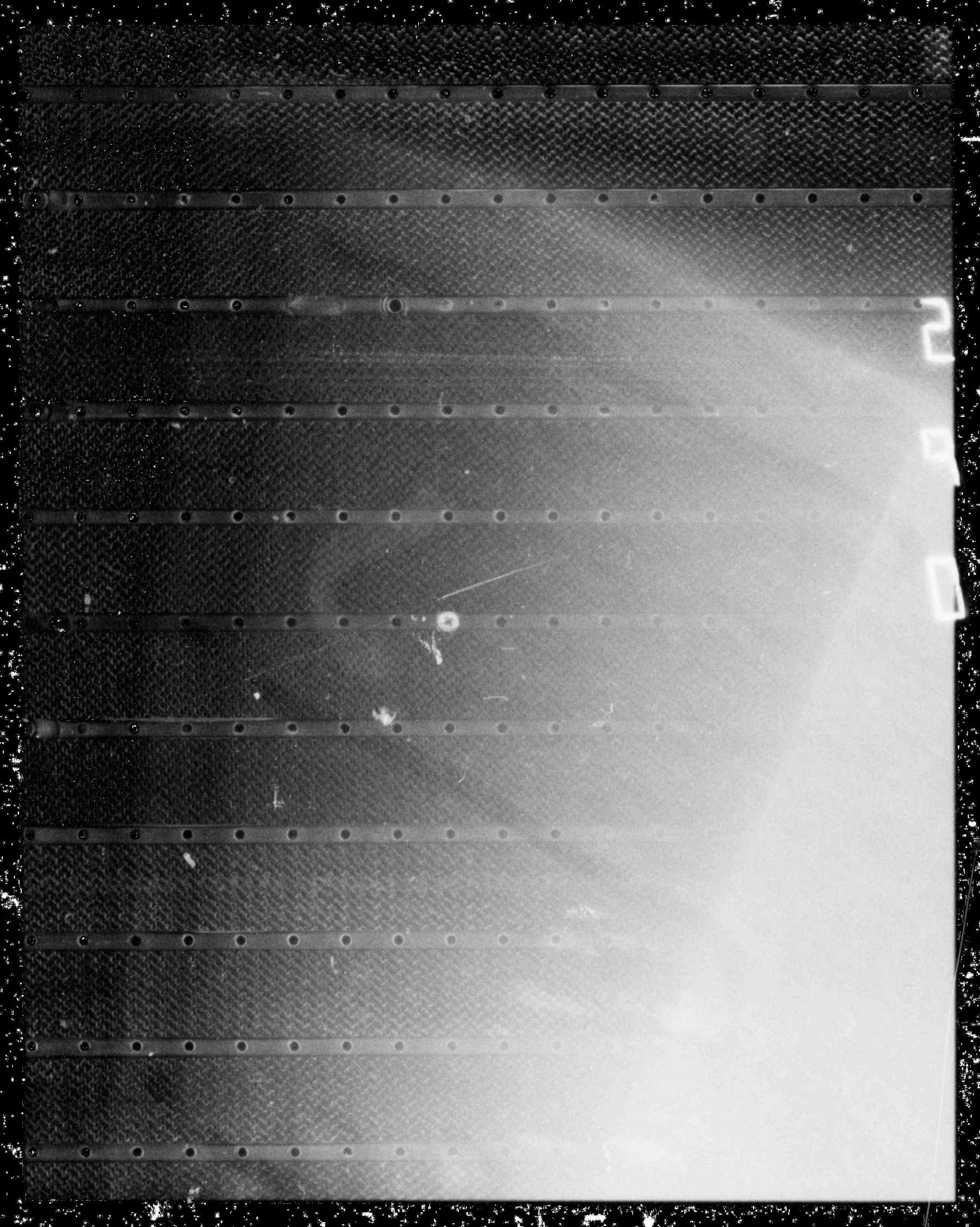
Addendum to CONAM  
Radiation Safety O&E Procedure Manual











NOTICE TO ALL RADIOGRAPHERS  
using x-ray equipment

The CONAM Operating and Emergency Procedure Manual is written to provide radiation safety to the general public and occupational personnel alike. The safety precautions therein shall apply to operations with x-ray generators where applicable. The several and individual states have provisions regulating the use of any radiation producing device. Enforcement measures are vested in their Departments of Public Health, with penalties for violations provided.

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Radiation Safety Department  
CONAM Inspection Div.

Addendum to CONAM  
Radiation Safety O&E Procedure Manual



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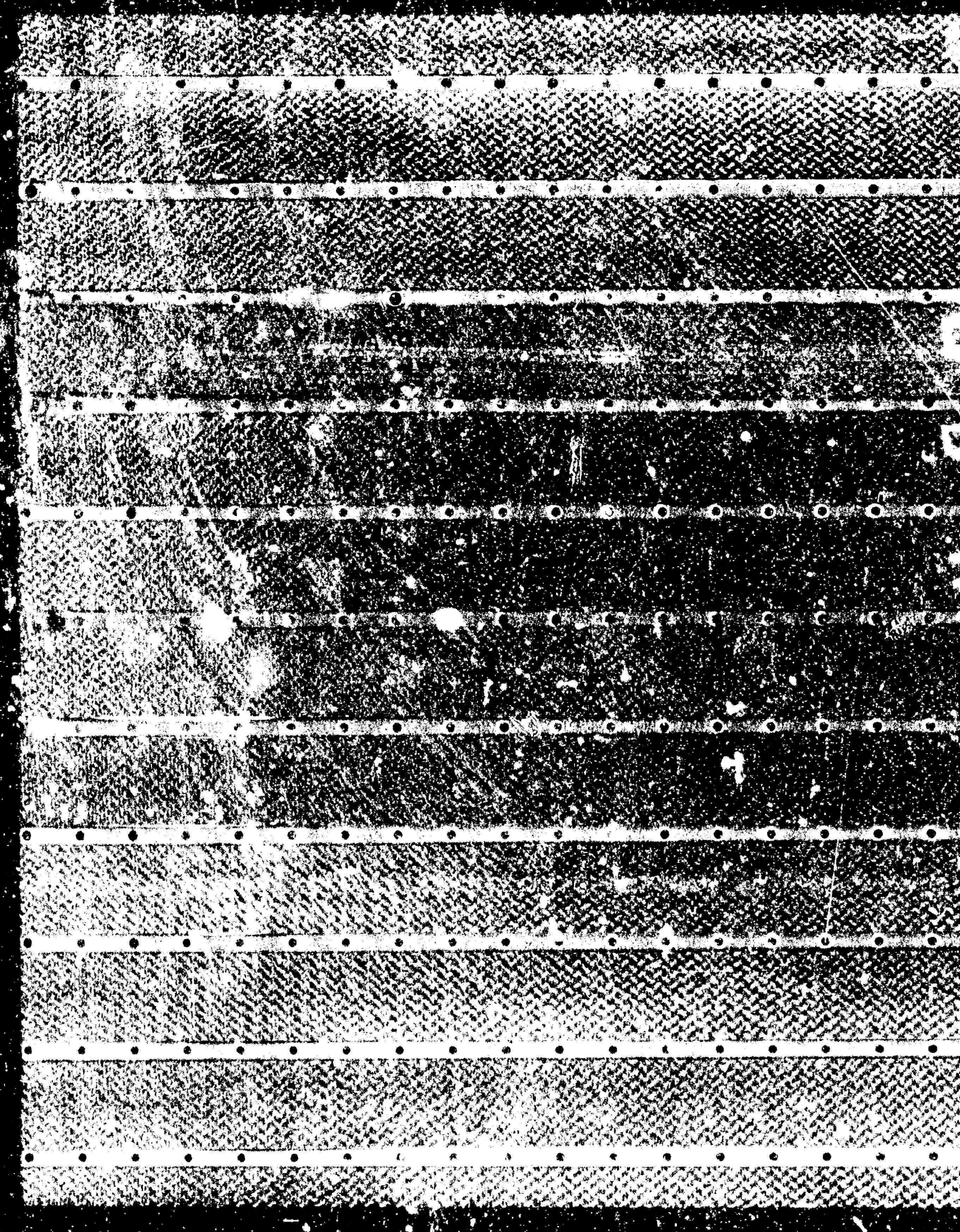
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Radiation Safety Department  
CONAM Inspection Div.

Addendum to CONAM  
Radiation Safety O&E Procedure Manual





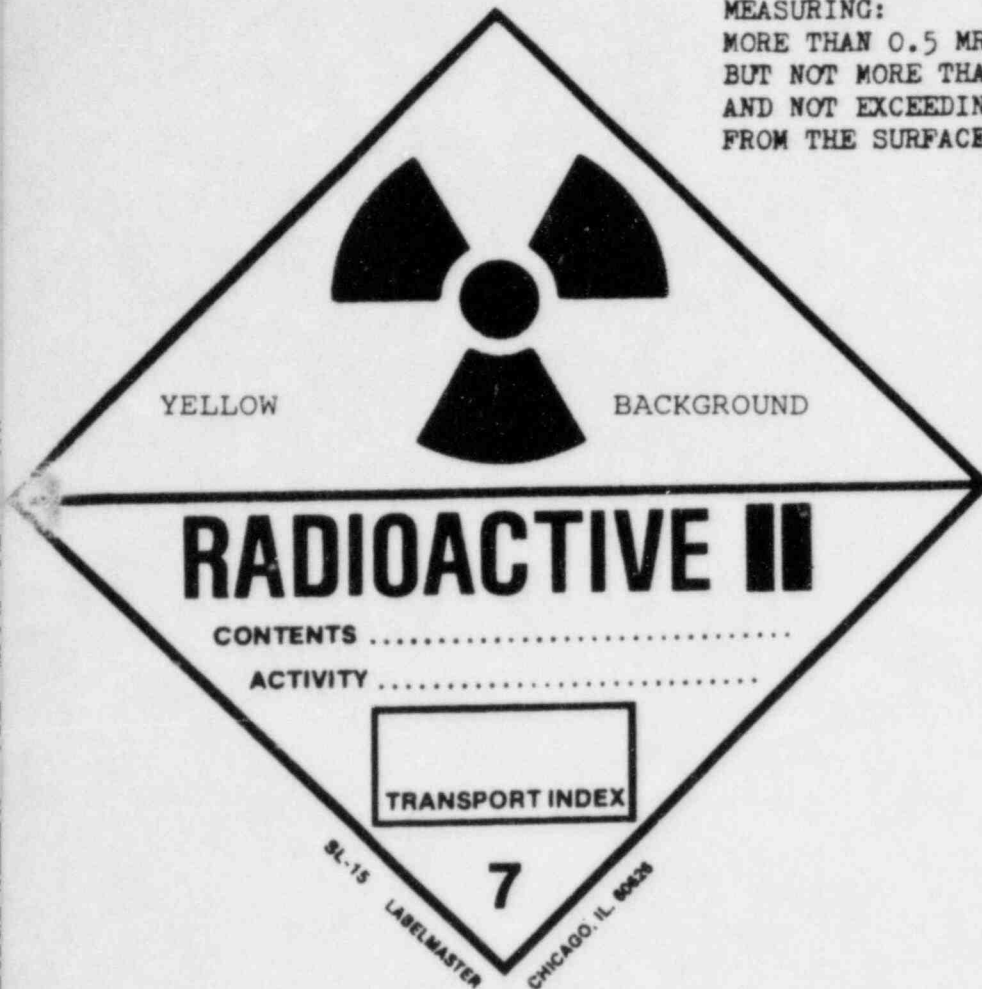
## PRIVACY ACT STATEMENT

Pursuant to 5 U.S.C. 552a(e) (3), enacted into law by section 3 of the Privacy Act of 1974 (Public Law 93-579), the following statement is furnished to individuals who supply information to the Nuclear Regulatory Commission on Form NRC-4. This information is maintained in a system of records designated as NRC 27 and described at 40 Federal Register 45344 (October 1, 1975).

1. **AUTHORITY** Sections 53, 63, 65, 81, 103, 104, 161(b), and 161(o) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2073, 2093, 2095, 2111, 2133, 2134, 2201(b), and 2201(o)). The authority for soliciting the social security number is 10 CFR Part 20.
2. **PRINCIPAL PURPOSE(S)** The information is used by the NRC in its evaluation of the risk of radiation exposure associated with the licensed activity and in exercising its statutory responsibility to monitor and regulate the safety and health practices of its licensees. The data permits a meaningful comparison of both current and long-term exposure experience among types of licensees and among licensees within each type. Data on your exposure to radiation is available to you upon request.
3. **ROUTINE USES** The information may be used to provide data to other Federal and State agencies involved in monitoring and/or evaluating radiation exposure received by individuals employed as radiation workers on a permanent or temporary basis and exposure received by monitored visitors. The information may also be disclosed to an appropriate Federal, State, or local agency in the event the information indicates a violation or potential violation of law and in the course of an administrative or judicial proceeding.
4. **WHETHER DISCLOSURE IS MANDATORY OR VOLUNTARY AND EFFECT ON INDIVIDUAL OF NOT PROVIDING INFORMATION** It is voluntary that you furnish the requested information, including social security number; however, the licensee must have a completed Form NRC-4 on each individual whom the licensee proposes to expose to a radiation dose in excess of the amounts specified in 10 CFR 20.101(a). Failure to obtain the requested information before permitting such exposure may subject the licensee to enforcement action in accordance with 10 CFR 20.601. The social security number is used to assure that NRC has an accurate identifier not subject to the coincidence of similar names or birthdates among the large number of persons on whom data is maintained.
5. **SYSTEM MANAGER(S) AND ADDRESS** Director, Office of Management Information and Program Control  
U.S. Nuclear Regulatory Commission, Washington, D.C. 20555

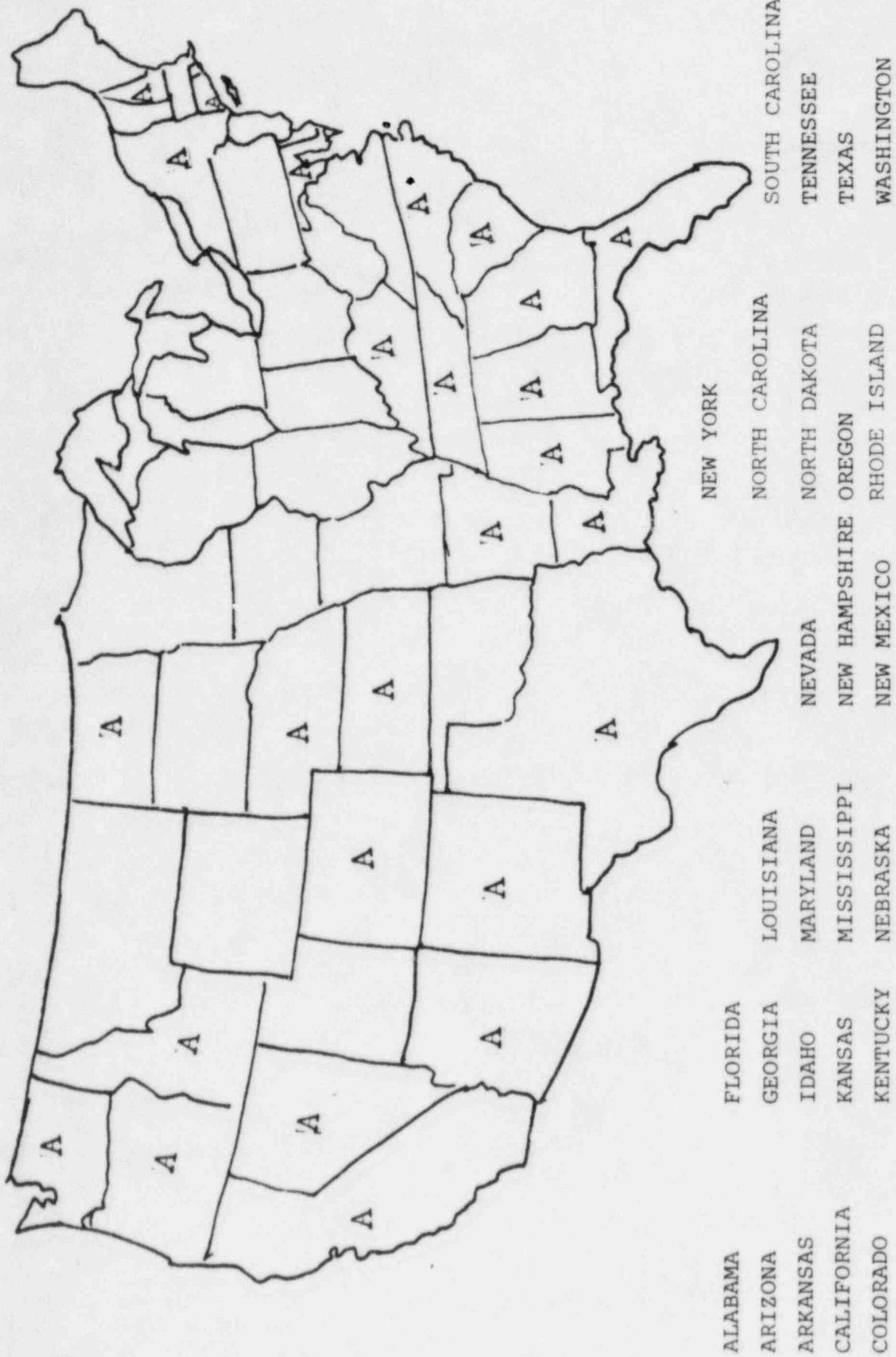


RADIOACTIVE YELLOW II LABELS MUST BE  
AFFIXED TO TWO SIDES OF EACH PACKAGE  
MEASURING:  
MORE THAN 0.5 MR AT ANY SURFACE.  
BUT NOT MORE THAN 50 MR AT ANY SURFACE.  
AND NOT EXCEEDING 1.0 MR AT THREE FEET  
FROM THE SURFACE.



RADIOACTIVE YELLOW III LABELS  
MUST BE USED FOR EACH PACKAGE  
EXCEEDING THE LIMITS FOR  
EITHER LABEL I OR II.

AGREEMENT STATES



## APPENDIX "L" CON'T

AGREEMENT STATES

<u>STATE</u>	<u>RECIPRIOCITY</u>	<u>NOTIFICATION</u>
1. Alabama	180 Days	3 Days
2. Arizona	180 Days	3 Days
3. Arkansas	20 Days	2 Days
4. California	180 Days	3 Days
5. Colorado	180 Days	5 Days
6. Florida	180 Days	10 Days
7. Georgia	45 Days (1)	3 Days
8. Idaho	20 Days	3 Days
9. Kansas	Unlimited	5 Days
10. Kentucky	Unlimited	2 Days
11. Louisiana	Unlimited	2 Days
12. Maryland	180 Days	3 Days
13. Mississippi	180 Days	2 Days
14. Nebraska	180 Days	3 Days
15. Nevada	180 Days	3 Days
16. New Hampshire	Unlimited	2 Days
17. New Mexico	180 Days	3 Days
18. New York	180 Days	7 Days
19. North Carolina	20 Days	5 Days
20. North Dakota	180 Days	3 Days
21. Oregon	180 Days	3 Days
22. Rhode Island	180 Days	3 Days
23. South Carolina	180 Days	3 Days
24. Tennessee	180 Days	2 Days
25. Texas	180 Days	2 Days
26. Washington	180 Days	5 Days

## NOTES:

(1) Not to exceed 45 consecutive days or 180 days in any 365 day period.





UNITED STATES NUCLEAR REGULATORY COMMISSION  
Washington, D.C. 20555

# NOTICE TO EMPLOYEES

STANDARDS FOR PROTECTION AGAINST RADIATION (PART 20), NOTICES, INSTRUCTIONS AND  
REPORTS TO WORKERS, INSPECTIONS (PART 19), EMPLOYEE PROTECTION

## WHAT IS THE NUCLEAR REGULATORY COMMISSION?

The Nuclear Regulatory Commission is an independent Federal regulatory agency responsible for licensing and inspecting nuclear power plants and other commercial uses of radioactive materials.

## WHAT DOES THE NRC DO?

The NRC's primary responsibility is to ensure that workers and the public are protected from unnecessary or excessive exposure to radiation and that nuclear facilities including power plants are constructed to high quality standards and operated in a safe manner. The NRC does this by establishing requirements in Title 10 of the Code of Federal Regulations (10 CFR) and in licenses issued to nuclear users.

## WHAT RESPONSIBILITY DOES MY EMPLOYER HAVE?

Any company that conducts activities licensed by the NRC must comply with the NRC's requirements. If a company violates NRC requirements, it can be fined or have its license modified, suspended or revoked.

Your employer must tell you which NRC radiation requirements apply to your work and must post NRC Notices of Violation involving radiological working conditions.

## WHAT IS MY RESPONSIBILITY?

For your own protection and the protection of your co-workers, you should know how NRC requirements relate to your work and should obey them. If you observe violations of the requirements, you should report them.

## HOW DO I REPORT VIOLATIONS?

If you believe that violations of NRC rules or of the terms of the license have occurred, you should report them immediately to your supervisor. If you believe that adequate corrective action is not being taken, you may report this to an NRC inspector or the nearest NRC Regional Office.

## WHAT IF I WORK IN A RADIATION AREA?

If you work with radioactive materials or in a radiation (controlled) area, the amount of radiation exposure that you may legally receive is limited by the NRC. The limits on your exposure are contained in sections 20.101, 20.103, and 20.104 of Title 10 of the Code of Federal Regulations (10 CFR 20). While those are the maximum allowable limits, your employer should also keep your radiation exposure as far below those limits as is "reasonably achievable."

## MAY I GET A RECORD OF MY RADIATION EXPOSURE?

Yes. Your employer is required to tell you in writing, if you receive any radiation exposure above the limits set in the NRC regulations or your employer's license. In addition, if your job involves radiation, you may request from your employer a record of your annual radiation exposures and a written report of your total exposure when you leave your job.

