

PITTSBURGH TESTING LABORATORY  
RADIATION SAFETY PROCEDURES

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PITTSBURGH TESTING LABORATORY  
RADIATION SAFETY PROCEDURES  
" MANAGEMENT RESPONSIBILITIES "  
PART A

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## 1.0 SCOPE

1.1 This procedure defines Pittsburgh Testing Laboratory (PTL) management's responsibility concerning all areas of Radiation Safety and related documentation.

## 2.0 RESPONSIBLE MANAGEMENT PERSONNEL

2.1 Vice President (VP) designated by the president of PTL to maintain overall active corporate control of the Radiation Safety Program.

- a) Serve as liaison officer to the NRC and other agencies on license matters.
- b) Direct and supervise other management personnel with delegated duties.

2.2 Radiological Safety Coordinator (RSC). The individual delegated the duties of maintaining active management enforcement and control of PTL's Radiation Safety Program.

- a) Maintain control of procurement and disposal of licensed material.
- b) Develop and maintain the use of up-to-date PTL operating and emergency procedures.
- c) Establish and maintain a personnel monitoring program.
- d) Procure and maintain radiation survey instruments.
- e) Establish and conduct the training program for ARSC, RSO, ARSO, radiographers and assistant radiographers.
- f) Examine and determine competence of radiographic personnel.
- g) Establish and maintain storage facilities.
- h) Maintain exposure devices, radiographic facilities, and associated equipment.
- i) Establish and maintain the leak-testing program.
- j) Establish and maintain the internal inspection system.
- k) Control source replacement operations.
- l) Control and maintain quarterly inventories and utilization logs.
- m) Establish and maintain a survey instrument calibration program.
- n) Establish and maintain the licensee's record keeping system.
- o) Review and ensure maintenance of those records kept by others.
- p) Assume control and institute corrective action in emergency situations.
- q) Investigate the cause of incidents and determine necessary preventive action.

2.3 Assistant Radiological Safety Coordinator (ARSC). The individual delegated the duties of assisting in maintaining active management enforcement and control of PTL's Radiation Safety Program.

- a) Assist in the duties of the RSC.

2.4 Radiation Safety Officer (RSO). The delegated individual whose duty is to implement and enforce the use of PTL's operating and emergency procedures at each radiographic operation under his supervision.

- a) Maintain a personnel monitoring program.
- b) Enforce the use of radiation survey instruments at all radiographic operations.
- c) Conduct or supervise the training program for radiographers and assistant radiographers.
- d) Examine and determine competence of radiographic personnel.
- e) Establish and maintain storage facilities.
- f) Maintain exposure devices, radiographic facilities and related equipment.
- g) Maintain the leak testing program.
- h) Maintain the internal inspection system.
- i) Direct source replacement operations.
- j) Conduct quarterly inventories and maintain utilization log.
- k) Maintain the record keeping system established by PTL's operating procedures.
- l) Assume control and institute corrective action in emergency situations.
- m) Investigate the cause of accidents and determine necessary preventive action.
- n) Submit to the RSC documentation required by PTL's operating procedures.
- o) Conduct radiation safety inspections quarterly on all radiographers under his license.
- p) Conduct the training of the ARSO.

2.5 Assistant Radiation Safety Officer (ARSO). The delegated individual whose duties are to aid the RSO in the performance of his duties. In the absence of the RSO the ARSO will assume the RSO responsibilities under the direction of the RSC.

### 3.0 CHANGES TO PROCEDURES, FACILITIES, LICENSES AND REGISTRATION

#### 3.1 Changes to Procedures and Facilities

- a) Requests for modifications of operating and emergency procedures or radiographic facilities must be submitted to the RSC.
- b) The RSC will review with the Liaison Officer their consistency with licensing conditions, applicable regulations, and company policies.
- c) These request will be transmitted to appropriate regulatory agencies for approval.
- d) The RSC will notify the appropriate management personnel when approved.

#### 3.2 Changes to Licenses and Registration

- a) Requests for proposed changes in licenses or registrations must be submitted to the RSC.



- b) The RSC will review with the Liaison Officer their consistency with regulations.
- c) These requests will be transmitted to appropriate regulatory agencies for approval.

#### 4.0 RADIATION SAFETY INSPECTIONS

4.1 Inspections of the radiation safety program must be performed to assure compliance with pertinent regulations and written operating procedures.

4.1.1 The RSC will review and follow up all reports of inspections. He will see that any necessary corrective action is taken without delay. He will report to the VP any situation that appears to the RSC to jeopardize safety or is not in compliance with regulations.

#### 4.2 Type and Frequencies of Inspections

4.2.1 Inspections by the RSC, ARSC or other qualified management personnel.

- a) A radiation records inspection will be performed for each district office at intervals not to exceed 12 months.
- b) Conduct interviews of responsible personnel to assure continuing compliance with regulations.
- c) Inspections may be announced or unannounced.
- d) Inspections will be documented and a copy forwarded to district.

4.2.2 Inspections by the Radiation Safety Officer (RSO) or Assistant Radiation Safety Officer (ARSO).

- a) The RSO or ARSO will conduct a radiation safety inspection at a minimum of once each calendar quarter for each qualified radiographer to assure compliance with pertinent regulations and written operating procedures.
- b) Documentation of each inspection will be on the radiation safety inspection form (RR-19).
- c) A copy of each inspection will be retained for two years in the district file and a copy submitted to the RSC.