## HOW ARE VIOLATIONS OF NRC REQUIREMENTS IDENTIFIED?

NRC conducts regular inspections at licensed facilities to assure compliance with NRC requirements. In addition, your employer and site contractors conduct their own inspections to assure compliance. All inspectors are protected by Federal law. Interference with them may result in criminal prosecution for a Federal offense.

## MAY I TALK WITH AN NRC INSPECTOR?

Yes. Your employer may not prevent you from talking with an NRC inspector and you may talk privately with an inspector and request that your identity remain confidential.

## MAY I REQUEST AN INSPECTION?

If you believe that your employer has not corrected violations involving radiological

working conditions, you may request an inspection. Your request should be addressed to the nearest NRC Regional Office and must describe the alleged violation in detail. It must be signed by you or your representative.

## HOW DO I CONTACT THE NRC?

Notify an NRC inspector on-site or call the nearest NRC Regional office collect. NRC inspectors want to talk to you if you are worried about radiation safety or other aspects of licensed activities, such as the quality of construction or operations at your plant.

## CAN I BE FIRED FOR TALKING TO THE NRC?

No. Federal law prohibits an employer from firing or otherwise discriminating against a worker for bringing safety concerns to the attention of the NRC. You may not be fired or discriminated against because you:

- ask the NRC to enforce its rules against your employer;
- testify in an NRC proceeding;
- provide information or are about to provide information to the NRC about violations of requirements;
- are about to ask for or testify, help, or take part in an NRC proceeding.

## WHAT FORMS OF DISCRIMINATION ARE PROHIBITED?

No employer may fire you or discriminate against you with respect to pay, benefits, or working conditions because you help the NRC.

## HOW AM I PROTECTED FROM DISCRIMINATION?

If you believe that you have been discriminated against for bringing safety concerns to the NRC, you may file a complaint with the U.S. Department of Labor. Your complaint must describe the firing or discrimination and must be filed within 30 days of the occurrence.

Send complaints to:

Office of the Administrator  
Wage and Hour Division  
Employment Standards Administration  
U.S. Department of Labor  
Room 53502  
200 Constitution Avenue, N.W.  
Washington, D.C. 20210

or any local office of the Department of Labor, Wage and Hour Division. Check your telephone directory under U.S. Government listings.

## WHAT CAN THE LABOR DEPARTMENT DO?

The Department of Labor will notify the employer that a complaint has been filed and will investigate the case.

If the Department of Labor finds that your employer has unlawfully discriminated against you, it may order you to be reinstated, receive back pay, or be compensated for any injury suffered as a result of the discrimination.

## WHAT WILL THE NRC DO?

The NRC may assist the Department of Labor in its investigation. NRC may conduct its own investigation where necessary to determine whether unlawful discrimination has prevented the free flow of information to the Commission. Also, if the NRC or Department of Labor finds that unlawful discrimination has occurred, the NRC may issue a Notice of Violation to your employer, impose a fine, or suspend, modify, or revoke your employer's NRC license.

## UNITED STATES NUCLEAR REGULATORY COMMISSION REGIONAL OFFICE LOCATIONS

A representative of the Nuclear Regulatory Commission can be contacted at the following addresses and telephone numbers. The Regional Office will accept collect telephone calls from employees who wish to register complaints or concerns about radiological working conditions or other matters regarding compliance with Commission rules and regulations.

### Regional Offices

REGION	ADDRESS	TELEPHONE
I	U.S. Nuclear Regulatory Commission Region I 831 Park Avenue King of Prussia, PA 19406	215 337-5000
II	U.S. Nuclear Regulatory Commission Region II 101 Marietta St., N.W., Suite 2900 Atlanta, GA 30323	404 221-4503
III	U.S. Nuclear Regulatory Commission Region III 799 Roosevelt Road Glen Ellyn, IL 60137	312 790-5500
IV	U.S. Nuclear Regulatory Commission Region IV 811 Ryan Plaza Drive, Suite 1000 Arlington, TX 76011	817 860-6100
V	U.S. Nuclear Regulatory Commission Region V 1480 Marie Lane, Suite 210 Walnut Creek, CA 94606	415 943-3700



NRC FORM 3  
(8-84)





PLEASE COMPLETE ALL INFORMATION IN THE 5 BLOCKS OUTLINED IN ORANGE  
SEE BACK OF FORM SET FOR COMPLETE PREPARATION INSTRUCTIONS

AIRBILL NUMBER

430153



733

YOUR FEDERAL EXPRESS ACCOUNT NUMBER

0770-1047-5

DATE

4-15-85

FROM (Your Name)

TO (Recipient's Name)

If Held For Pick Up or Saturday Delivery  
Recipient's Phone Number

COMPANY

DEPARTMENT/FLOOR/NO

CONAM INSPECTION

COMPANY

DEPARTMENT/FLOOR/NO

Conam Inspection

STREET ADDRESS

6106 ROOK IN

STREET ADDRESS (P.O. BOX NUMBERS ARE NOT DELIVERABLE)

4000 Lockbourne Rd.

CITY

HOUSTON

STATE

TX

CITY

Columbus

STATE

Ohio

AIRBILL NO.

107430153

IF ACCURATE ZIP CODE REQUIRED FOR CORRECT DELIVERY

77074

IN TENDERING THIS SHIPMENT SHIPPER AGREES THAT  
F.E.C. SHALL NOT BE LIABLE FOR SPECIAL INCIDENT  
OR CONSEQUENTIAL DAMAGES ARISING FROM

IF ACCURATE ZIP CODE REQUIRED FOR OVERNIGHT DELIVERY

43207

42918

YOUR NOTES/REFERENCE NUMBERS (FIRST 12 CHARACTERS WILL ALSO APPEAR ON INVOICE)

PAYMENT: ☐ Bill Shipper ☐ Bill Recipient's F.E.C. Acct. ☐ Bill 3rd Party F.E.C. Acct. ☐ Bill Credit Card  
☐ Cash in Advance Account Number/Credit Card Number

CARRIAGE HEREON F.E.C. DIS-  
CLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, WITH  
RESPECT TO THIS SHIPMENT. THIS IS A NON-NEGOTIABLE  
AIRBILL SUBJECT TO CONDITIONS OF CONTRACT SET FORTH  
ON REVERSE OF SHIPPER'S COPY. UNLESS YOU DECLARE A  
HIGHER VALUE, THE LIABILITY OF FEDERAL EXPRESS COR-  
PORATION IS LIMITED TO \$100.00. FEDERAL EXPRESS DOES  
NOT CARRY CARGO LIABILITY INSURANCE.

FEDERAL EXPRESS USE

FREIGHT CHARGES

DECLARED VALUE CHARGE

SERVICES  
CHECK ONLY ONE BOX

DELIVERY AND SPECIAL HANDLING  
CHECK SERVICES REQUIRED

PACKAGES

WEIGHT

DECLARED  
VALUE

D/S

PRIORITY 1

OVERNIGHT LETTER

1 ☐ OVERNIGHT PACKAGES  
DEL. BY 10:00 A.M.

1 ☐ HOLD FOR PICK UP AT FOLLOWING  
FEDERAL EXPRESS LOCATION SHOWN  
IN SERVICE GUIDE. RECIPIENT'S  
PHONE NUMBER REQUIRED.

COURIER PAK

2 ☐ DELIVER  
SATURDAY MORNING (REGULATED  
MATERIALS ONLY)

2 ☐ OVERNIGHT EXMT. OR  
P.A.K. (2 LBS.)

3 ☐ DELIVER  
SATURDAY AFTERNOON (REGULATED  
MATERIALS ONLY)

3 ☐ OVERNIGHT BOX  
P.A.K. (5 LBS.)

4 ☐ DELIVER  
SATURDAY EVENING (REGULATED  
MATERIALS ONLY)

4 ☐ OVERNIGHT TUB  
P.A.K. (10 LBS.)

5 ☐ DELIVER  
SATURDAY NIGHT (REGULATED  
MATERIALS ONLY)

5 ☐ DELIVER  
SATURDAY NIGHT (REGULATED  
MATERIALS ONLY)

6 ☐ DELIVER  
SATURDAY NIGHT (REGULATED  
MATERIALS ONLY)

STANDARD AIR

7 ☐ OTHER SPECIAL SERVICE

OVERNIGHT IS NEXT BUSINESS DAY  
(MONDAY THROUGH FRIDAY) TWO DAY  
FROM ALASKA/HAWAII. SATURDAY DELIV-  
ERY AVAILABLE IN CONTINENTAL U.S.  
SEE SPECIAL HANDLING.

8 ☐

9 ☐

1 Box Special Form N.O.S. UN2974  
Type "B" Package I.D. #USA/9006/B(U)  
35 Curies IR 192 Yellow II  
1 piece 24 lbs. Declared Value \$1,200.00

DATE/TIME For Federal Express Use

AGT/PRO

ADVANCE ORIGIN

AGT/PRO

ADVANCE DESTINATION

OTHER

TOTAL CHARGES

PART# 2041730751  
FEC S-0751 D/O/B  
REVISION DATE  
2183 GBF  
PRINTED USA



The space on airbills is limited, but the following information is required.

- (1) Radioactive Material, Special Form, N.O.S. UN2974
- (2) Type "B" package.
- (3) Package I.D. number. This number can be found on most new type "B" packages. The 500 SU changer is #USA/9006/B(U); the Model 520 Camera is #USA/9007/B(U). Most other cameras are not type "B" unless they are packed in a Type "B" overpack (drum). The overpack will have the package I.D. number on the outside. Overpacks are available from AII, Tech/Ops and Gamma Industries and Gulf Nuclear for their respective cameras.
- (4) Number of curies.
- (5) Material (IR 192) or (CO 60).
- (6) Indicate the "Bar" label applied to the package, Yellow II or Yellow III.

MARK AS HAZARDOUS MATERIAL AND CARGO AIRCRAFT ONLY.


**FEDERAL  
EXPRESS**COMBINATION AIRBILL/  
SHIPPER CERTIFICATION

AIRBILL NUMBER

087

APPENDIX "N" CONT.

FEDERAL EXPRESS CORPORATION

YOUR FEDERAL EXPRESS ACCOUNT NUMBER		DATE 4-9-85	APPENDIX "N" CONT.	
FROM (Your Name) Otis C. Gamble		TO (Recipient's Name) James Kelker		IF Hold For Pick-Up or Saturday Delivery Recipient's Phone Number
COMPANY Conam Inspection <b>1</b>		COMPANY Conam Inspection <b>2</b>		DEPARTMENT/FLOOR NO
STREET ADDRESS 6106 Rookin		STREET ADDRESS (P.O. BOX NUMBERS NOT DELIVERABLE) 4000 Lockbourne Rd.		
CITY Houston		CITY Columbus		STATE Ohio
AIRBILL NO. <b>323087925</b>		ZIP: ACCURATE ZIP CODE REQUIRED FOR CORRECT DELIVERY 7 7 0 7 4 3 7 9 2		ZIP: ACCURATE ZIP CODE REQUIRED FOR OVERNIGHT DELIVERY 4 3 2 0 7 4 2 9 8
YOUR NOTES/REFERENCE NUMBERS (FIRST 12 CHARACTERS WILL ALSO APPEAR ON INVOICE) <b>3</b>				
PAYMENT <input checked="" type="checkbox"/> Bill Shipper <input type="checkbox"/> Bill Recipient's F.A.C. <input type="checkbox"/> Bill 3rd Party F.E.C. Acct. <input type="checkbox"/> Bill Credit Card <input type="checkbox"/> Cash in Advance Account Number/Credit Card Number				
SERVICES CHECK ONLY ONE BOX		DELIVERY AND SPECIAL HANDLING CHECK SERVICES REQUIRED		PACKAGES WEIGHT DECLARED VALUE Q'S
PRIORITY 1 <input checked="" type="checkbox"/> OVERNIGHT PACKAGES (UP TO 70 LBS.)		<input type="checkbox"/> HOLD FOR PICK-UP AT FOLLOWING FEDERAL EXPRESS LOCATION SHOWN IN SERVICE GUIDE. RECIPIENT'S PHONE NUMBER IS REQUIRED		<b>5</b>
<input type="checkbox"/> DELIVER		<input type="checkbox"/> SATURDAY SERVICE REQUIRED (See Reverse) (Extra charge applies for delivery)		
<input type="checkbox"/> RESTRICTED ARTICLES SERVICES (P. 1 and Standard Air Packages only) (extra charge)		<input type="checkbox"/> RGS (Registration Security Service) (required) (extra charge applies)		
<input type="checkbox"/> DRY ICE		<input type="checkbox"/> OTHER SPECIAL SERVICE		
<input type="checkbox"/> STANDARD AIR		<input type="checkbox"/> ORMS AND RADIOACTIVE MATERIAL ONLY		
"OVERNIGHT" IS NEXT BUSINESS DAY (MONDAY THROUGH FRIDAY) TWO DAYS FROM ALASKA/HAWAII. SATURDAY DELIV- ERY AVAILABLE IN CONTINENTAL U.S. SEE "SPECIAL HANDLING."				
RECEIVED AT SHIPPER'S DOOR <input type="checkbox"/> REGULAR STOP <input type="checkbox"/> ON-CALL STOP <input type="checkbox"/> F.E.C. LOC Federal Express Corporation Employee No. DATE/TIME For Federal Express Use				
				
FEDERAL EXPRESS USE FREIGHT CHARGES DECLARED VALUE CHARGE AGT/PRO AGT/PRO ADVANCE ORIGIN ADVANCE DESTINATION OTHER TOTAL CHARGES PART #2041730761 REVISION DATE 2/83 GBF PRINTED U.S.A.				

ORIGIN ACCOUNTING COPY

AIRBILL NUMBER  
323087925SHIPPER'S CERTIFICATION FOR RESTRICTED ARTICLES  
(TYPE OR PRINT)

NO. OF PKGS.	PROPER SHIPPING NAME (PER 49 CFR, 172.101)	CLASSIFICATION	IDENTIFICATION NO.	NET QUANTITY PER PACKAGE
1	Radioactive Material Special Form N.O.S.	Radioactive Material	UN2974	100 Ci.

ADDITIONAL DESCRIPTION REQUIREMENTS FOR RADIOACTIVE MATERIALS (SEE BACK)	RADIOISOTOPE	FORM	ACTIVITY	CATEGORY OF LABELS	TRANS. INDEX	PACKAGE IDENT.
	Iridium 192	Solid Metal Special Form	100 Ci.	Radioac- tive Yellow III	2.0	USA/9006/B (U) Type "B"

THIS SHIPMENT IS WITHIN THE LIMITATIONS PRESCRIBED FOR

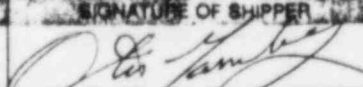
PASSENGER  
AIRCRAFTCARGO  
AIRCRAFT ONLY

(DELETE-NONAPPLICABLE)

IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS OR TREATMENT.

I HEREBY CERTIFY THAT THE CONTENTS OF THIS CONSIGNMENT ARE FULLY AND ACCURATELY DESCRIBED ABOVE BY PROPER SHIPPING NAME AND ARE CLASSIFIED, PACKED, MARKED, AND LABELED, AND IN PROPER CONDITION FOR CARRIAGE BY AIR ACCORDING TO APPLICABLE NATIONAL GOVERNMENTAL REGULATIONS.

CONAM O &amp; E 4-15-85

NAME/TITLE OF PERSON SIGNING CERTIFICATION Otis C. Gamble R.S.O.	76	EMERGENCY TELEPHONE NO. 1-713-774-9657	SIGNATURE OF SHIPPER 
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# COMBINATION AIRBILL/CERTIFICATION INSTRUCTIONS

APPENDIX "N" CONT.

FOR CUSTOMER ASSISTANCE ANYTIME, CALL TOLL FREE 1-800-238-5355. IN TENNESSEE, CALL 1-800-542-5171.

- 1 A. Enter your Federal Express Account Number.  
\*Note: If you don't know your Federal Express Account Number, please call your local Federal Express office. If you have questions concerning our Features of Service, please refer to your Federal Express Service Guide.
- 2 B. Enter your name, then your company name, department, street address, city, state (two letter postal abbreviation) and zip code.  
A. Enter the date of shipment.  
B. Enter receiving party's name, phone number, then the company name, street address, city, state (two letter postal abbreviation) and zip code.
- 3 A. Enter any special notes or reference number. The first 12 characters will appear on your invoice to help identify the shipment.  
B. "Bill to Shipper" means the Account Number entered in Section (1) above will be billed.  
C. "Bill to Recipient" means that the company entered in Section (2) above will be billed.  
D. "Cash in Advance" means that you would like to pay in advance for the charges either by check, currency or credit cards (most major credit cards are accepted by Federal Express Couriers and at all Federal Express office locations).  
E. "Bill to Third Party" means that you would like to bill someone else for service charges. The Federal Express Account Number to be billed must be entered in the space provided.
- 4 A. Check the type of service desired (refer to your Federal Express Service Guide); mark either Priority 1, Courier Pak, Standard Air, or Overnight Letter.  
B. "Hold for Pick Up" indicates that you would prefer that the package be held for Recipient at the Federal Express office. Please supply the address including the 3 letter identifier of the desired Federal Express destination office on the line provided. (Refer to the Federal Express Service Guide for the locations of our offices).  
C. Check the "Deliver" box if you would prefer that our Courier deliver the package(s) to the Recipient.  
D. Check "Saturday Service" if the package is to be picked up by or delivered to the recipient on Saturday (if Saturday Delivery is required, extra charges apply).  
E. Check "Restricted Articles Service" for a shipment of hazardous materials (Priority 1 and Standard Air packages only). Also attach 2 copies of properly completed Shipper's Certificate.  
F. Check "Signature Security Service" for a shipment requiring additional care in transit.  
G. Check "Dry Ice" if the shipment contains Dry Ice and indicate the weight in pounds of Dry Ice contained in the shipment.  
H. Check "Other Special Services" and indicate the service on the line provided, if applicable to this shipment.
- 5 FOR PRIORITY 1 AND STANDARD AIR SERVICE  
For up to 4 nonidentical packages (different weights, sizes or declared values), complete items A through F.  
For a bulk shipment of up to 99 identical packages (same weight, size and declared value), complete items A, B, and C for one of the packages, write "Bulk" on the next line and then complete items D through F for the entire bulk shipment.  
FOR COURIER PAK SERVICE (ENVELOPE, BOX OR TUBE), and  
FOR OVERNIGHT LETTER SERVICE:  
Complete item F only:  
A. Enter "1" for each package.  
B. Enter the pound weight of each package.  
C. Enter the declared value of each package.  
D. Enter the total number of packages.  
E. Enter the total weight in pounds.  
F. Enter the total declared value.

## RADIOACTIVE MATERIAL SHIPMENT INFORMATION

Radionuclide	-	Element and mass number
Form	-	Special form or chemical and physical form
Activity	-	Use appropriate units - Ci - curie, mCi - millicurie, uCi - microcurie
Label	-	White I, Yellow II, Yellow III, or None when no label required
Transport Index	-	For Yellow II and Yellow III labeled packages only
Package Identification	-	NRC Certificate of Compliance identification number, or Certificate of Competent Authority identification number, or package type, if applicable, and not included in identification number, or package specification if none of above not applicable

**WARNING:** Failure to comply in all respects with the applicable regulations of the Department of Transportation, 49 CFR, Parts 100-199 and, for international shipments, the IATA Restricted Articles Regulations may be a breach of the applicable law, subject to legal penalties. This certification shall in no circumstance be signed by an IATA Cargo Agent or a consolidator for international shipments.



## SHIPPER'S CERTIFICATION FOR RADIOACTIVE MATERIALS

Two completed and signed copies of this certification shall be handed to the carrier.

(Use block letters)

WARNING: Failure to comply in all respects with the applicable regulations of the Department of Transportation, 49-CFR, CAB 82 and, for international shipments, the IATA Restricted Articles Regulations may be a breach of the applicable law, subject to legal penalties. This certification shall in no circumstance be signed by an IATA Cargo Agent or a consolidator for international shipments.

This shipment is within the limitations prescribed for: (mark one)

☐ passenger aircraft And contains radioactive material intended for use in, or incident to, research, or medical diagnosis or treatment.
(1) ☒ cargo-only aircraft

## NATURE AND QUANTITY OF CONTENT

## PACKAGE

(2) PROPER SHIPPING NAME	(3) RADIOISOTOPE	(4) GROUP	(5) FORM	(6) ACTIVITY	(7) Number of Packages	(8) CATEGORY	(9) TRANSPORT INDEX	(10) TYPE
FOR U.S. SHIPMENTS. SEE SECTION 2, CAB 82, TARIFF 6-D	NAME OR SYMBOL OF PRINCIPAL RADIOACTIVE CONTENT	GROUP NUMBER OF GROUPS I TO VII	CHEMICAL FORM AND PHYSICAL STATE (GAS/ LIQUID/SOLID) or SPECIAL FORM, or SPECIAL ENCAPSULATION	NUMBER OF CURIES, or MILLI-CURIES		I—WHITE or II—YELLOW or III—YELLOW LABEL	FOR YELLOW LABEL CATEGORIES ONLY	INDUSTRIAL or TYPE A, or TYPE B
RADIOACTIVE MATERIAL SPECIAL FORM N.O.S. CARGO ONLY AIRCRAFT	Iridium 192 Non-Fissile		Solid Metal  Special Form	Curies 101	1	Yellow III	2.0	Type B
UN2974		(11) Source #12567						

## ADDITIONAL INFORMATION REQUIRED FOR FISSILE MATERIALS ONLY

EXEMPTED FROM THE ADDITIONAL REQUIREMENTS FOR FISSILE MATERIALS SPECIFIED IN 7.1. OF PART 2 OF THE IATA RESTRICTED ARTICLES REGULATIONS ☐

NAMES, PLUS QUANTITY IN GRAMS, OR CONCENTRATION OR ENRICHMENT IN U235.

NOT EXEMPTED: FISSILE CLASS I ☐ FISSILE CLASS II ☐ FISSILE CLASS III ☐

Additional certificates obtained by the Shipper when necessary:

Special Form Encapsulation Certificate(s) ☐Certificate(s) for Large Radioactive Source ☐Type "B" Packaging Certificate(s) ☐Government Approvals/Permits ☐Certificate(s) for Fissile Material ☐

Special Handling Information

(12) CARGO ONLY AIRCRAFT

I hereby certify that the contents of this consignment are fully and accurately described above by Proper Shipping Name and are classified, packed, marked, labelled and in proper condition for carriage by air according to applicable national governmental regulations, and for International Shipments, the current IATA Restricted Articles Regulations.

Name and full address of Shipper (13) Conam Inspection	Name and title of person signing Certification (14) OTIS C. GAMBLE
6106 Rookin St.	RADIATION SAFETY OFFICER
Houston, Texas 77074	Phone 713 774-9657
Date (15) 4-15-85	Signature of the Shipper (see WARNING above) <i>Otis Gamble</i>
Air Waybill No.*	Airport of Departure*
	Airport of Destination*



SHIPPERS CERTIFICATION FOR RADIOACTIVE MATERIAL  
CARGO-ONLY AIRCRAFT

ATTENTION: Air shipments require two (2)  
Danger Labels

The individual who completes and signs a shippers certification has certified the consignment is fully and accurately described by proper shipping name and classified, packed, marked, labelled and in proper condition for carriage by air.



- Instructions -

1. Mark, cargo-only aircraft
2. Indicate proper shipping name just as shown. ID# UN2974
3. Radionuclide - Iridium 192 or Cobalt 60. DO NOT ABBREVIATE, indicate NON-FISSILE.
4. Group - NA
5. Form - (as shown)
6. Activity - Use the word CURIES and indicate amount.
7. Number of packages covered by this document.
8. Category - Indicate Yellow II or Yellow III.
9. Transport Index - mR/hr at three feet.
10. Type - Type B.
11. The serial number of the source should be shown as indicated.
12. Special Handling information (CARGO-ONLY AIRCRAFT).
13. Name and address of shipper.
14. Name and title of person signing certification. (a phone contact is advisable).
15. Date.

Distribution: 2 Copies handed to carrier  
1 copy - Regional office  
1 copy - RSO in Houston

PACKAGES OVER 110 LBS MUST HAVE THE WEIGHT MARKED ON THE OUTSIDE OF THE PACKAGE.

## ORIGINAL—NOT NEGOTIABLE

Shipper No. \_\_\_\_\_

Carrier No. \_\_\_\_\_

(1) Roadway Express

(2) Date 4-15-85

(Name of Case)

(SCAC)

TO: (3) Consignee Conam Inspection On Collect on Delivery shipments, the letters "COD" must appear before consignee's name & as otherwise provided in Item 430, Sec. 1	FROM: Shipper Conam Inspection (4)
Street 4000 Lockbourne Rd.	Street 6106 Rookin St. Houston, Texas 77074
Destination Columbus, Ohio Zip Code 43207	Origin Phone: (713) 774-9657

Route

Vehicle  
Number

No. of Units & Container Type	HM	DESCRIPTION AND CLASSIFICATION (Proper Shipping Name and Class per 49 CFR 172.101)	TOTAL QUANTITY (Weight, Volume, Gallons, etc.)	WEIGHT (Subject to Correction)	RATE	CHARGES (For Carrier Use Only)
1 Box	XX	Radioactive Material	58 lbs.	58 lbs.	70	
(5)	(6)	Special Form N.O.S. ID# UN2974				
		Type "B" Package				
		101 Curies Iridium 192				
		Yellow III Label applied				
		Non-Fissile				
		Transport Index 2.0				
		Package ID# USA/9006/B(U)				
		PLACARDS TENDERED: YES <input checked="" type="checkbox"/> NO <input type="checkbox"/>				

<b>REMIT C.O.D. TO ADDRESS</b>		<b>COD</b> Amt \$		<b>C.O.D. FEE</b> PREPAID <input type="checkbox"/> COLLECT <input type="checkbox"/> \$	
Note—Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property. The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding \$ <u>0.40</u> per <u>lb.</u>		This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.		<b>TOTAL CHARGES \$</b>  <b>FREIGHT CHARGES</b> EXCESS WEIGHT PREPAID <input type="checkbox"/> Check box if charges are to be paid by consignee EXCESS WEIGHT TO BE PAID <input type="checkbox"/>	
RECEIVED: subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading, the property described above in apparent good order except as noted (contents and condition of contents of packages unknown); marked, consigned and destined as indicated above which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed as to each carrier of all or any of, said property over all or any portion of said route to destination and as to each party at any time interested in all or any said property, that every service to be performed hereunder shall be subject to all the bill of lading terms and conditions in the governing classification on the date of shipment.		Subject to Section 7 of the conditions, if this shipment is to be delivered to the consignee without recourse on the consignee, the consignee shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.		Shipper hereby certifies that he is familiar with all the bill of lading terms and conditions in the governing classification and the said terms and conditions are hereby agreed to by the shipper and accepted for himself, not his assigns.	
Signature		Signature of Consignee			

SHIPPER	Conam Inspection	CARRIER	
PER		PER	
6106 Rookin St., Houston, Tx. 77074		DATE	

Pyrimidinyl-2,6-dithiopyran-4-ylidene-1,3-dithiane-5-thione

STYLE F 65 LABELMASTER CHICAGO II 60660

BILL OF LADING

A Bill of Lading other than the one shown on page 80 may be used if it contains space for the same information and has the certification statement as shown.

- (1) Enter the name of the carrier
- (2) Date
- (3) Consignee
- (4) Shipper
- (5) Enter number of units and container type. Examples (1 Box)  
(1 drum)
- (6) Indicate HM (HAZARDOUS MATERIAL)
- (7) Description and Classification
  - (a) Radioactive Material, Special Form, N.O.S. ID# UN2974
  - (b) Type "B" Package
  - (c) number of curies and material (Iridium 192 or Cobalt 60)
  - (d) Indicate "Bar" label applied to package, Yellow II or Yellow III
  - (e) Non-Fissile
  - (f) Transport index number of package
  - (g) Package I.D. number. This number can be found on most new type "B" packages. The 500 SU changer is #USA/9006/B(U); the Model 520 Camera is #USA/9007/B(U). Most other cameras are not type "B" unless they are packaged in a Type "B" overpack (drum). The overpack will have the package I.D. number on the outside. Overpacks are available from AII, Tech/Ops and Gamma Industries and Gulf Nuclear for their respective cameras. If you are in doubt as to the correct packaging (or description) of any device, contact the manufacturer or the Radiation Safety Office for instructions.

PACKAGES OVER 110 LBS MUST HAVE THE WEIGHT MARKED ON THE OUTSIDE OF THE PACKAGE.

PROCEDURES FOR SOURCE RECOVERY

Procedures contained in Conam's Operating and Emergency Procedures Manual 11.2(d)2 instruct the technician to contact the nearest radiation safety manager or supervisor in the event a source cannot be returned to the exposure device. Instructions for the radiation safety manager or supervisor are contained in the Administrative Manual (7.1). It has always been assumed a member of the radiation safety program, (because of the necessary training and experience required to be included in the program) could evaluate the information and make the proper decision as to the next step. #1 allow the radiographer to attempt the recovery (based on the radiographers experience, training and the anticipated difficulty of the recovery) or #2, instruct the radiographer to keep the area under constant surveillance until a program member with the proper equipment could arrive at the job site or #3, take no action until advised by the radiation safety officer. No matter which of the above is decided, the RSO shall be advised at the earliest opportunity.

It has been decided, that procedures should be developed to assist in recovery operations. It must be kept in mind that no set of procedures can take into account all the conditions that can come into play during a radiation emergency (i.e. type of source, curie strength, type of malfunction, terrain, environment, type of camera, type of hook-up, recovery equipment available etc., etc.,) If a call is received from a radiographer reporting he cannot retract the source, the first step is to follow the instructions in the Administrative Manual (7.1)

- (a) Determine the physical condition of the radiographer.
  - (b) Ascertain the condition of the survey meter.
  - (c) Confirm that the area has been restricted and posted, and is under constant surveillance.
  - (d) Ascertain the condition of the exposure device.
- a- If the physical condition of the radiographer is such that he is unable to perform his duties, instruct the assistant radiographer to maintain constant surveillance until assistance arrives and a member of the radiation safety program must go to the location and take charge. If there is no assistant radiographer available or able to restrict the area, the civil authorities must be notified and instructed to isolate the area until assistance arrives.
  - b- If the survey meter is not operational, no one shall enter the radiation area until assistance arrives. Employee or employees shall check their dosimeters at reasonable lengths of time to determine that they receive less than 5 mr an hour. Constant surveillance shall be maintained.

- c- It is assumed an exposed source would have malfunctioned during radiographic operations; if so the established radiation area shall be maintained (or adjusted if necessary) so that no one outside the restricted area can receive more than 2 mr in any one hour. If the source is exposed at some time other than during radiographic operations (such as if the camera is dropped from some high place dislodging the source) a radiation area must be established until the source is recovered.
- d- The condition of the exposure device and attachments will indicate the need for replacement equipment required for recovery.

Assuming there is no present danger of overexposure to employees or others (the radiographer is able to perform his duties, the survey meter is operational, the area is restricted and under constant surveillance, and all equipment is operational), it must be determined what steps can be taken to recover the source or reduce the radiation to a safe level.

If the dosimeter of the radiographer has not gone over 200 mr (off scale) and a discussion indicates the type of recovery is well within his ability, and he has had recovery training and experience, it is permissible to allow him to perform those functions that present little danger of overexposure and to make a recovery that is within his ability.

If the determination is made that the recovery should be made by an experienced member of the radiation program then it is necessary that constant surveillance be maintained until assistance arrives.

If at any time during the activities it is felt assistance or special equipment is required, contact the Radiation Safety Officer or any member of the program (found in Appendix "C" of the Operating and Emergency Manual).

#### Source Recovery Procedures

1. The area shall be restricted and posted until the source is recovered and constant surveillance will be maintained.
2. At least one operational survey meter shall be used during all operations.



3. PRIOR TO ANY SOURCE RECOVERY OPERATIONS TO PLAN BASED ON THE SITUATION WILL BE FORMULATED THAT WILL ALLOW THE RECOVERY TO BE MADE WITH THE MINIMUM EXPOSURE TO ANY INDIVIDUAL.
4. At any time it is felt the recovery operations are beyond the capabilities of the individuals involved or there is doubt the recovery can be made safely, THE OPERATIONS WILL BE DISCONTINUED AND THE RADIATION SAFETY MANAGER CONTACTED.
5. The recovery operations shall be broken into work and stop sequences. The work sequences shall be used to perform a necessary function. The stop is to allow the person making the recovery to leave the radiation area, check and recharge his dosimeter. No work sequences shall be started unless the dosimeter is "zeroed". All dosimeter readings shall be recorded when recharging the dosimeter. Great care must be taken not to discharge the dosimeter beyond the readable range of the person making the recovery.
6. When it is necessary to perform any operation that could result in a dose to the hands higher than total body dose, a 5R (or higher) dosimeter should be placed in the general area of the hands to assist in determining dose to the extremities.
7. Source recovery will usually be necessary under one of the following conditions:
  - a- Source in the guide tube (disconnect) (tube not damaged).
  - b- Source in the guide tube (no disconnect) (tube damaged).
  - c- Source outside guide tube (disconnect).
  - d- Source outside guide tube (connected).
  - e- Source outside guide tube (lost or out of sight).
- \*- This symbol in the following operations is an indication of a STOP (leave radiation area and READ, RECORD, AND RECHARGE DOSIMETER prior to continuing). All the following operations require the constant use of a survey meter.

All the following operations require the constant use of a survey meter.

- a. Source in guide tube (disconnected). This is the most common type of problem and it can be handled in many different ways but the following has been used many times without difficulty:

Operate the hand cranks to drive the source to the end of the source tube. Retract the drive cable leaving the source in the end of the tube.\* Working very quickly enter the area and place the lead sheets over the source to reduce the radiation level.\* (check dosimeter after each trip, RECORD READING, and RECHARGE). Enter the area and place a shipping container in the general area of the safe end of the source tube (camera end).\* With the source tube and source covered with lead disconnect the source tube from the camera. \* Using the safe end of the source tube (verify with survey meter) draw the source tube from under the lead and quickly lift the closed end of the source tube with the remote handling tongs and shake the source onto the ground. (This should be performed in such a manner some type of shielding is between the individual and the source) \* Enter the area and using the remote handling tongs, grasp the hook-up end of the source placing it in the shipping container. \* CHECK ALL EQUIPMENT PRIOR TO RELOADING THE CAMERA.

- b. Source in the guide tube (no disconnect) (tube damaged).

This procedure can be followed in those cases where the source cannot be retracted thru the source tube due to damage to the tube. It is assumed the drive cable will pass thru the tube restriction (if not, add shielding to the source and notify the Radiation Safety Officer). Crank the source out to the end of the source tube and retract until the source is stopped by the restriction. Crank the source forward (toward the closed end) about two inches to be sure the source is not jammed in the restriction. \* Enter the area and place lead sheets over the source until the radiation level will allow work to be performed at the end of the source tube without an overexposure. After each trip into the area with lead READ, RECORD, and RECHARGE DOSIMETER prior to continuing. Enter the area and remove the end from the source tube (unscrew or cut). \* Crank the source forward until it is out of the source tube \* (leave the source connected to the drive cable). Enter the area and cover the source with lead shielding being careful not to damage the source.\* Enter the area remove the lead from the source tube.\* Being careful not to draw the source from the lead shielding, disconnect the source tube from camera.\* Strip the drive cable thru the camera (leaving the crank connected). \* Pull the source tube from the drive cable being careful not to pull the source from the shielding.\*

b. Continued

Cut the source tube on the camera side of the damaged area, and reconnect the shortened source tube to the camera.\* Pass the drive cable back thru the source tube and camera until it engages with the cranks.\* Operate the cranks to draw the source from the shielding and into the camera.\* (It may be necessary to align the source with the remote tongs as it passes thru the open end). CLEAN, REPAIR AND INSPECT ALL EQUIPMENT PRIOR TO RETURNING UNIT TO OPERATORS. It is possible (with some cameras) for the source to disconnect during the above operations; if this happens, the remote handling tongs must be used to place the source in a shipping container.

c. Source outside the guide tube (disconnected).

Enter the area and place a shipping container in the source area.\* Enter the area and using remote handling tongs, place the source into the shipping container capsule end first.\*

d. Source outside the guide tube (connected).

This normally occurs if the end cap comes off the source tube and the source does not stop at the end but continues outside the tube until the drive cable discharges all the drive cable. Enter the area and determine the radiation level at the cranks and/or the rear of the exposure device.\* If it is less than 200 mr an hour, the following can be done with less exposure than if shielding is hand carried to cover the source. If it is over 200 mr/hr follow the procedures for placing shielding over the source. After each placement of shielding, leave area and READ, RECORD and RECHARGE DOSIMETER prior to continuing. Enter the radiation area and disconnect the drive cable housing at the cranks.\* Enter the area and if the drive cable is present in the housing, pull the source back into the camera.\* (If the drive cable is not in the housing, it will be necessary to make a disconnection at the camera and feed the cable back to the hand cranks). The remote tongs may be required to assist the source as it re-enters the source tube.

e. Source outside guide tube. (lost or out of sight).

The first step is to locate the source. This can be accomplished by using a piece of lead one quarter inch thick for iridium, or one half inch thick for cobalt.

The survey meter is set on a scale where it reads less than full scale. A survey is made with the lead placed in front of the survey meter. The direction of the survey (direction indicates a line passing thru the meter and the lead sheet) is changed until a meter drop is indicated. At this point, the source, lead sheet and survey meter are in a line. A calculation at this time, based on known source strength and type of source will give a rough indication of the distance. (Use the unshielded reading).

e. Continued

EXAMPLE- Survey reading 100 mr/hr/50 curies/IR 192

$$I = 50 \times 5.9R/hr = 295R/hr$$

$$I_2 = .1R/hr \text{ (100 mr/hr)}$$

$$D_2 + \sqrt{\frac{295}{.1}} = 55'$$

After the general direction and distance is calculated, move to another location about the same direction from the source and test for direction again, where these projected lines would cross will be the general area of the source.\* If the source can be located without difficulty, it can be recovered by using remote handling tongs. If the source cannot be seen (because of water, mud, grass or other obstructions) keep the area under constant surveillance and call the radiation safety officer and he will make the recovery. These guide lines and procedures will handle most recovery operations. It must be kept in mind no recovery should be attempted by any radiographer unless he has received instructions to do so from a member of the radiation safety program. See Appendix "C" of the Conam Operating and Emergency Manual. No member of the safety program should attempt a recovery unless he feels his experience and training are adequate to perform the recovery without undue exposure to himself or others.

If a source must be returned to a camera, and a shipping container is not available, the following procedures can be used.

The source is picked up about one inch behind the tip with the remote handling tongs. The hook-up end is fed into the front of the camera and source tip is left protruding about one inch. A piece of wood about three or four foot long can be used to tap (not too hard) the source back into the camera a short distance. Use the remote handling tongs and the front camera plug to push the source into the camera.

REMEMBER

PLANNING IS THE KEY TO SAFE RECOVERYS

NEVER TOUCH A SOURCE WITH YOUR HANDS

A COOL HEAD IS ABSOLUTELY NECESSARY



## Recovery Equipment

1 set Hand Tools

Screw Driver

Wire Plyers

Tubing Cutters

Solder

Hand Torch

Hack Saw

Adjustable Wrench

1 remote handling device (5' minmum)

3 sheet lead 1' x 1' x  $\frac{1}{4}$ " (minimum)

1 shipping container (or lead pot) (or empty camera)

NOTE: Camera must be licensed for the source in question.

1 5R dosimeter

1 dosimeter charger

NUCLEAR ENERGY SERVICES, INC.

NES DIVISION

CONAM INSPECTION DIVISION

PROCEDURE FOR COMPLIANCE WITH 10 CFR PART 21

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## PROCEDURE FOR COMPLIANCE WITH 10 CFR PART 21

### 1. PURPOSE AND SCOPE

- 1.1 This document details the procedures Nuclear Energy Services, Inc. will follow to acquire, evaluate, record and report information as required under 10 CFR Part 21. They are applicable to all NES, Inc. personnel whose tasks include design, engineering, licensing analysis, manufacture, procurement, construction, or inspection of safety related items as defined within 10 CFR Part 21. Additionally it extends to all activities conducted under the company's by-product material license.

### 2. DISCUSSION

The Nuclear Regulatory Commission has amended its regulations. The new requirements are identified as Part 21 of 10 CFR. Part 21 was established as a reporting requirement that is imposed on Nuclear Energy Services, Inc. and both of its divisions due to our consulting and inspection services to the nuclear industry and our by-product material license. Part 21 is directed at detecting and anticipating problems before they cause safety hazards or radiation over exposure. Part 21 requires a responsible officer within the organization to report to the NRC defects in components and noncompliances with regulatory requirements that could lead to substantial safety hazard. This individual is subject to a personal fine for failure to report. Procedures must be developed to assure that deviations are identified, brought to the attention of the responsible individual, and evaluated to determine if they are reportable items.

In addition to requiring procedures, Part 21 requires posting of certain documents and distribution of the part to part 34 employees. Suppliers must be notified in procurement documents of their responsibilities under Part 21, when parts and services are covered by Part 21.

### 3. DEFINITIONS

- 3.1 For the purpose of this document, the following definitions shall apply:

#### a. Defect

1. A deviation in a basic component or service delivered to a purchaser for use in a facility or an activity subject to the regulations in 10 CFR Part 21 if, on the basis of an evaluation, the deviation could create a substantial safety hazard; or

2. The installation, use, or operation of a basic component containing a defect as defined in A.1.; or
3. A deviation in a portion of a facility subject to the construction permit or manufacturing licensing requirements of 10 CFR Part 50 provided the deviation could, on the basis of an evaluation, create a substantial safety hazard and the portion of the facility containing the deviation has been offered to the purchaser for acceptance; or
4. A condition or circumstance involving a basic component that could contribute to the exceeding of a safety limit, as defined in the technical specifications of a license for operation issued pursuant to 10 CFR Part 50.

b. Deviation

A departure from the technical requirements included in a procurement document.

c. Responsible Officers

The President of the Conam Inspection Division for its activity and the President of the NES Division for its activity.

d. Group Manager

A division Vice President or Director.

e. Evaluation

The process accomplished by or for a licensee to determine whether a particular deviation could create a substantial safety hazard.

f. Procurement Document

A contract that defines the requirements that services or basic components must meet in order to be considered acceptable by the purchaser.

g. Substantial Safety Hazard

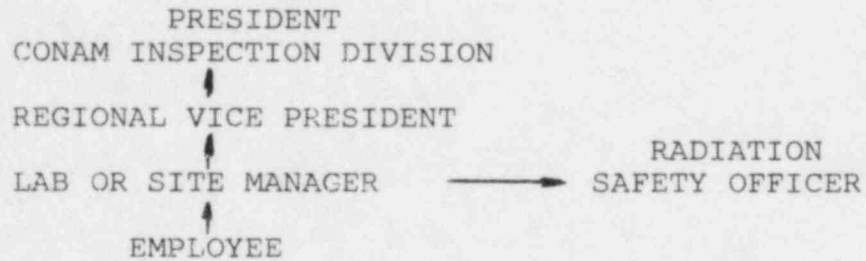
A loss of safety function to the extent that there is a major reduction in the degree of protection provided to public health and safety for any facility or activity.



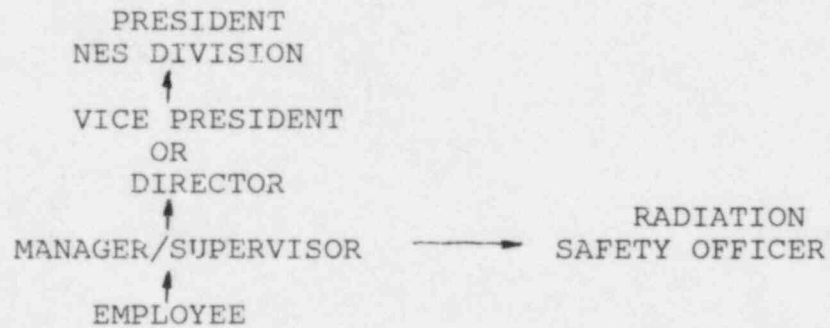
FIGURE 1

DEVIATION REPORTING AND EVALUATION

CONAM DIVISION REPORTING SEQUENCE



NES DIVISION REPORTING SEQUENCE



#### 4. COMMUNICATIONS

- 4.1 Any employee of Nuclear Energy Services, Inc. who has reason to believe a deviation exists, is required to supply this information both verbally and in writing to his immediate supervisor. The written report shall be in accordance with the form of Appendix A. It shall be prepared within one working day of the verbal notification. The reporting and evaluation chain is shown in Figure 1.
  - 4.2 The manager or supervisor to whom the deviation is reported shall review all details concerning the deviation to determine if a defect exists. If, in his opinion, the deviation is a defect, or is potentially a defect, or if he is uncertain whether it is a defect, the manager or supervisor shall forward the written report, which shall include the results of his evaluation to the appropriate group manager. In addition, deviations that fall within the scope of Conam's by product license for industrial radiography (42-16559-01) shall be reported to the Conam Radiation Safety Officer.
  - 4.3 The group manager shall convene whatever resources are required to evaluate the deviation to determine whether or not it is a defect. If it is determined that the deviation is a defect, the group manager shall notify the appropriate responsible officer immediately.
  - 4.4 The responsible officer shall then notify NRC of the defect, verbally or in writing, within two days. If the initial report to NRC was other than in writing, a written report shall be submitted to NRC within five days of the time of the defect is brought to the attention of the responsible officer. The content of this report (see Appendix B) shall be in accordance with Part 21, 21.21 (B) (3) I through VIII. Three copies of the report are required by NRC.
- NOTE: Notification is not required for those items reported in compliance with other parts of 10 CFR, i.e. Parts 19, 20 and 34.
45. If it is determined at any organizational level that the deviation is not a defect, that information shall be recorded on the form and single copies of the completed form sent to the responsible officer for file and also to the originator and the cognizant group manager for information.

- 4.6 Any item or service supplied by NES, Inc. that, after acceptance by the customer if found to contain a deviation from the technical requirements of a procurement document that specified that the provisions of 10 CFR Part 21 apply, shall be evaluated to determine if the deviation could lead to a substantial safety hazard. If necessary, communications shall be established with purchaser for evaluation.

In the event a determination cannot be made as to whether the deviation is a defect, all information regarding the deviation shall be supplied to the purchaser in writing for his evaluation and any subsequent action. The responsible officer is responsible for notifying the purchaser.

5. RECORDS (Effective January 6, 1978)

The following records shall be maintained by the responsible officer:

1. one copy of each completed deviation reporting form regardless of disposition.
2. one copy of all written communication with purchasers relative to the reporting of deviations to a purchaser.
3. one copy of all correspondence and written reports relative to the reporting of a defect to NRC.

All records in connection with Conam's by-product material license required to assure compliance with the regulations in 10 CFR Part 21 shall be maintained by the radiation safety officer in the corporate radiation safety office.

6. PROCUREMENT DOCUMENTS (Effective January 6, 1978)

Any procurement document or purchase order issued by Nuclear Energy Services, Inc. for quality or safety related items, where a deviation from specifications could create a substantial safety hazard, shall specify that the provisions of 10 CFR Part 21 apply.

7. POSTING REQUIREMENTS (Effective January 6, 1978)

- 7.1 To comply with the posting requirements of Part 21.6, a copy of the following documents shall be posted in a conspicuous position in each Nuclear Energy Services, Inc. regional and field office:

1. Section 206 of the Energy Reorganization Act of 1974 as Amended.
  2. A copy of this document.
  3. A copy of 10 CFR Part 21.
- 7.2 At locations other than those specified in 7.1, a copy of Appendix C of this document shall be posted.
- 7.3 All radiographers engaged in activities covered by Conam's NRC license shall be issued a copy of Part 21.

APPENDIX A

PART 21 EVALUATION REPORT

ORIGINATOR

DATE \_\_\_\_\_ OFFICE/JOB SITE \_\_\_\_\_

NAME \_\_\_\_\_ SUPERVISOR CONTACTED \_\_\_\_\_

DESCRIPTION OF DEVIATION (Indicate location, component, nature, etc.)

POTENTIAL SAFETY HAZARD

\_\_\_\_\_  
SIGNATURE OF ORIGINATOR

DATE \_\_\_\_\_ OFFICE/JOB SITE \_\_\_\_\_

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

EVALUATION

ACTION

\_\_\_\_\_  
SIGNATURE OF SUPERVISOR

SUPERVISOR



MANAGER

DATE \_\_\_\_\_ OFFICE/JOB SITE \_\_\_\_\_

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

EVALUATION

ACTION

\_\_\_\_\_  
SIGNATURE OF MANAGER

VICE PRESIDENT  
OR DIRECTOR

DATE \_\_\_\_\_ OFFICE/JOB SITE \_\_\_\_\_

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

EVALUATION

ACTION

\_\_\_\_\_  
SIGNATURE OF VICE PRESIDENT

DIVISION  
PRESIDENT

DATE \_\_\_\_\_ OFFICE/JOB SITE \_\_\_\_\_

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

EVALUATION

ACTION

\_\_\_\_\_  
SIGNATURE OF PRESIDENT

APPENDIX B

TRANSMITTAL FORM FOR PART 21 REPORT

REPORT SUBMITTED TO:

WASHINGTON, DC \_\_\_\_\_ DATE \_\_\_\_\_

REGION # \_\_\_\_\_ TIME \_\_\_\_\_

NOTE: THE COMMISSION REQUIRES THREE COPIES OF THIS REPORT.

HAS INITIAL REPORT BEEN MADE, OTHER THAN WRITTEN? \_\_\_\_\_

IF YES, BY WHAT METHOD? \_\_\_\_\_ DATE \_\_\_\_\_

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

NUCLEAR ENERGY SERVICES, INC.

SHELTER ROCK ROAD

DANBURY, CONNECTICUT 06810

THIS REPORT SHALL INCLUDE THE INFORMATION REQUIRED UNDER  
21.21 (b) (3)

ONE COPY OF THIS REPORT MUST BE ON FILE IN THE OFFICE OF THE  
PRESIDENT OF CONAM INSPECTION OR NES DIVISION IN DANBURY,  
CONNECTICUT.

## APPENDIX C

### NOTICE TO ALL EMPLOYEES

Section 206 of the Energy Reorganization Act requires each employee to report to his immediate supervisor certain deviations and/or defects pursuant to the regulation which is printed below.

#### "Noncompliance"

Section 206. (a) any individual director, or responsible officer or a firm constructing, owner, operating, or supplying the components of any facility or activity which is licensed or otherwise regulated pursuant to the Atomic Energy Act of 1954, as amended, or pursuant to this Act, who obtains information reasonably indicating that such facility or activity or basic components supplied to such facility or activity--

- (1) fails to comply with the Atomic Energy Act of 1954, as amended, or any applicable rule, regulation, order or license of the Commission relating to substantial safety hazards, or
- (2) contains a defect which could create a substantial safety hazard, as defined by regulations which the commission shall promulgate, shall immediately notify the commission of such failure to comply, or such defect, unless such person has actual knowledge that the commission has been adequately informed of such defect or failure to comply.
  - (b) Any person who knowingly and consciously fails to provide the notice required by subsection (a) of this section shall be subject to a civil penalty in an amount equal to the amount provided by Section 234 of the Atomic Energy Act of 1954, as amended.
  - (c) The requirements of this section shall be prominently posted on the premises of any facility licensed or otherwise regulated pursuant to the Atomic Energy Act of 1954, as amended.

- (d) The commission is authorized to conduct such reasonable inspections and other enforcement activities as needed to insure compliance with the provisions of this section.

Part 21 of CFR 10 establishes procedures and requirements for implementation of Section 206 of the Energy Reorganization Act of 1974 and Nuclear Energy Services, Inc.'s procedures for reporting defects 99-PFRD-001 may be examined at the respective headquarters of its respective divisions or at its regional office. Reports of deviations and noncompliance shall be made to the cognizant manager for evaluation. Evaluated defects and items of noncompliance shall be reported to the President of Conam Inspection or the NES Division as appropriate.

B. F. Creech  
Nuclear Energy Services, Inc.  
Conam Inspection Division  
1245 W. Norwood  
Itasca, Illinois 60143-1186

W. J. Manion  
Nuclear Energy Services, Inc.  
NES Division  
Shelter Rock Road  
Danbury, Connecticut 06810

[illegible]



OPERATING INSTRUCTIONS  
AND PROCEDURES FOR PIPELINE  
TYPE RADIOGRAPHY CAMERAS

GAMMA INDUSTRIES MODEL 1

GAMMA INDUSTRIES MODEL 201

GULF NUCLEAR MODEL 10X

SPEC MODEL SPEC check II

## GAMMA INDUSTRIES

### PIPELINER

#### MODEL 1

By referring to the cross-sectional drawing, you can see that the body of the unit is composed of four (4) basic parts: (1) a depleted uranium rotor which has a threaded hole to accomodate the source capsule, (2) a depleted uranium housing in which the rotor turns, (3) the outer shell, a dome shaped casting and, (4) another aluminum casting which is the face plate. It is apparent that the rotor and the shaft upon which it is mounted are the only moving parts so that there should be a minimum of maintenance due to wear. If handled properly and with care, the device will give good service for an indefinite period.

Let us assume that your film is in position and that you are ready to attach the "camera" to the pipe. Every effort should be made to point the unit toward the area where there is the smallest number of men. If only two shots are required per joint, the camera will probably be directed straight down for one and up for the other. However, the operator should bear in mind that scattered radiation would be vastly different for these two shots. For instance, if the pipe is raised only a foot off of a steel deck for a downward shot, the scatter will be much more intense than if this same pipe were six feet off of the deck. Yet due to primary radiation this latter case could easily be more hazardous than the former. Actually, there is no way to accurately predetermine the intensity of scatter and in remote controlled devices, we are not usually concerned with it. Not so with the Pipeliner. This is a self-contained unit designed for a strong iridium source and in order to turn it on and off the operator must enter a strong field of scattered radiation. This radiation intensity will vary greatly depending on pipe size, pipe elevation, material thickness, type and distance to other materials in area (such as walls, floors, etc.). The only way to know the level of scattered radiation is to check with a survey meter. A good radiographer will be aware of this and will conduct himself accordingly. In actual application, a man made 196 exposures and received 16 milliroentgens. In another, the operator made 180 exposures in 10 hours and received 18 mr. But both of these radiographers were experienced, competent people who were able to accomplish a good day's work with very nominal exposure. A less careful operator would undoubtedly have received much higher doses.

Figure 1(a) is a cross-sectional view of the rotor when the source is in the safe position inside of its housing. To expose the source, the rotor is turned through  $180^{\circ}$  (Figure 1(c)) and as you can see from figure 1(b), there is very little shielding as the source passes the  $90^{\circ}$  point.

Since only a split second is involved, this does not represent a particularly hazardous situation. Nevertheless, this side of the device is marked and it is strongly recommended that operation not be conducted from this side. This warning tag says, "Do not stand on this side when turning unit on and off".

Figure 2 shows radiation levels at various distances from the camera with a 100 curie source being used to radiograph a pipe weld. From this figure, you can see why we are concerned with the operator's dosage, and why it is important that he remove himself from the immediate vicinity. If he stands too close to the unit, or does not move quickly when turning it on and off, he will soon accumulate his maximum allowable dosage. Therefore, we recommend that the operator "stretch out" as shown in Figure 3, in order to keep himself as far away as possible. Time is also an important factor. Scattered radiation levels of 1000 mr/hr are not uncommon. It can easily be seen that an operator could not be in this field more than 72 seconds/day in order to stay within permissible dosage limits. Therefore, it behooves one to work as quickly as practical.

Occasionally, it happens that auxiliary shielding is available to radiographers and advantage should be taken of this situation if it arises. Figure 4 is an example of such a set up in which the whole body dosage would probably be minimal regardless of the number of shots.

To operate unit, proceed as follows -

- 1) Check camera with survey meter. Radiation levels should range between 5 mr/hr and 50 mr/hr at a distance of 6" from the surface.
- 2) Remove dust cap (figure 5).
- 3) Place knurled knob in position so that it engages end of shaft (figure 5a).
- 4) Screw retaining collar over knob (figure 6).
- 5) Place camera in position to make exposure.
- 6) Unlock camera.
- 7) Expose source by rotating knurled knob  $180^{\circ}$ . Refer to Figure 3. You will note that the operator keeps his body as far away as possible; this is very important.
- 8) Red indicator pin should now be in view.
- 9) Source is now exposed. Move as far away as exposure time permits.

- 10) After prescribed exposure time, turn camera "off" by rotating knob 180° opposite to step 7 above. Remember to "stretch" as shown in Figure 3.
- 11) Red pointer should have disappeared from view.
- 12) Approach camera with survey meter in hand.
- 13) If meter indicates that source is in safe position, lock unit.
- 14) Check dosimeter. Other than zero, there is no ideal dosimeter reading. Yet if we're engaged in radiography, we know that we are most certainly going to pick up some dosage. Therefore, a practical figure should be established that may assist the operator in evaluating his own performance. With our Pipeliner, we have set this figure at 1/10 mr per exposure. If a radiographer can consistently keep his average dosage at this level, he can feel sure that he is working in accordance with good safety procedures.
- 15) Be sure to wear film badge and dosimeter where they are apt to receive radiation. You want to know your dosage.

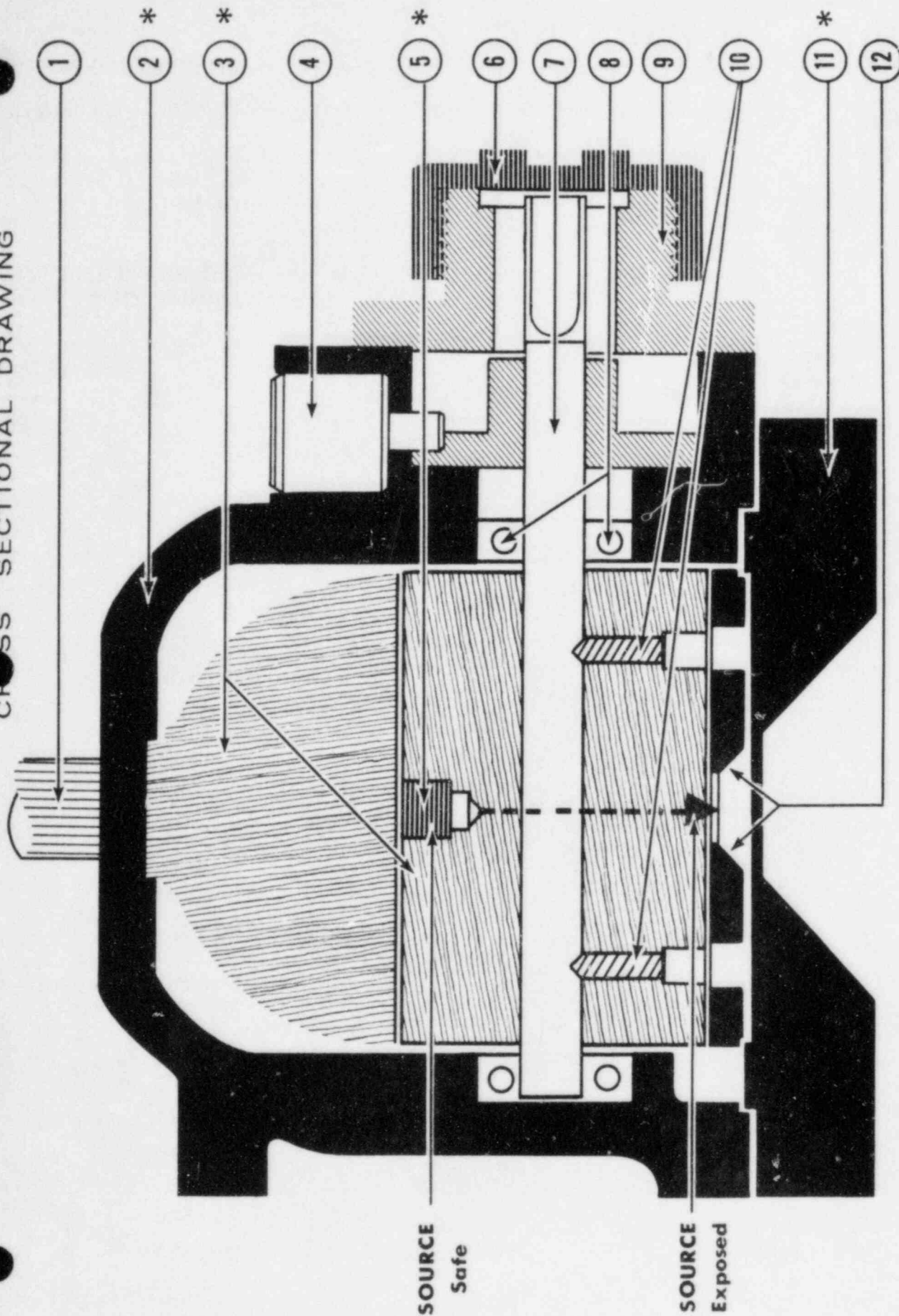
On all other exposure devices manufactured by Gamma Industries, source position indicators have been deliberately omitted. It has always been our feeling that these indicators created a hazard since there could be a tendency on the part of the radiographer to neglect using his survey meter and to rely on the indicator instead. Consequently, we have never incorporated flashing lights or other gadgetry into our equipment. The Pipeliner, however, is an exception. Since the source is completely enclosed and is never seen by the Operator, we felt the some sort of an indicator should be included to show that the unit is on or off. This has been accomplished by a red pin that is mechanically activated so that it protrudes from the housing when the source is in the exposed position (figure 7). It retracts into the outer shell when the source is safe (figure 8). However, this indicator should never be used instead of your survey meter. It is only meant as an additional safety aid to the radiographer. Be carefully checking this indicator and by diligently using a survey meter, there should never be any doubt in the mind of the operator whether the source is in the safe position.

As stated above, the source capsule itself should never be seen by anyone in the field. This unit is hermetically sealed and exposing the capsule to view can only be handled by someone who is intimately familiar with the device and who has the proper facilities. Therefore, replacement of decayed sources has to be accomplished at Gamma Industries and should never be attempted elsewhere.

When in need of a new source, ship your Pipeliner to us and we pledge the same excellent service that we have always rendered and which our customers deserve. Also shipping your unit in for loading enables us to check it over and perform any necessary minor repairs so that the customer will always have a properly operating unit. There is no point, except perhaps in an emergency, for you to perform any repair or maintenance in the field.



# CROSS SECTIONAL DRAWING



SOURCE  
Safe

SOURCE  
Exposed

- |     |                |     |                       |     |                                     |
|-----|----------------|-----|-----------------------|-----|-------------------------------------|
| ①   | Handle         | * ⑤ | Source                | ⑩   | Rotor Locking Set Screws            |
| * ② | Outside shell  | ⑥   | Dust Cap              | * ⑪ | Face Plate                          |
| * ③ | Uranium shield | ⑦   | Rotor Shaft           | ⑫   | Uranium Shield for Collimating Beam |
| ④   | Plunger lock   | ⑧   | Ball Bearings         |     |                                     |
|     |                | ⑨   | Control Adapter Plate |     |                                     |

\* FOUR BASIC PARTS

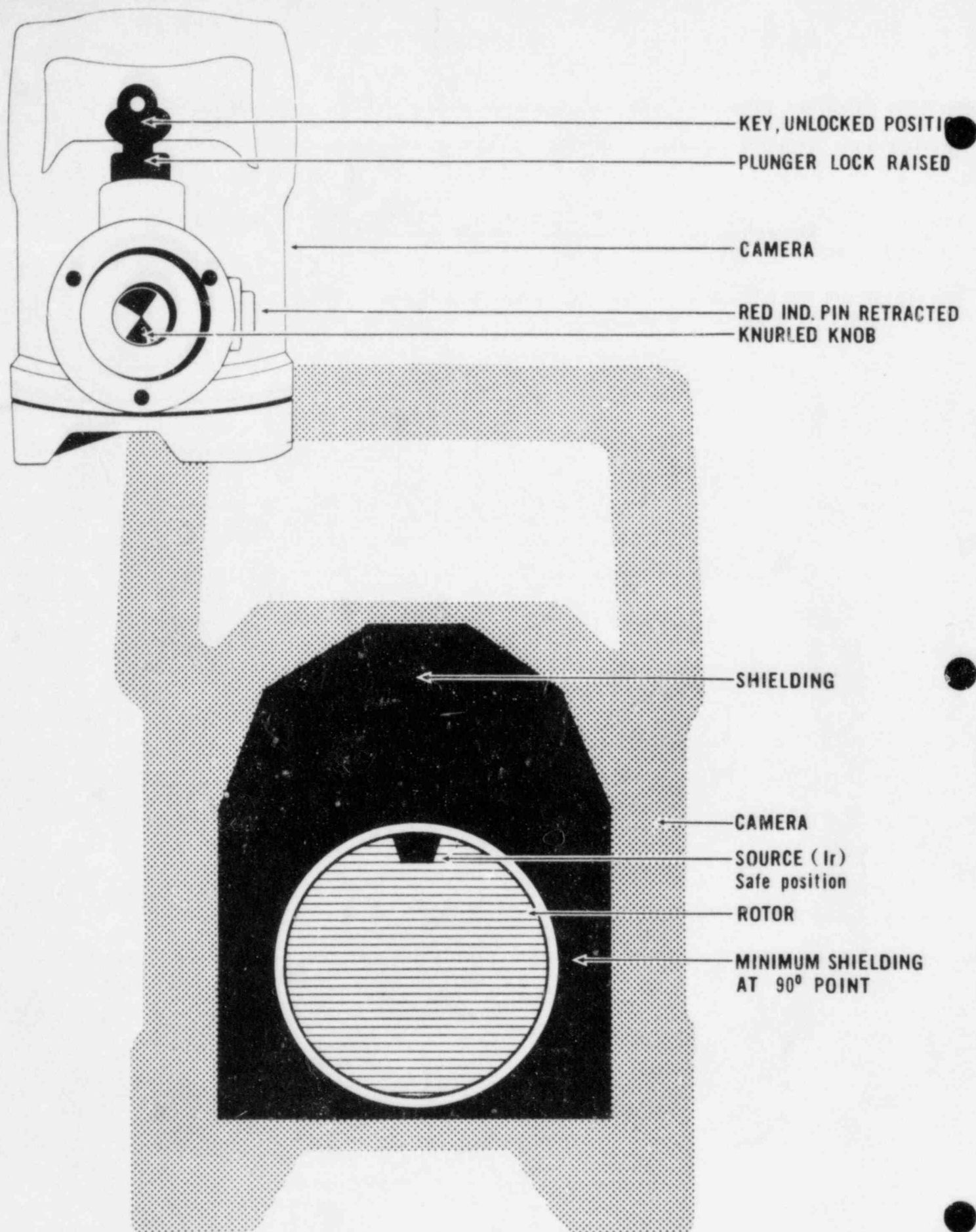


FIGURE 1a

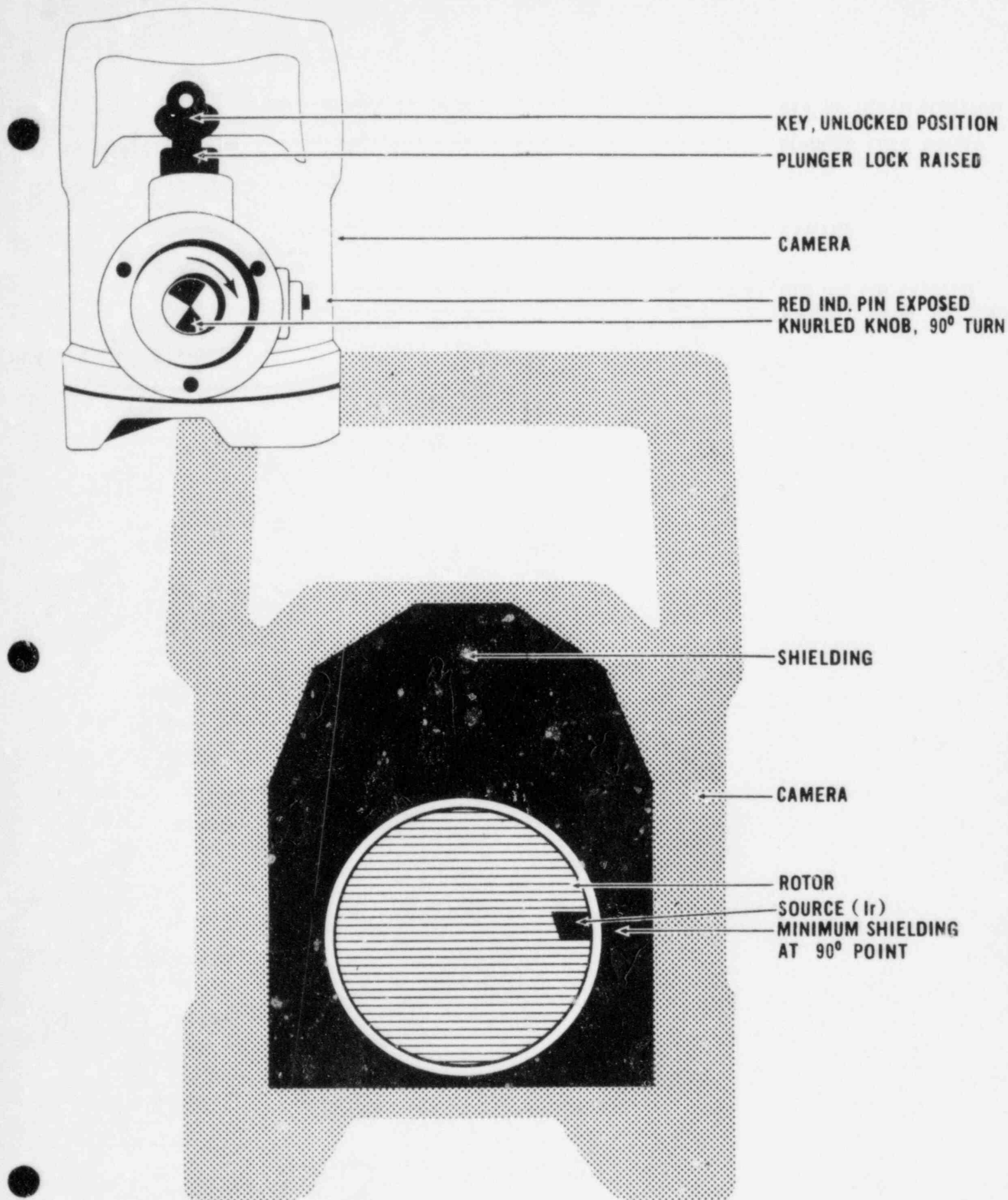


FIGURE 1b

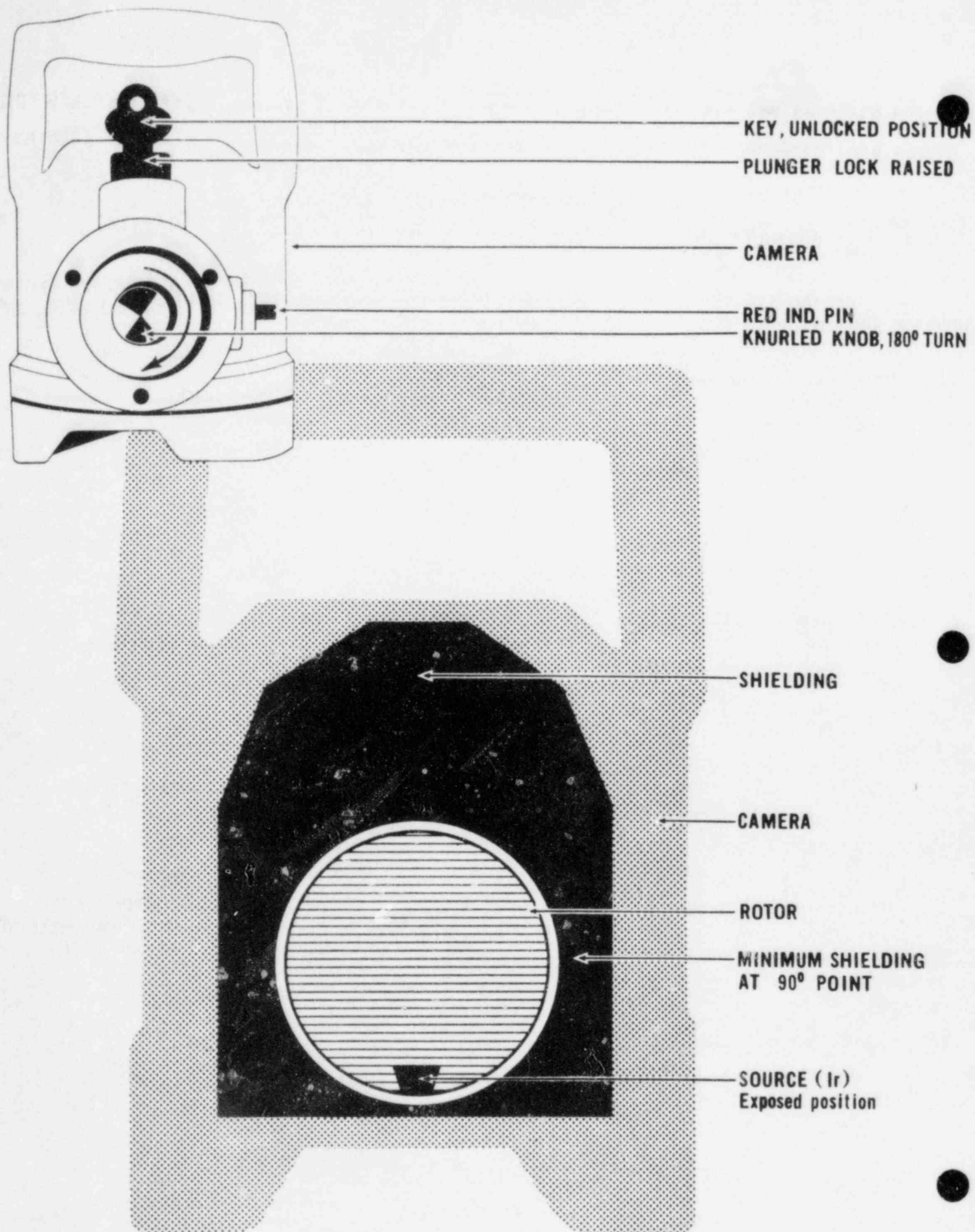


FIGURE 1c  
 S-9

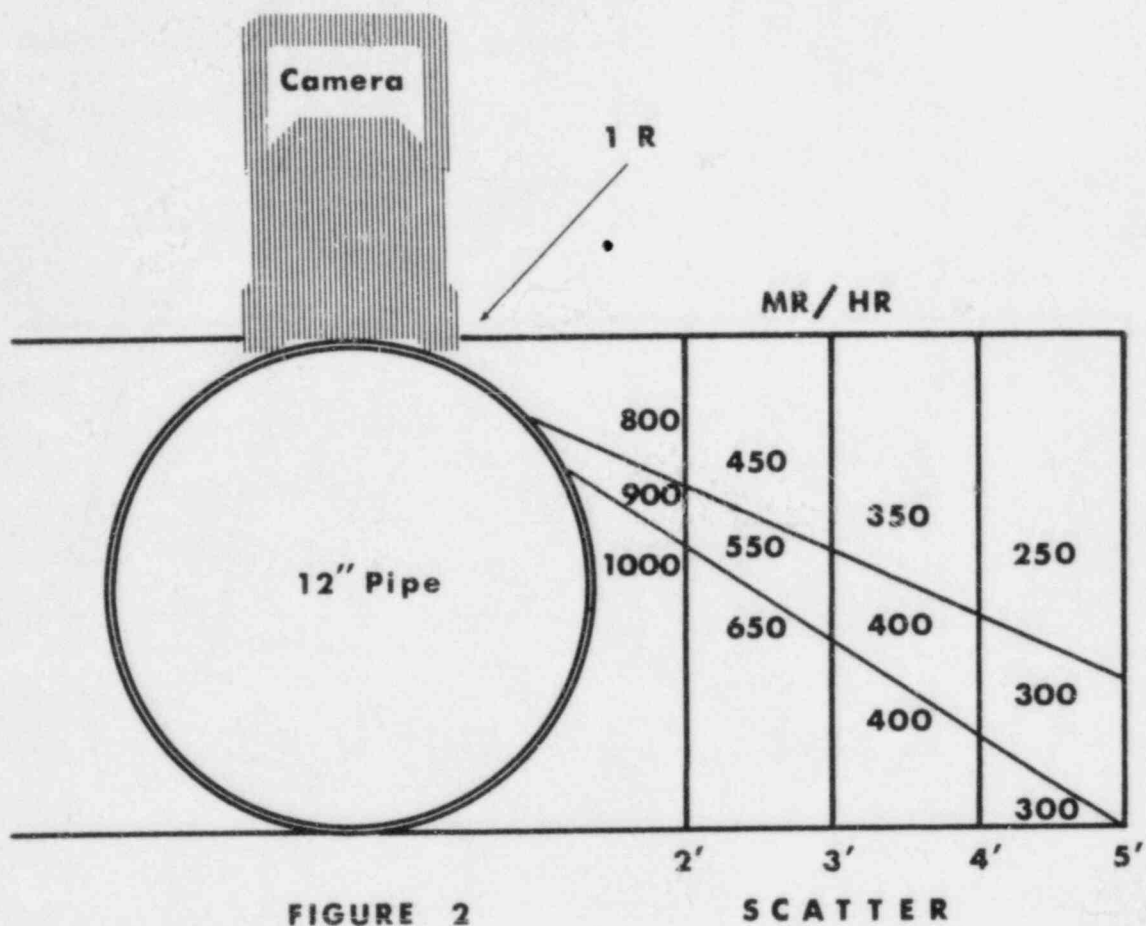
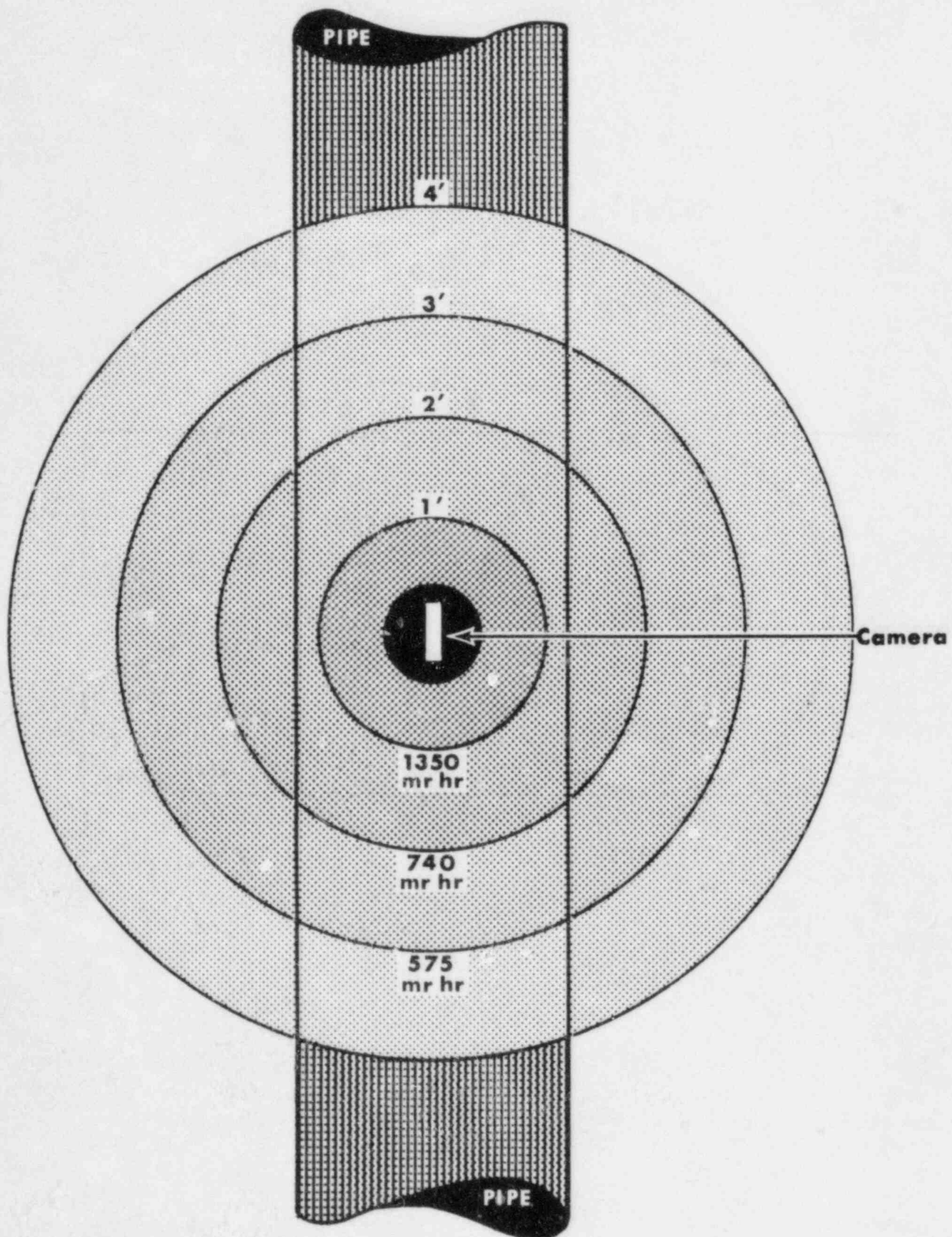


FIGURE 2

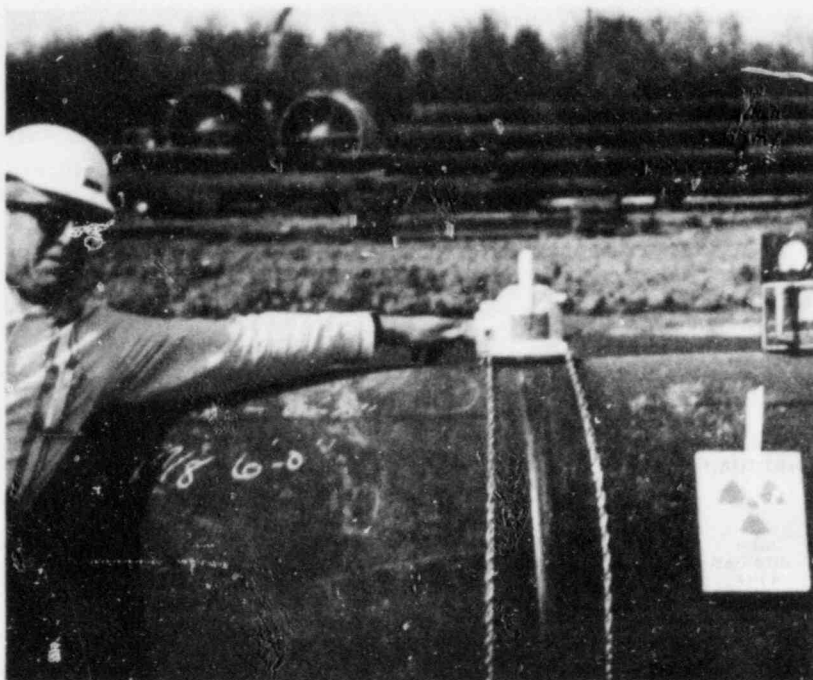




**FIGURE 2a**



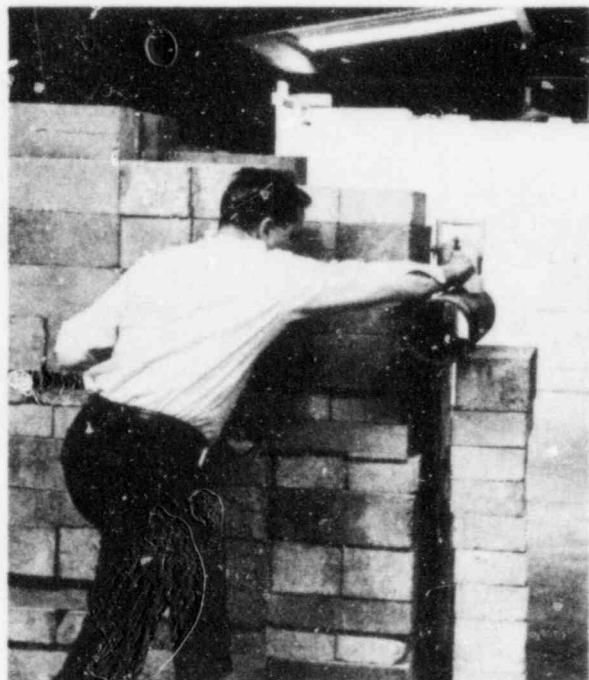
WRONG WAY



RIGHT WAY

FIGURE 3

S-12



CONAM O & E 10-8-82  
FIGURE 4

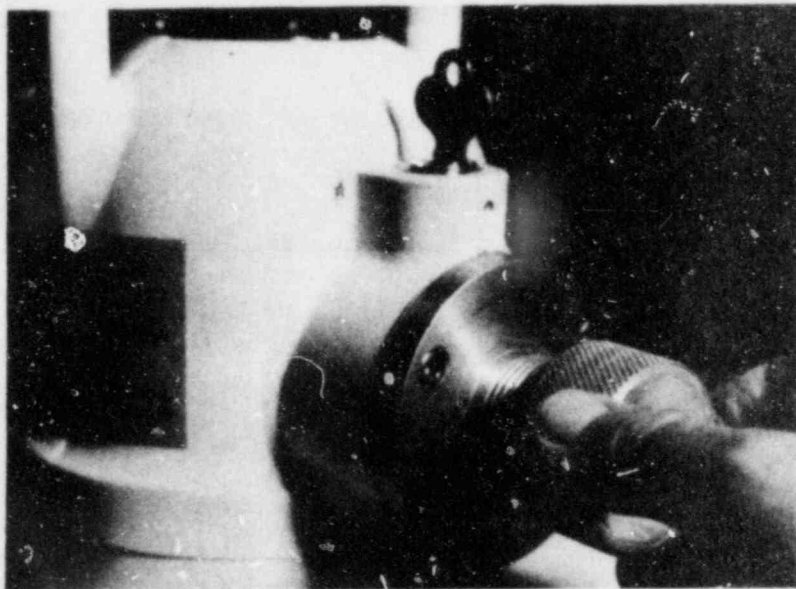


FIGURE 5

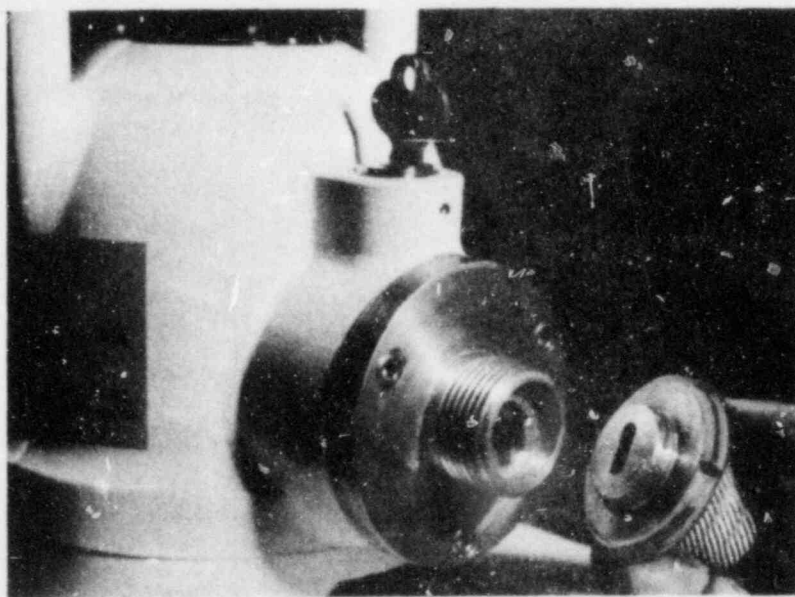
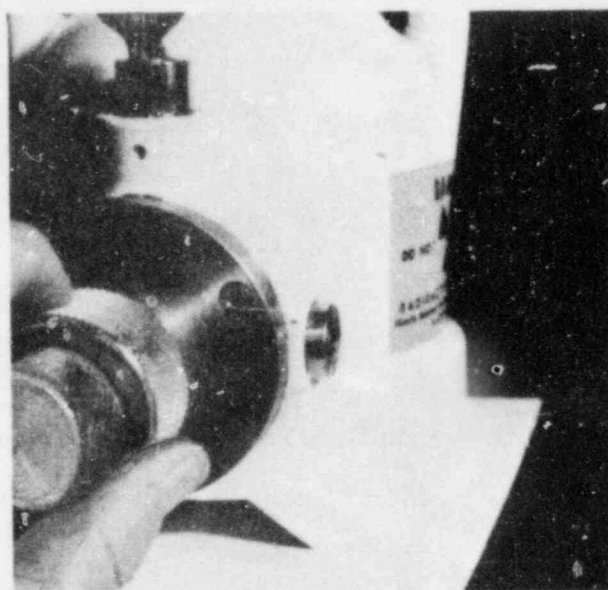
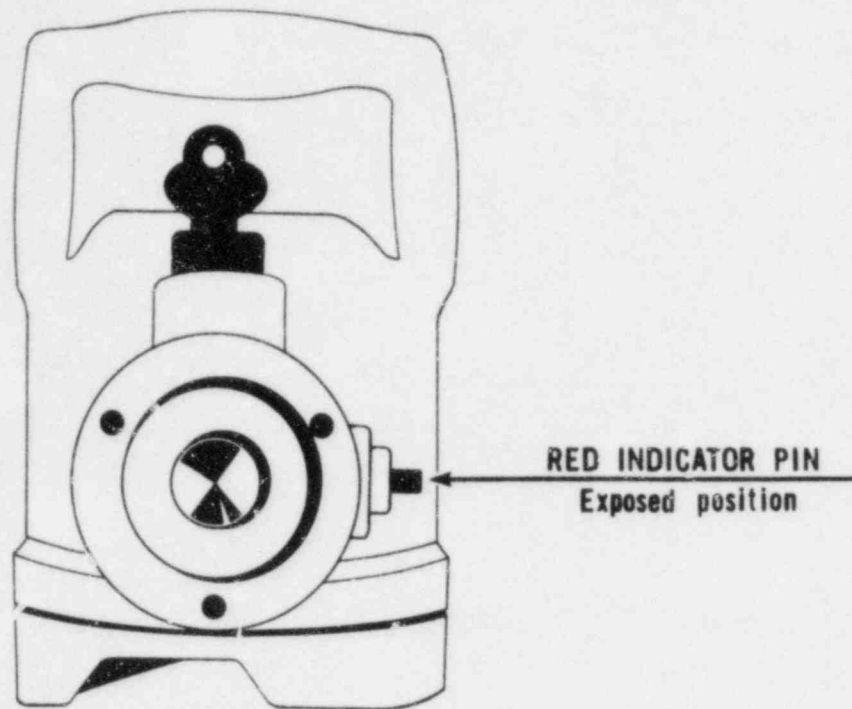


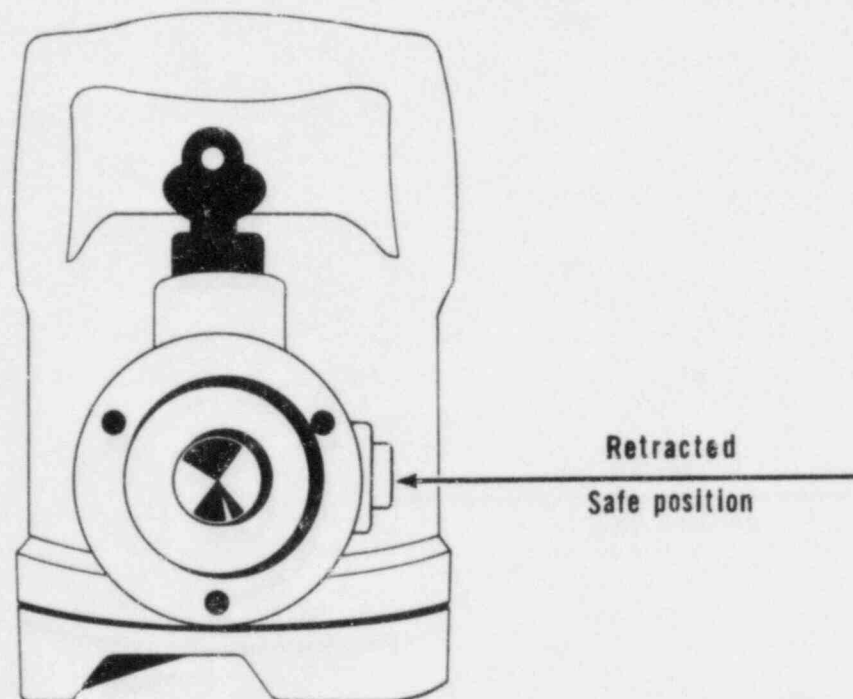
FIGURE 5a

FIGURE 6





**FIGURE 7**



**FIGURE 8**



## GAMMA INDUSTRIES

### PIPELINER MODEL 201

#### INTRODUCTION

Your Gamma Industries Pipeliner Model 201 is the result of our best efforts of engineering, materials and workmanship. Nothing has been spared in our endeavor to make this unit the finest radiography device on the market. Drawing No. 607-7001-003 at the back of this manual is a sectional view of the Pipeliner 201 showing the unit with the Iridium source in the stored position. Note that the component parts are the depleted uranium shield, the steel shell, the lock box and the remote handling system. With minimum maintenance, this unit will give trouble free, safe operation for an indefinite period of time. Proper use of this device will allow you to work with large quantities of radioactive materials, while minimizing personnel radiation exposure.

#### DESCRIPTION

The Gamma Pipeliner Model 201 is a depleted uranium shielded, industrial radiography device for the making of radiographs of welded joints. The unit is distinguished by the following features:

##### ISOTOPE AND CAPACITY

The Pipeliner 201 has a capacity of 200 curies nominal of Iridium 192. Gamma Industries source model for this device is PL-2. Other isotopes may be used for special applications: the capacity varies for these different isotopes according to the Gamma ray energy.

##### REMOTE CONTROL

Positive mechanical control of the source is provided by a 10 foot control assembly. (Other lengths may be used as safety dictates.) The device can also be manually operated when the activity of the source is less than 100 curies or in an emergency. No external power supply is required. This device is compatible with any set of Gamma Industries controls equipped with the "SAF-T-KEY A" or "SAF-T-KEY G" connector.

##### SAFETY FEATURES

Remote control reduces radiation exposure to the radiographer simply because he does not have to enter the high radiation field to operate the device. Because of the design of this device, it is impossible to lose the source due to a source disconnect. If a malfunction of the remote control system should occur, the device can be operated manually. The source can be removed from the device only by the manufacturer.



### CAUTIONS TO THE RADIOGRAPHER

By referring to the cross-sectional drawings, (fig. 1) you can see that the body of the unit is composed of four (4) basic parts:

- (1) a depleted uranium rotor which has a cavity to accomodate the source capsule,
- (2) a depleted uranium housing in which the rotor turns,
- (3) the outer shell, constructed of stainless steel, to which is attached the lock box, rotor operating mechanism, and the lifting handle, and
- (4) a stainless plate, which acts as an enclosure face plate and adapter plate for buckling the device to pipe.

The rotor, the shaft, and the control cable are the only moving parts so that there is a minimum of maintenance due to wear. If used properly and with care, this device will give excellent service for an indefinite period.

When making exposures with the Pipeliner 201 every effort should be made to point the "camera" toward an area where personnel radiation exposure would be minimized. If only two radiographs are required for a pipe joint, the camera should be directed straight up or straight down to reduce personnel exposure. However, the operator should bear in mind that scattered radiation will be vastly different for these two radiographs. For instance, if the pipe is raised a foot from a steel deck for a downward exposure the scatter radiation will be much greater than if this same pipe were six feet from the deck. Due to primary radiation this latter case would easily be more hazardous than the former. There is no way to accurately predetermine the intensity of scatter radiation for all applications. This is a self-contained unit designed for a strong Iridium source and, in order to turn it on and off, the operator must either enter a strong field of scatter radiation or use the remote controls designed for the unit. The radiation intensity will vary greatly depending on pipe size, pipe elevation, material thickness, type and distance of other materials in the area. The only way to know the level of scattered radiation is to measure with a survey meter. The radiographer must be aware of this scatter radiation and will conduct himself accordingly, using a survey meter at all times. Figure 1 is a cross-sectional view of the rotor when the source is in the safe position inside its housing. To expose the source, the rotor is turned 180°.

Figure 2 shows radiation levels at various distances from the unit with a source strength of 240 curies of Iridium 192. The source is in the exposed position, attached to a 16" diameter pipe,  $\frac{1}{4}$ " wall thickness and the pipe is on a concrete floor. From this figure, you can see why we are concerned with the radiographer's potential exposure dose, and why it is important that he remove himself from the immediate vicinity. If he stands too close to the unit, he will soon accumulate his maximum allowable radiation dose. Until the source has decayed down to 100 curies or less, always use the remote controls. When the source is 100 curies or less, the radiographer may then control the source wheel manually, but use of the remote control should always be considered, as personal exposure will be minimized. When using the unit manually, we recommend that the radiographer use the "stretch out" as shown in Figure 3, in order to keep himself as far away as possible. Time is also an important factor in personnel exposure. Therefore, it is important to work as quickly as possible.

Occasionally, auxiliary shielding is available to radiographers and advantage should be taken of this situation. Figure 4 is an example of such a set up in which the whole body dose would be reduced.

When the source is in the shielded position and contains 240 Ci IR-192 the expected dose rates were measured as follows:

1. Six (6) inches from the surface: 47 mr/hr (highest)
2. Surface of the device: 466 Mr/Hr. (highest)
3. Handle: 70 Mr/Hr.
4. "On-Off" knob: 25 Mr/Hr.
5. Five (5) feet from camera: .5 Mr/Hr.
6. Gonadal dose rate (when carried): 10 Mr/Hr.

The above readings are approximate and will vary according to scatter conditions.

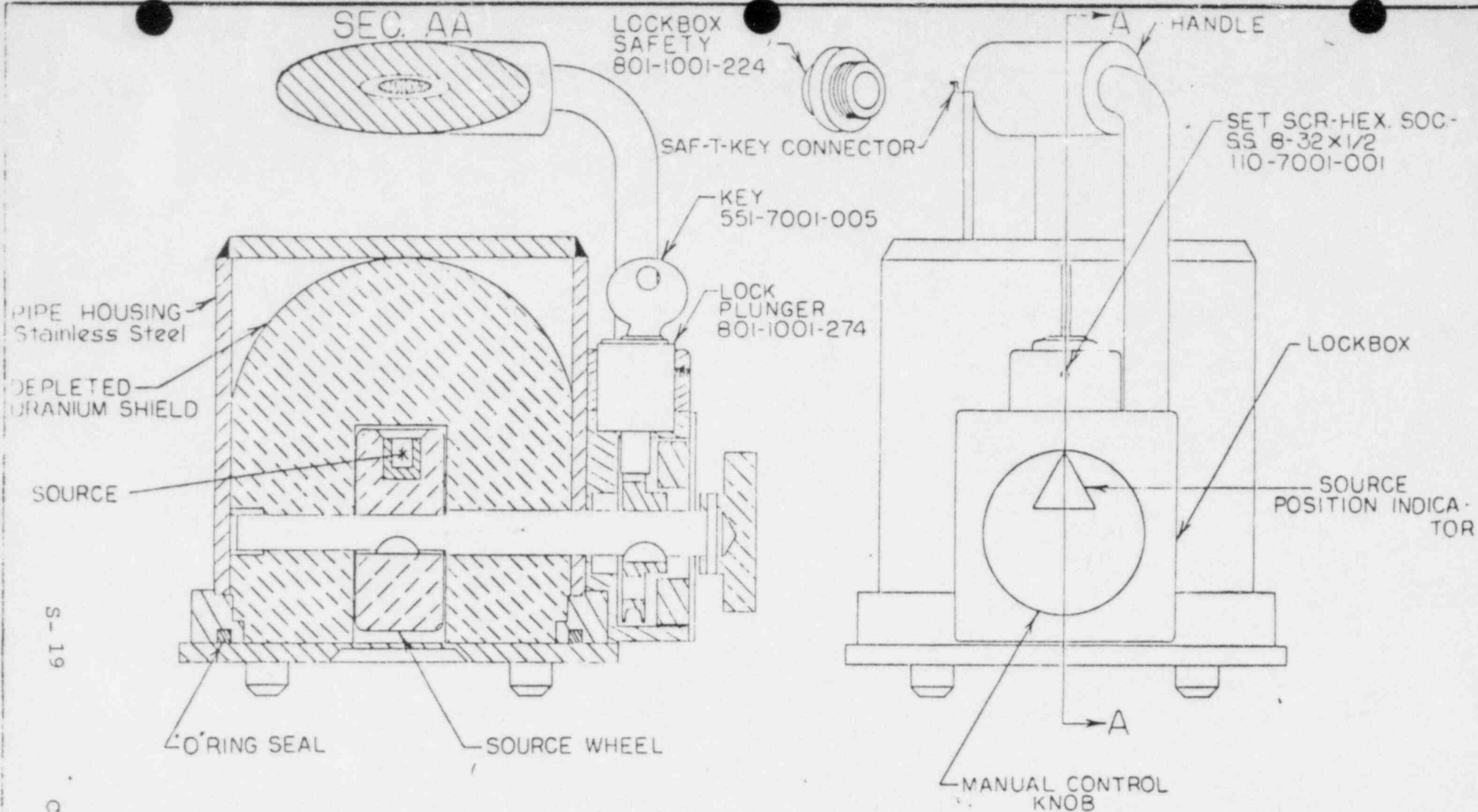
#### OPERATION

For the safe operation of this unit, the following procedure is recommended:

1. Have an operating and calibrated survey meter on hand and use it every time you make an exposure.

## OPERATION

2. Remove the protective cap from the end of the handle revealing the control cable connector.
3. Crank the controls drive cable out to approximately twelve (12) inches.
4. Connect the controls drive cable connector to the control cable connector of the device.
5. Crank the control device in so that the male connecting threads can be screwed into the control cable housing (handle).
6. Screw the swivel adaptor into the device handle.
7. Place the device in the required position to make the radiograph.
8. Stretch the control cable away from the exposure area in as straight a line as possible.
9. Unlock the unit using the key supplied with it.
10. By turning the crank handle of the controls clockwise, approximately  $180^{\circ}$ , the source wheel is turned and the source exposed.
11. Survey to see that the radiation levels are within limits.
12. At the end of the exposure, return the source to the shielded position by cranking counter clockwise on the control handle.
13. SURVEY CAREFULLY TO BE SURE THAT THE SOURCE HAS RETURNED TO THE SAFE POSITION.
14. Depress the lock plunger.
15. Disconnect the swivel adaptor.
16. Disconnect the drive cable.
17. Screw the protector cap back into place.



PARTS WITH AJJOINING NUMBERS  
CAN BE PURCHASED BY CUSTOMER  
TO REPAIR CAMERAS

FIGURE # 1

GAMMA INDUSTRIES B.R., L.A.

SCALE: NONE

APPROVED BY:

DRAWN BY KJR

DATE: 7-8-77

REVISED

CATALOG DWG. FOR PIPELINER 20I

DRAWING NUMBER

607-700I 003

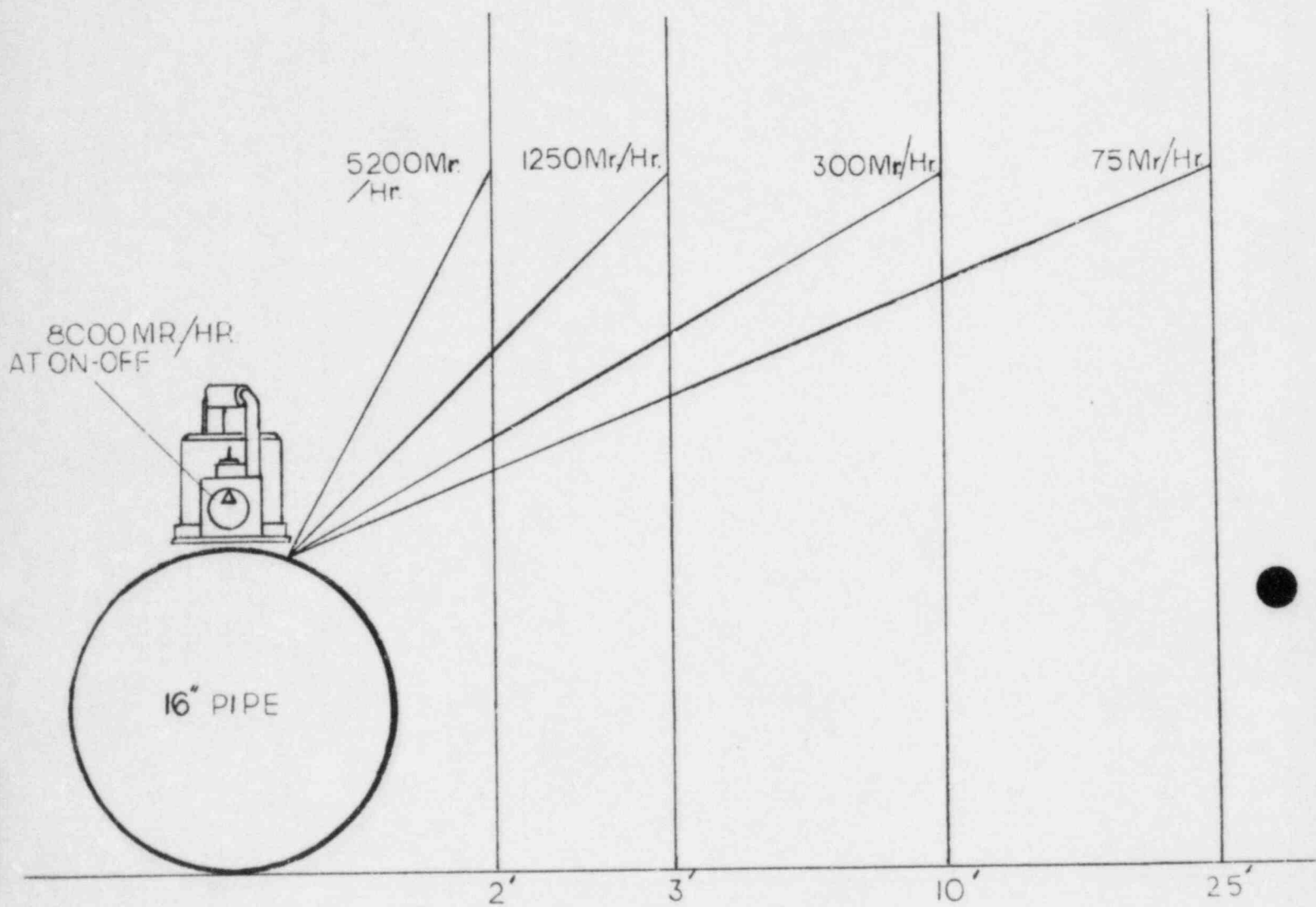


FIGURE 2



GULF NUCLEAR, INC.  
MODEL 10X PIPELINER  
OPERATING MANUAL

PHYSICAL DESCRIPTION

The Gulf Nuclear, Inc. Model 10X Pipeliner camera is an exposure device designed for making radiographs of pipeline welds. The device is hand operated and does not require any external power or accessories. In the "ON" position, the gamma radiation is directed out through the bottom of the camera. The device can be rotated on its' base plate to aid in operation as the camera is moved around the pipe. Although specifically designed for making radiographs of pipelines, the exposure device can be used on any cylindrical or flat surface where the film can be properly placed.

- Control Knob: (Appendix A-Part 14) This control is located on the front of the device and rotates the uranium drum that contains the Iridium-192 source. There is a radiation symbol located in the center of the knob. The knob rotates 90° and the drum rotates 180°.
- Lock: (Appendix A-Part 10) This is located over the gear box that houses the control knob. The key operated lock is springloaded and is depressed when the camera is in the "OFF" position only, to lock the camera so that the gamma source is in the shielded position.
- Base Plate: (Appendix A-Part 13) Constructed of stainless steel and is fabricated such that the camera can be rotated without changing the position of the base plate.
- Latching Device: Chain and latch are used to hold camera in position. Latch is spring loaded.

SOURCE DESCRIPTION

(Appendix A-Part 21) Camera requires Gulf Nuclear, Inc. RPL-5 Pipeliner source containing a nominal 100 curies of Iridium-192.

SAFETY PRECAUTIONS

1. Camera should be "OFF" and locked except when it is actually being used to expose film.

2. Operator should never remain beside the camera during an exposure. One should walk as far from the camera as practicable during film exposure to reduce body exposure. If one considers the fact that the dose rate (depending upon the actual operating condition) at a distance of 3 feet adjacent to the camera in the "ON" position is approximately .2 mr/sec, it is readily apparent that an operator that remains at the camera for 2 seconds will obtain .4 mrem exposure versus an operator that remains at the camera for 1 second receiving .2 mrem exposure. Distance is even more important since the dose rate decreases rapidly as you move away from the device. As in the example above, the dose rate at 3 feet was approximately .2 mr/sec. This extra distance decreases the body dose by a factor of ten.

Another worthwhile consideration is minimizing exposure is shielding material such as soil banks that the operator can step behind.

3. Position the camera such that when the camera is turned "ON" the control knob rotation is toward the operator. This action rotates the source away from the operator and decreases the exposure.
4. See Appendix B for radiation profile of camera in the "ON" position.
5. Disassembly of this device or replacement of radioactive material in this device shall only be performed by Gulf Nuclear, Inc. or other persons specifically licensed to perform such services.
6. Inspection and maintenance will be performed by Gulf Nuclear, Inc. personnel when the camera is returned for reloading. This inspection and maintenance does not replace, but is in addition to that required by the regulatory agency under which the device is licensed.
7. Although the Gulf Nuclear, Inc. Model 10X Pipeliner camera is designed to prevent failure of the "ON"- "OFF" capability, if the camera cannot be turned off, place the camera on the ground, on a lead surface, or otherwise shield the beam, making sure to keep out of the direct beam. Secure the area about the camera and notify Gulf Nuclear, Inc. immediately. (713-332-3581)

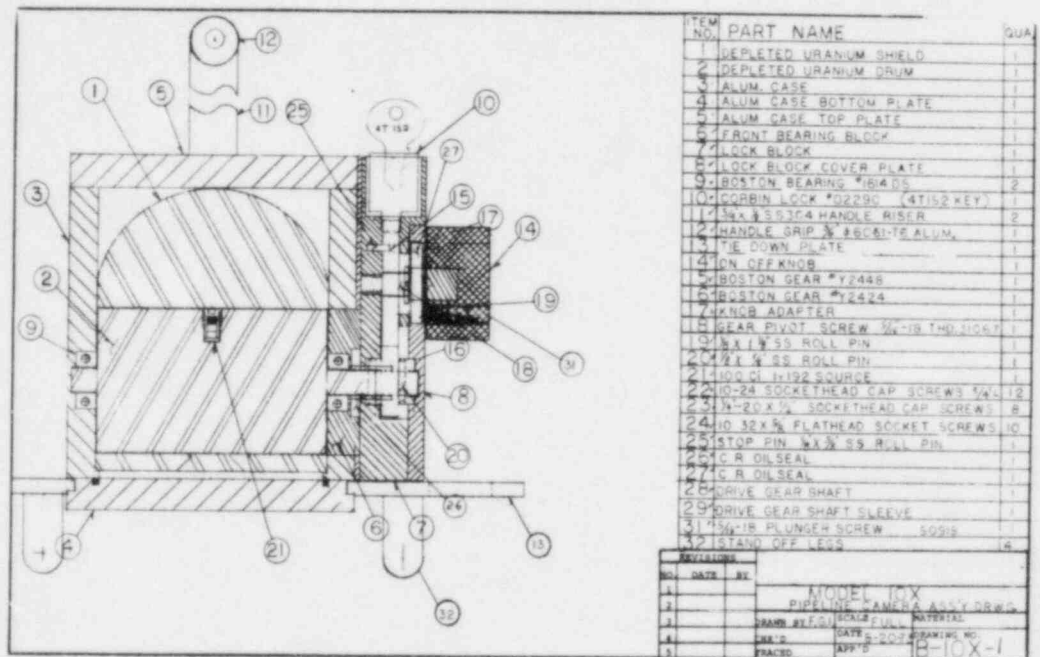
#### CAMERA OPERATION

NOTE: Operation of this device must be in accordance with the regulations set forth by the regulatory agency under which the radioactive material is licensed.

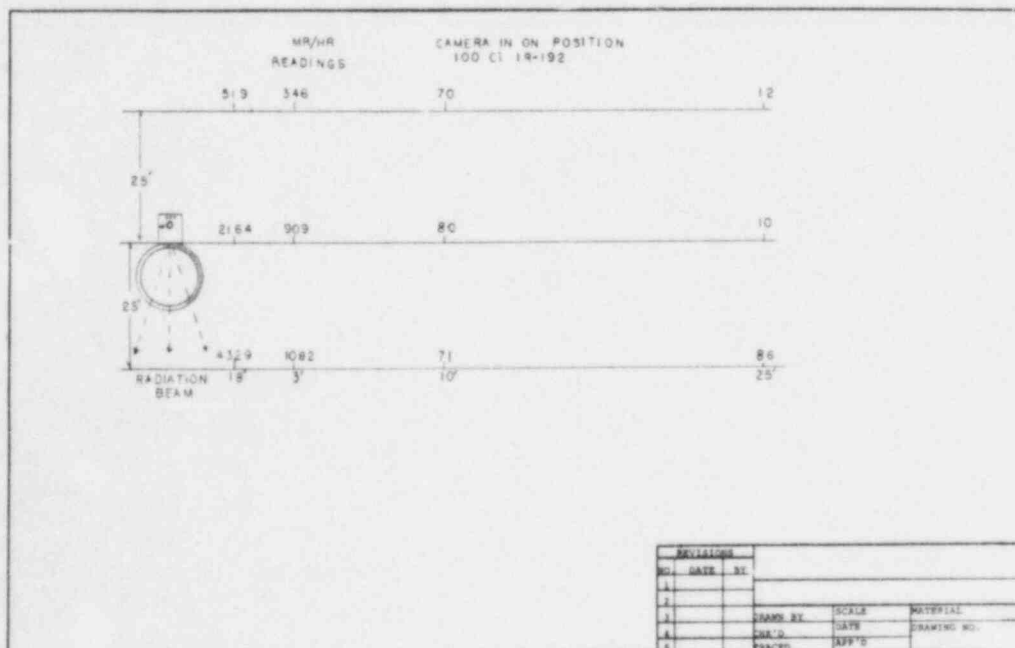
1. Place camera on surface to be radiographed.
2. Connect chain and latching device to camera and around pipe and latch.

3. Position film.
4. While timing the operation, turn camera "ON" at arms length to reduce body exposure and immediately walk away from the camera. Remain as far from the camera as practicable during exposure.
5. Lock the camera in the "OFF" position.
6. The camera is now ready for relocation.

A



B



SOURCE PRODUCTION AND EQUIPMENT CO., INC.

SPEC-CHECK MODEL II

OPERATING MANUAL

GENERAL DESCRIPTION

The SPEC-CHECK Model II exposure device is a manually controlled uranium shielded radiography unit designed for use in the field as well as the laboratory. Its rugged construction and design characteristics make it particularly effective for pipeline radiography. The basic composition of the unit is the light weight depleted uranium rotor and shield and a steel housing. The SPEC-CHECK is built for use under the most adverse conditions with virtually no maintenance.

While the unit is particularly well adapted for pipeliner radiography it may also be used in any application requiring a beam emitting device.

SPECIFICATIONS

Total weight of the SPEC-CHECK is approximately 32 pounds and it contains approximately 23 pounds of depleted uranium. The case is heavy gauge steel built to DOT specifications. The unit has been approved by all applicable regulatory agencies for use with an iridium 192 source up to 150 curies.

The source is controlled manually with knurled control knobs located on two sides of the unit. The lock is a plunger-type recessed in the steel housing. The unit is equipped with an attachment frame to facilitate the attachment of the unit to the pipe or vessel. The sturdily built handle is equipped with a nylon grip to minimize the possible transfer of heat to the operator's hands.

SAFETY

The SPEC-CHECK was designed to be used safely and efficiently. However, complete safety can be assured only through careful and proper operation. It is essential that all the operating instructions included in this manual be carefully followed. The operator should realize that his body is only a short distance from a source of up to 150 Curies and his hand is only inches away. Although this is a potentially hazardous situation, careful operation of the unit will prevent an overexposure.

There are no source position indicators incorporated into the design of the SPEC-CHECK Model II except pointers on the control knobs. This omission is deliberate because mechanical or electrical indicators may create a hazard since there could be a tendency on the parts of the radiographer to rely on the indicator rather than on his survey meter.

The operator should always use his survey meter to determine source position.

Each time the SPEC-CHECK exposure device is returned to Source Production and Equipment Co., Inc. for loading, the unit will be thoroughly inspected and repaired if necessary. Do not attempt to completely disassemble the unit or inspect the source in the field.

#### OPERATING PROCEDURES

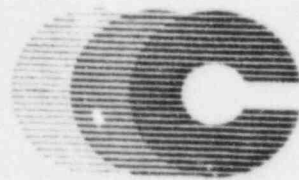
1. Before handling the SPEC-CHECK Model II exposure device, make sure you have an operable, calibrated survey meter and monitor every operation.
2. With the device in the locked mode, place securely in position to make exposure.
3. Unlock the unit.
4. Expose the source by rotating either of the two knurled knobs 180 degrees. The operator should keep his body as far away from the source as possible. Turn the knob nearest to the operator to eliminate reaching across the unit. It is important to reach as far as possible when turning on the unit to maintain the maximum distance from the source.
5. The survey meter should now indicate that the source is exposed. Move as quickly and as far away from the source as is practicable.
6. After desired exposure time has elapsed, turn the knob 180 degrees to return the source to the shielded or safe position. Reach as far as possible to maintain maximum distance from the source and perform this operation as quickly as is practicable.
7. Check the device with a survey meter to verify that the source is in the shielded position.
8. Lock unit by depressing lock plunger.
9. Check dosimeter after each exposure to verify that operations are being performed safely with minimum dosage.



NUCLEAR ENERGY SERVICES, INC.  
CONAM INSPECTION DIVISION

Division Radiation Control Office

6106 Rookin Street  
Houston, Texas 77074  
(713) 774-9657



# **RADIATION SAFETY**

## **ADMINISTRATIVE MANUAL**



CONAM ADMINISTRATIVE MANUAL

REVISION

ALL ORIGINAL PAGES DATED 8-1-81

REVISION # 1 DATED 4-30-82 PAGE 7

REVISION # 2 DATED 7-7-82 PAGE 26 AND 27

DATED 8-18-82 PAGE 20

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Conam Inspection Div.  
ADMINISTRATIVE PROCEDURES MANUAL

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ADMINISTRATIVE PROCEDURES MANUAL  
(for the use of byproduct material)

1.0 PURPOSE AND SCOPE

- 1.1 The purpose of this manual is to establish detailed procedures that management personnel shall follow to administer CONAM'S radiation safety program. These procedures implement the requirements of Title 10, Chapter 1 Parts 19,20,21,34 Code of Federal Regulations.
- 1.2 The administrative organization is outlined and the specific responsibilities assigned to each segment for operation of the program are detailed. These responsibilities include training and qualification of radiographic personnel, monitoring of radiographic operations to assure compliance with Commission regulations and CONAM procedures and maintenance of required records.

2.0 REFERENCES

- 2.1 The following references form a part of this manual:
  - (a) CONAM Inspection Div., Operating and Emergency Procedures Manual (for the use of byproduct material).
  - (b) Byproduct Material License No. 42-16559-01.

3.0 DEFINITIONS

- 3.1 For the purpose of this manual, the definitions in Paragraph 3.0 of the Operating and Emergency Procedures Manual apply.

#### 4.0 ADMINISTRATIVE ORGANIZATION AND RESPONSIBILITIES

Responsibility for administering the radiation safety program is distributed among three levels of management under the President as detailed on the organization chart, see Appendix A. The Radiation Safety Officer and the Radiation Safety Monitors represent the division level, the Radiation Safety Manager, the regional level and the Radiation Safety Supervisors, the field operations level. All participants in the program are responsible for enforcing its administrative, operating and emergency procedures and may assume control and institute corrective action in emergency situations. Additional responsibilities of each position are shown below:

- 4.1 Radiation Safety Officer: Reports directly to CONAM'S President and is responsible for implementing, auditing and enforcing the radiation safety program for the entire company. He is the only one with authority to issue or change administrative, operating, or emergency procedures.
- 4.2 Assistant Radiation Safety Officer: Reports directly to the Radiation Safety Officer and is responsible for performing any phase of the program as instructed by the Radiation Safety Officer.
- 4.3 Radiation Safety Monitor: Reports directly to the Radiation Safety Officer and is responsible for performing audits of any phase of the program as instructed by the Safety Officer.
- 4.4 Radiation Safety Manager: Reports directly to the Radiation safety Officer and is responsible for implementing, auditing and enforcing the radiation safety program for one region of the company. His direct responsibilities include, but are not limited to, training, testing and monitoring the progress of radiographic personnel within his region, maintaining all required records, investigating the cause of incidents, determining the necessary preventive and disciplinary action and reporting the results of such investigations and actions.
- 4.5 Assistant Radiation Safety Manager: Reports directly to the Radiation Safety Manager and acts as Radiation Safety Manager in the absence of the Radiation Safety Manager or whenever directed to by him.
- 4.6 Radiation Safety Supervisor: Reports to the Radiation Safety Manger or Assistant Radiation Safety Manager and is responsible for performing those duties assigned by the Safety Manager.



## 5.0 PERSONNEL TRAINING AND QUALIFICATION REQUIREMENTS

5.1 Administrative Personnel - All administrative personnel named on Appendix A, (other than electronic repair), shall meet either (a) or (b) plus (c) below.

(a) Three years practical experience in performing or directing the performance of industrial radiographic operations

or

(b) Successful completion of an approved formal course of instruction in radiation health physics (i.e. training school courses of general industry acceptance, qualified licensee's training program or equivalent programs).

plus

(c) Successful completion of a one hundred twenty five (125) question radiation safety test.

Additionally, all administrative personnel must be qualified radiographers prior to performing radiography and, to perform source recoveries, they must be qualified radiographers plus shall have completed a source recovery training program or equivalent experience (i.e. possess experience in source recovery prior to 1981)

In no event shall any administrative personnel perform functions in excess of their experience and training.

5.1.1 The experience and training record of each man named shall be documented and maintained on file by the Radiation Safety Officer.

5.2 Radiographers - To qualify as a radiographer with CONAM Inspection Div. each technician must meet the following requirements:

5.2.1 Receive a minimum of three months on-the-job training performing industrial radiography under the supervision of a qualified radiographer and have assigned to him a copy of CONAM'S "Operating and Emergency Procedures Manual."

5.2.2 Receive a minimum of forty total hours formal instructions covering the following points:

1. Fundamentals of Radiation Safety
  - a. Characteristics of gamma radiation.
  - b. Units of radiation dose (mrems) quantity of radioactivity (curie).
  - c. Hazards of exposure to radiation.
  - d. Levels of radiation from licensed material.
  - e. Methods of controlling radiation dose.
    1. Working Time.
    2. Working Distances.
    3. Shielding.
- II. Radiation Detection Instrumentation To Be Used
  - a. Use of radiation survey instruments.
    1. Operation
    2. Calibration.
    3. Limitations.
  - b. Survey Techniques.
  - c. Use of personnel monitoring equipment:
    1. Film badges and thermoluminescent dosimeters (TLD'S)
    2. Pocket Dosimeters.
- III. Radiographic Equipment To Be Used
  - a. Remote handling equipment
  - b. Radiographic exposure devices.
  - c. Storage containers.
- IV. Inspection and Maintenance Performed by the Radiographers
- V. Case Histories of Radiography Accidents

- 5.2.3 The forty hour total required to qualify as a radiographer may consist of: the sixteen hours formal training to qualify as an assistant radiographer, plus twenty four given to qualify as radiographer or may consist of a forty hour course given by outside agency, approved by the radiation safety officer.
- 5.2.4 Demonstrate his ability to properly utilize radiation survey instruments, personnel monitoring equipment and evidence a thorough understanding of a survey techniques involved. Must be aware of the correct operation of such instruments, the calibration requirements and the limitations of the instruments used. Must also have a working knowledge of the primary mathematics involved in basic radiation calculations.
- 5.2.5 Demonstrate thorough familiarity with the radiographic exposure equipment used, daily inspections and maintenance requirements, and with instructions for safe application of the units involved. This will be documented using the field examination form (Radiographer).
- 5.2.6 Pass a written examination designed to test his knowledge and understanding of the points covered in the training and instructions he has received. The examination will consist of fifty or more questions selected from a list of 125 possible questions and a grade of 75% or better is required to pass. Each question that is answered incorrectly will be discussed and reviewed with the student.
- 5.2.7 Technicians who have previously worked as radiographers for another licensee may be qualified for CONAM if:
- (a) It can be verified that the technicians has worked as a fully qualified radiographer for another licensee and,
  - (b) Satisfies the requirements of 5.2.4 and 5.2.5 by practical demonstration, and
  - (c) Is tested as required in paragraph 5.2.6.

- 5.2.8 Students not passing the initial examination shall not be qualified as radiographers until additional instruction and re-examination (using different questions) qualifies them.

To maintain the qualification of radiographer, the technician must follow, in detail, the requirements of CONAM'S Operating and Emergency Procedures Manual, and the N.R.C. Regulations.

- 5.2.9 All qualified radiographers and assistant radiographers will receive at least eight hours refresher training annually. Training will be administered by a member of the Radiation Safety Program or an outside agency who conducts training programs in conjunction with a state or federal isotope license or an outside agency approved by the Radiation Officer.

(a) Refresher training will be documented and placed on file. Documentation will indicate:

1. Date of Training
2. Attendance
3. Items Covered
4. Instructor

- 5.2.10 Due to our lack of control of the hire and termination dates of employees, the year of hire will not require refresher training, nor the final year of employment.

- 5.3 Radiographers Assistants-Applicants for radiographer's assistant must have acceptable judgement, comprehension and stability, in the opinion of the Radiation Safety Manager, to participate safely in the use of radiographic exposure devices.

- 5.3.1 Applicants without prior training will be given sixteen hours instructions in radiation safety per the "Instructors Outline for Teaching Radiation Safety" and will be given a written test consisting of all test questions noted by use of an asterick.

- 5.3.2 He must also demonstrate competence to use, under the personal supervision of the radiographer, the radiographic exposure devices, sealed sources, related handling tools, and radiation safety instruments that will be used in his assigned duties. This will be documented using the field examination form.

- 5.3.3 Personnel selected as radiographer's assistants will be assigned copies of CONAM'S "Operating and Emergency Procedures Manual".

- 5.4 Applicable Training and Experience Criteria-All qualified and certified radiographic personnel employed prior to January 11, 1982 shall conform to the training and experience requirements of the previous R.S.A.M. dated 1/25/77. Those radiographic personnel employed after January 11, 1982 shall conform to the current training and experience requirements of the existing R.S.A.M. amendment dated 4/30/82.

## 6.0 REQUIREMENTS, METHODS AND EXEMPTIONS FOR INSPECTING RADIOGRAPHIC OPERATIONS

### 6.1 INSPECTION REQUIREMENTS

The performance of each radiographer will be evaluated by a member of the Radiation Safety Program at regular intervals, to determine his degree of compliance with CONAM'S Operating and Emergency Procedures, License Conditions and N.R.C. Regulations.

- (a) After initially qualifying, each radiographer will be inspected at three (3) months intervals.
- (b) Where a radiographic inspection crew is made up of more than one radiographer, one radiographer assuming the duties and responsibilities of radiographer and the other or others assuming the duties of assistant radiographer, inspection credit will be given to each qualified individual.

### 6.2 METHODS OF INSPECTION OR RADIOGRAPHIC OPERATIONS

Each member of the Radiation Safety Program performing an inspection of radiographic operations will follow this basic outline.

- (a) Job site visits for the purpose of evaluating the degree of compliance with radiation safety requirements shall be unannounced.
- (b) Radiographic Operations should be observed unannounced. After radiographic operations have been observed and personal evaluations have been made, the inspector should announce his intentions to conduct an inspection to determine the radiographer's degree of competency.
- (c) All observations made up to this point whether complimentary or detrimental should be presented to the radiographer for his comment. A record of these observations should be noted on the CONAM Radiation Safety Internal Inspection Report.
- (d) A physical inspection of the radiography unit, personnel monitoring equipment, survey instruments and exposure device is to be made by the inspector. Pertinent information should be recorded on the CONAM Radiation Safety Internal Inspection Report.



- (e) The radiographer's copy of CONAM'S Radiation Safety Operating and Emergency Procedures, 10 CFR Parts 19,20,21,34 and the N.R.C. Byproduct Material License with amendments are to be examined by the inspector to insure that are complete and up to date. Sections that need revising are to be revised at this time. A record of the sections revised is to be recorded on the internal inspection report.
- (f) The inspector is to review with the radiographer and his assistant dosimeter records and the radiation reports. Any entry not acceptable to regulations or O & E Procedures will be discussed and provisions for the corrections made.
- (g) The inspector is to review with the radiographer and his assistant (s) his findings. The inspector will in definite terms outline all areas where conditions do not meet O & E Procedures or N.R.C. Regulations. Provisions are to be made to correct any deficiency noted.
- (h) The inspector is to complete the Radiation Safety Internal Inspection Report, noting all corrective actions and present it to the region (all three copies) for approval. The region will forward all copies to the Division Radiation Safety Office for its approval. Region and employee copies will be returned to the region for their files. A copy of the report will be placed in the employee file in the Division Radiation Safety Office.

#### 6.2B ALTERNATIVE METHOD OF INSPECTION FOR RADIOGRAPHIC OPERATIONS

Radiographic operations may be inspected under alternative Method B when a radiographer has no radiography scheduled at the time of inspection.

- (a) Radiographers will be requested to set up a simulated radiographic procedure for the purpose of determining his degree of competency. No exposures are necessary, but Radiation Reports are to be prepared and noted. The Inspection Certification and Securing Survey are to be recorded. The radiographer should record "Inspection and Radiographic Operation" in remarks column of the Radiation Report.
- (b) All observations made up to this whether complimentary or detrimental should be presented to the radiographer for his comment. A record of these observations should be noted on the CONAM Radiation Safety Internal Inspection Report.

- (c) A physical inspection of the radiography unit, personnel monitoring equipment, survey instruments and exposure device is to be made by the inspector. Pertinent information should be recorded on the CONAM Radiation Safety Internal Inspection Report.
- (d) The radiographer's copy of CONAM'S Radiation Safety Operating and Emergency Procedures, 10 CFR, Parts 19,20,21,34 and the N.R.C. Byproduct Material License with amendments are to be examined by the inspector, to insure they are complete and up to date. Sections that need revising are to be recorded on the internal inspection report.
- (e) The inspector is to view with the radiographer and his assistant (s) meter records and the radiation reports. Any entry unacceptable to regulations or O & E Procedures will be discussed and provisions for the corrections made.
- (f) The inspector is to review with the radiographer and his assistant (s) his findings. The inspector will in definite terms outline all areas where conditions do not meet O & E Procedures or N.R.C. Regulations. Provisions are to be made to correct any deficiency noted.
- (g) The inspector is to complete the radiation safety internal inspection report, noting all corrective actions and present to the region (all three copies) for approval. The region will forward all copies to the Division Radiation Safety Office for its approval. Region and employee copies will be returned to the region for their files. A copy of the report will be placed in the employee file in the Division Radiation Safety Office.

6.3 CONDITIONS WHERE INSTRUCTIONS OF RADIOGRAPHIC OPERATIONS  
MAY BE EXEMPT OR POSTPONED UNTIL A LATER DATE

- (a) Members of the Radiation Safety Administrative Program that, on occasions, perform radiography in order to test equipment, develop techniques, or are in jobs of delicate or sensitive nature will be exempt from inspections by other members of the Radiation Safety Administrative Program. The Radiation Safety Officer will evaluate performances of any Radiation Safety Administrative member when there is reason to believe conditions of "Radiation Safety Operating and Emergency Manual, "License Conditions, 10 CFR Parts 19,20,21,34 and/or the Radiation Safety Administrative Manual" are not being met.
- (b) Radiographers employed on assignments other than radiography for a period of thirty (30) days will have the inspection of radiographic operations delayed by the amount of time there are employed on the non-radiographic equipment.
- (c) Radiographers performing assignments for a period of thirty (30) days where entry of the inspector is not permitted due to security (National Defense or contractual) will have the inspection of radiographic operations postponed until the month following the assignment.
- (d) Radiographers performing radiography on assignments for a period of thirty (30) days where working conditions are considered as hazardous (above normal) will have the inspection postponed until the month following the assignment.
- (e) Radiographers performing radiography on assignments for a period of thirty (30) days which is inaccessible by commercial transportation will have the inspection postponed until the month following the assignment.
- (f) Radiographers have interrupted service (vacations and lay-off) of less than one year will have the inspection of radiographic operations delayed by the amount of time of the interruption.

## 7.0 EMERGENCY PROCEDURES

Whenever an emergency situation exists, make certain sufficient information regarding the accident has been accumulated before issuing any instruction.

### 7.1 For Exposed Sealed Sources

- (a) Determine the physical condition of the radiographer
- (b) Ascertain the condition of the survey instrument
- (c) Confirm that the area has been restricted and posted, and is under constant surveillance.
- (d) Ascertain the condition of the exposure device.

After all information has been evaluated, issue any additional instructions that may be needed until a recovery of the sealed source can be made.

### 7.2 For Leaking Sealed Sources and Contaminated Equipment

- (a) Ascertain the condition of the survey meter.
- (b) Review the steps taken in making the leak test, to make certain that the swab was monitored correctly.
- (c) Review the steps taken by the employee to secure the source and store the device.
- (d) Reinstruct the employee to avoid direct contact with the contaminated equipment.
- (e) Instruct the employee on additional precautions to be taken until the condition can be corrected.

## 8.0 PROCEDURE FOR CALIBRATING SURVEY METERS

8.1 Calibration of survey meters will be performed by any of the following:

- (a) The manufacturer of the meter
- (b) Members of the Radiation Safety Program who have received instructions in meter calibration or have had over one year experience in meter calibration prior to July 1, 1981.
- (c) Members of CONAM electronic repair department listed in Appendix "A".

8.2 Meters calibrated by CONAM personnel will be calibrated using a T.O. Model 571 no more than 15 millicuries of CO 60

CS 137 G.N. Model IC 50 no more than 200 millicuries of

CS 137 G.N. Model IC 51 no more than 300 millicuries of

- (a) For the T.O. Model 571 dose-distance computer located at the bottom of the identification label will be used to calculate the desired dose rates; for the Gulf Nuclear IC 50 or IC 51 the dose rate chart will be used. The calibration of each survey meter will be checked two times on each scale, once near the low end and once near the high end. There will be at least 50% of the scale between check points.
- (b) Place meter on a stand, preferably 3 or more feet above the ground to eliminate most scatter.
- (c) Measure distance from source to center line of detecting tube to correspond to the calculated distance required for the radiation intensities.
- (d) Unlock calibrating device using same safety precautions as are required in making a radiographic exposure.
- (e) If meter reads over 20% plus or minus of calculated reading, instrument must be recalibrated.
- (f) After completing calibration, lock and secure calibrating device in the same manner that is required for radiographic exposure devices.
- (g) If meter cannot be calibrated to meet the 20% plus or minus requirements, send it to our repair facility for repairs and replace with calibrated meter.



- (h) Complete and affix certification label to the outer surface of the case. Complete certification certificate, one copy for region office, one copy for division office and the third copy inside the meter case.

NOTE

A copy of the operating instructions for the Calibration Kit being used will be at hand when performing all calibrations and all safety instructions will be observed.

9.0 REQUIREMENTS FOR PERIODIC INSPECTION AND MAINTENANCE OF RADIOGRAPHIC EQUIPMENT

- 9.1 All radiographic equipment and area safeguards of shielded facilities are to be inspected by management or its designated representative at intervals not to exceed 90 days. Copies of the inspection reports will be filed with the region and the division office.

Faulty equipment must be removed from service until authorized repairs are performed.

- 9.2 Inspection and maintenance procedures for exposure devices are as follows:

9.2.1 BUDD COMPANY (AUTOMATION INDUSTRIES) GAMMA INDUSTRIES DEVICES\*\*

\*\*For Model 100A, 100A-1, 520, 52B, 51B, 151H,(A.I.) 50 and 100 (G.I)

"WARNING"- ALL MODELS EXPOSURE DEVICES CAN BE LOCKED IN AN UNSAFE POSITION"

1. Check for abnormal surface radiation levels.
2. Establish a radiographic area and check the operation of the equipment. Make required surveys.
3. Lock the device, disconnect source tube and control assembly.

4. Inspect the source pigtail.

- (a) Inspect the connector for true elbow, straightness, excessive wear and cracks.
- (b) Inspect the flexible cable at the connector for straightness.

Maintenance: If defective, the source must be returned to the source supplier.

5. Inspect the connector on drive cable. This hole will show some wear but should not be out-of-round to the extent that it will disconnect from the mating piece other than in the correct position. It should not be loose on the drive cable. The portion of the connector with the connector hole should not be bent, but should be straight and parallel with the body of connector.

Maintenance: Replace, if the connector does not meet the above requirements.

6. Connect the drive cable to the source pigtail connector. Test the connection by pulling straight back on the cable applying about 30 to 40 pounds pressure.

CAUTION: BE SURE THE LOCK PLUNGER IS DEPRESSED BEFORE MAKING THE PULL TEST.

7. Remove drive cable from conduit and disassemble control assembly. Clean all parts with solvent and dry.

- (a) Inspect the drive cable for flexibility, wear and rust. The cable should be free of any stiffness, kinks or other mating conditions that would prevent the cable from running on the gear in the gear housing.

Special attention should be given to the first 12 to 18 inches of the drive cable at the source connector end. This portion of the cable is unprotected by the cable conduit when connecting the components for use and is most susceptible to foreign matter and damage.

Maintenance: Repair or replace, as needed. Lubricate with a light weight rust inhibitor.

- (b) Inspect crank assembly parts for excessive wear or any damage that may impair operation. The bronze bushings in the gear housing and the plate are most likely place to find wear. Worn bushings permit the gear to wobble and eventually wear out. Wear around the inner circumference of the housing permits the drive cable to slip on the gear and prevents the source from moving properly through the exposure device.

Maintenance: Reassemble and check for excessive wear and damage. Remove and replace parts, as needed. Apply a light weight lubricant on the bushings.

- (c) Inspect drive cable conduit for any damage or kinking that can prevent the drive cable from moving freely. This includes examining the conduit near the end connection for damage from excessive flexing while being assembled and disassembled. Also, inspect the cable conduit end fitting and the inlet connection of the exposure device by mating the two parts and checking for extensive wear and slack.

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

8. Connect the source tube to the exposure device. Test the connection by pulling straight back on the source tube applying about 5 pounds of pressure.
9. Inspect the source tube for foreign matter, kinks or damage that may effect the source travel through the tube.

Maintenance: Crimps, kinks and other damaged places may be cut out and connectors placed on ends so that tube is not shortened excessively. The coupling and end cap may also be removed and replaced. Remove foreign matter by washing with solvent and blowing with compressed air.

10. Inspect lock plunger ease of operation. The plunger should retract about  $\frac{1}{2}$  inch, at its fullest extent. This permits free travel of the source in and out of the exposure device.

Maintenance: Remove the lock plunger, wash with solvent and lubricate. Lock may also be cleaned and lubricated by spraying a lubricant (such as WD-40) into the lock.

11. Check all labels for legibility.
12. Inspect for shifting of shield inside the device.
13. Inspect carriage, wheels, lifting lugs and handles on units, so equipped.
14. Replace missing and damaged protector or safety plugs and caps.

#### 9.2.2 GAMMA INDUSTRIES AND GULF NUCLEAR DEVICES \*\*

\*\*For Models 35 & Century exposure devices (Gamma Industries)  
For Models 20V & 40V exposure devices (Gulf Nuclear)

WARNING-ALL MODELS EXPOSURE DEVICES CAN BE LOCKED IN AN UNSAFE POSITION

1. Check for abnormal surface radiation levels.
2. Establish a radiographic area and check the operation of the equipment. Make required surveys.
3. Lock the device, disconnect source tube and control assembly.
4. Inspect the source pigtail.
  - (a) Inspect the connector for true elbow, straightness, excessive wear and cracks.
  - (b) Inspect the flexible cable at the connector for straightness.

Maintenance: If defective, the source must be returned to the source supplier.

5. Inspect connector on drive cable. This hole will show some wear but should not be out-of-round to the extent that it will disconnect from the mating piece other than in the correct position. It should not be loose on the drive cable. The portion of the connector with the connector hole should not be bent, but should be straight and parallel with body of connector.

Maintenance: Replace, if the connector does not meet all of the above requirements.

6. Connect the drive cable to the source pigtail connector. Test the connection by pulling straight back on the cable applying about 30 to 40 pounds pressure.

CAUTION: Be sure the lock plunger is depressed before making the pull test.

7. Remove drive cable from conduit and disassemble control assembly. Clean all parts with solvent and dry.
  - (a) Inspect the drive cable for flexibility, wear and rust. The cable should be free of any stiffness, kinks or other damaging conditions that would prevent the cable from running on the gear in the gear housing.

Special attention should be given to the first 12 to 18 inches of the drive cable at the source connector end. This portion of the cable is unprotected by the cable conduit when connecting the components for use and is most susceptible to foreign matter and damage.

Maintenance: Repair or replace, as needed. Lubricate with a light weight rust inhibitor.

- (b) Inspect crank assembly parts for excessive wear or any damage that may impair operation. The bronze bushings in the gear housing and the plate are the most likely places to find wear. Worn bushings permit the gear to wobble and eventually wear out. Wear around the inner circumference of the housing permits the drive cable to slip on the gear and prevents the source from moving properly through the exposure device.

Maintenance: Reassemble and check for excessive wear and damage. Remove and replace parts as needed. Apply a light weight lubricant on the bushings.

- (c) Inspect drive cable conduit for any damage or kinking that can prevent the drive cable from moving freely. This includes examining the conduit near the end connection for damage from excessive flexing while being assembled and disassembled. Also, inspect the cable conduit end fitting and the inlet connection of the exposure device by mating the two parts and checking for extensive wear or slack.



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

8. Connect the source tube to the exposure device. Test the connection by pulling straight back on the source tube applying about 5 pounds of pressure.
9. Inspect the source tube for foreign matter, kinks or damage that may effect the source travel through the tube.

Maintenance: Crimps, kinks and other damaged places may be cut out and connectors placed on ends so that tube is not shortened excessively. The quick disconnect coupling and end cap may also be removed or replaced. Remove foreign matter by washing with solvent and blowing with compressed air.

10. Inspect lock plunger for ease of operation. The plunger should retract about 1/2 inch, which is at its fullest extent. This permits free travel of the source in and out of the exposure device.
- 10.a Replacement of lock in Gamma Models Century and 35 exposure devices.  
If lock mechanism is found to be defective it is to be replaced with original equipment.

Maintenance: Remove the lock plunger, wash with a solvent and lubricate. Lock may also be cleaned and lubricated by spraying a lubricant (such as WD-40) into the lock.

11. Check all labels for legibility,
12. Inspect for shifting of shield inside the device.
13. Inspect carriage, wheels, lifting lugs and handles on units.

14. Replace missing and damaged protector or safety plugs and caps.

\*\*For Pipeliner Model 1. (Gamma)  
For Pipeliner Model 201 (Gamma)  
For Pipeliner Model 10X (Gulf)  
For Pipeliner SPEC Check Model II (SPEC)

1. Check for abnormal surface radiation readings.
2. Remove face plate and check rotor locking set screw for tightness. These set screws are cemented in place, therefore it is not necessary to apply pressure to assure tightness.
3. Remove old oil from rotory chamber and refill with mixture of one half diesel fuel and one half motor oil 10 weight.
4. Check face plate O ring and replace if damaged. (Not applicable for SPEC Check Model II)
5. Replace face plate.
6. Remove dust cap, knurled knob and control adaptor plate. Check and clean lock and red indicating pin.
7. Lubricate with vaseline and replace.
8. Replace all damaged labels as required.
9. All major repairs required must be accomplished by the manufacturer.

#### 9.2.3 TECHNICAL OPERATIONS DEVICE\*\*

\*\*For Model 446 Devices

"WARNING -ALL MODELS EXPOSURE DEVICES CAN BE LOCKED IN AN UNSAFE POSITION"

1. Check for abnormal surface radiation levels.
2. Establish a radiographic area and check the operation of the equipment. Make required surveys.
3. Test the connection between the source tube and the exposure device by pulling straight back on the source tube applying about 5 pounds pressure.

4. Disconnect source tube, replace and lock safety plug.

THE FOLLOWING STEP IN THE PROCEDURE IS NOT TO BE PERFORMED WITHOUT SPECIAL INSTRUCTION

5. If the unit does not operate properly, disconnect and remove the control cable conduit.

CAUTION: DO NOT DISCONNECT THE CONTROL CABLE FROM THE SOURCE PIGTAIL

- (a) Clean the control cable with solvent and dry. Inspect the drive cable for flexibility, wear and rust. The cable should be free of any stiffness, kinks or other damaging conditions that would prevent the cable from running on the gear in the gear housing.

Maintenance: Repair or replace as needed. Lubricate with a light weight rust inhibitor.

- (b) Disassemble control assembly. Clean all parts with solvent and dry. Inspect crank assembly parts for excessive wear or any damage that may impair operation. The bronze bushings in the gear housing and the plate are the most likely places to find wear. Worn bushings permit the gear to wobble and eventually wear out. Wear around the inner circumference of the housing permits the drive cable to slip on the gear and prevents the source from moving properly through the exposure device.

Maintenance: Reassemble and check for excessive wear and damage. Remove and replace, as needed. Apply a light weight lubricant on the bushings.

- (c) Inspect drive cable conduit for any damage or or kinking that can prevent the drive cable from moving freely.

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

6. If the unit operates properly, inspect control assembly for loose screws and fittings and cable sheathing for kinks and wear.
7. Inspect the source tube for any foreign matter, kinks or damage that may effect the source travel through the tube.
8. Inspect lock, hasp and safety plug. Clean and lubricate lock, as needed.
9. Check all labels for legibility.
10. Inspect for shifting of shield inside the device.
11. Inspect carriage, wheels, lifting lugs and handles on units, so equipped.

**\*\* For Model 533 exposure devices**

"WARNING - ALL MODELS EXPOSURE DEVICES CAN BE LOCKED IN AN UNSAFE POSITION"

1. Survey for abnormal surface radiation levels.
2. Establish a radiographic area and check the operation of the equipment. Make required surveys.
3. Lock the device, disconnect source tube and control assembly.
4. Inspect the source pigtail.
  - (a) Inspect the connector for wear and cracks
  - (b) Inspect the flexible cable at the connector for straightness.

Maintenance: If defective, the source must be returned to the source supplier.

5. Inspect the connector on drive cable. It should not be loose on the drive cable. The connector should be parallel with the cable.

Maintenance: Replace the entire cable if the connector does not meet all the above requirements.

6. Connect the drive cable to the source pigtail connector. Test the connection by pulling straight back on the cable applying about 30 to 40 pounds pressure.

CAUTION: BE SURE TO LOCK PLUNGER IS DEPRESSED BEFORE MAKING THE PULL TEST

7. Remove the drive cable from conduit and disassemble control assembly. Clean all parts with solvent and dry.
  - (a) Inspect the drive cable for flexibility, wear and rust. The cable should be free of any stiffness, kinks or other damaging conditions that would prevent the cable from running on the gear in the gear housing.

Special attention should be given to the first 12 to 18 inches of the drive cable at the source connector end. This portion of the cable is unprotected by the cable conduit when connecting the components for use and is most susceptible to foreign matter and damage.

Maintenance: Repair or replace, as needed. Lubricate with a light weight rust inhibitor.

- (b) Inspect crank assembly parts for excessive wear or any damage that may impair operation. The bronze bushings in the gear housing and the plate are the most likely places to find wear. Worn bushings permit the gear to wobble and eventually wear out. Wear around the inner circumference of the housing permits the drive cable to slip on the gear and prevents the source from moving properly through the exposure device.

Maintenance: Reassemble and check for excessive wear and damage. Remove and replace parts, as needed. Apply a light weight lubricant on the bushings.

- (c) Inspect the drive cable conduit for any damage or kinking that can prevent the drive cable from moving freely. This includes examining the conduit near the end connection for damage from excessive flexing while being assembled and disassembled. Also, inspect the cable conduit end fitting and the inlet connection of the exposure device by mating the two parts and checking for extensive wear and slack.



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

8. Connect the source tube to the exposure device. Test the connection by pulling straight back on the source tube applying about 5 pounds of pressure.
9. Inspect the source tube for any foreign matter, kinks or damage that may effect the source travel through the tube.

Maintenance: Replace, as needed. Remove foreign matter by washing with solvent and blowing with compressed air.

10. Inspect lock plunger for ease of operation. The plunger should retract about 1/2 inch, which is its fullest extent.

Maintenance: Remove the lock plunger, wash with a solvent and lubricate. Lock may also be cleaned and lubricated by spraying a lubricant (such as WD-40) into the lock.

11. Check all labels for legibility.
12. Inspect for shifting of shield inside the device.
13. Replace missing and damaged protector or safety plugs and caps.

#### 10.0 REQUIREMENTS FOR MAINTAINING RECORDS

- 10.1 It is responsibility of the Radiation Safety Manager to make certain that personnel who handle or use byproduct material in his region follow the record keeping requirements of CONAM'S Operating and Emergency Procedures Manual and Administrative Procedures Manual.

- 10.2 The following records will be on file at region and division offices.

(a) Occupational External Radiation Exposure History  
(Form N.R.C. 4)

- (b) Film Badge Reports
- (c) Current Occupational External Radiation Exposure  
(Forms N.R.C., 5, or equivalent)
- (d) Weekly Reports (daily dosimeter readings)
- (e) Reports of Overexposure
- (f) Copies of Notification of Incidents  
(All correspondence)
- (g) Radiation Reports (utilization survey and daily  
inspection of device)
- (h) Weekly Isotope Activity Reports
- (i) Quarterly Inventory Reports
- (j) Survey Meter Calibration Reports
- (k) Leak Test Reports
- (l) Requisition, Receiving, Shipping and Survey Reports
- (m) Copies of Decay Charts
- (n) Copies of Radiographer Qualification Examinations
- (o) Radiographer's Inspection Check List
- (p) Radiographic Device Inspection Reports
- (q) Shipping Documents
- (r) Quarterly Inspection of Area Safeguards
- (s) Copies of Radiographer's Assistant and Trainee  
Qualification Examination

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