#### 5.0 MAINTAINING CALIBRATED AND OPERABLE SURVEY INSTRUMENTS

5.1 The RSO is responsible to see that all survey instruments under his license are calibrated, operable, and:

- a) They are capable of detecting 2 mR/hr through 1 R/hr.
- b) They are returned to Radiation Records for maintenance and calibration on their scheduled dates.
- c) Shipping regulations are followed.
- d) He must maintain records of all survey instruments under his license.

5.2 The procedure for survey instrument calibration and maintenance appears in Part "C".

## 6.0 LEAK TESTS OF RADIOGRAPHIC EXPOSURE DEVCIES.

### 6.1 General Information

- a) Leak tests are required at intervals not to exceed 6 months.
- b) Applied Health Physics supplied, Mark V leak test kits will be used.
- c) PTL personnel will conduct leak tests.
- d) Applied Health Physics will analyze and report results to the RSC and district office.
- e) Personnel authorized to perform leak tests must be trained in the use and handling of radioactive materials
- f) Detailed instructions for leak tests are listed in Part "D".

6.2 Each RSO is responsible to see that leak tests are conducted and:

- a) The required data is properly recorded.
- b) The sample is properly forwarded.
- c) The leak test is conducted within the time frame necessary for compliance.
- d) The results are within allowable limit.
- e) Leak test data is attached to exposure device.
- f) Remove from service any device without current leak test.

## 7.0 QUARTERLY INVENTORY AND MAINTENANCE INSPECTION

7.1 A physical inventory of sealed sources will be conducted during the last two weeks of each calendar quarter.

7.2 Each RSO is required to account for all sealed sources under his license during this inventory.

7.3 Record the inventory results on form RR-17 (Radioactive Material Inventory Reports).

- a) Record all data asked for on the form.
- b) Use model number and serial numbers.
- c) Record exact day of inventory.
- d) Record the location of device on day of inventory.
- e) RSO must sign the certification.

7.4 Send one copy of the inventory to Radiation Records, one copy must be maintained in the licensee file for 2 years.

7.5 The RSO is responsible to see that the Quarterly Maintenance and inspection is performed on each inventoried device containing sealed sources in accordance with Part "C".

## 8.0 REGULATORY AGENCY NOTIFICATION.

8.1 it is the responsibility of the RSO in charge of the license to report by telephone to the RSC any incident requiring notification.

8.2 Any incident which may cause or threaten to cause an emergency listed as items in 8.4 require notification.

8.3 Never underestimate the seriousness of an incident. Gather all facts pertinent to the incident before reporting, but report at the earliest possible opportunity.

8.4 Notification Requirements are as shown in the chart that follows.

#### NOTIFICATION REQUIREMENTS

ITEM	SECTION AND WHEN REQUIRED	NOTIFY	METHOD
a) Loss or Theft of Source	Immediate 20.402 or State Reg. Number	Nearest NRC office and/or state agency	Telephone and Telegraph
b) (1) Exposure of 25 Rems or more (2) Release of source material (3) Loss of work area for 1 week (4) Property damage over \$200,000.00	Immediate 20.403 or state reg. number	Nearest NRC office and/or state agency	Telephone and Telegraph
c) (1) Exposure of 5 Rems or more (2) Loss of work area for 1 day (3) Property damage over \$2,000.00	Within 24 hrs 20.403(b) and/or state reg. number	Nearest NRC office and/or state agency	Telephone and Telegraph
d) (1) Any incident in above (2) Any other over exposure (3) Levels over 10 times the allowable in unrestricted areas	Within 30 days 20.405(a) and/or state reg. number	Director, U.S. NRC, or nearest NRC office and/or state agency	In writing describing a) Extent of exposure b) Levels of radiation c) cause d) Action taken
e) Over exposure to radiation	Within 30 days 20.405(b) and/or state reg. number	Individual(s) involved	In writing

(CHART CONTINUED NEXT PAGE)

## NOTIFICATION REQUIREMENTS (continued)

f) Exposure of former employees	Within 30 days 20.404 and/or state reg. number	Individual(s) involved	In writing
g) Exposure of employees	Annual on request 20.406 and/or state reg. number	Individual(s) involved	Advise

### 9.0 REQUIREMENTS FOR SOURCE REPLACEMENT

9.1 Directional or beam type exposure devices must be returned to an authorized supplier for source replacement.

9.2 Remote control exposure devices for Iridium 192 and Cobalt 60 may have source replacement by authorized suppliers or by PTL personnel provided that:

- a) Authorized personnel are: Radiographer, ARSU, RSO, ARSC and RSC.
- b) Receipt of sources and source changers are covered by license.
- c) All monitoring and safety precautions are followed.
- d) Detailed instructions for source replacement in Part "D" are followed.
- e) The depleted source and source changer are returned to supplier promptly.

9.3 The RSO is responsible to see that the source change report (RR-18) is completed and that the data is correctly recorded. One copy is sent to Radiation Records and one copy maintained in the license files.

### 10.0 OPERATIONAL CHECK OF DOSIMETER PENCILS

10.1 Dosimeter pencils will be checked annually in accordance with the procedure in Par.5.0 of Part "C".

10.2 It is the responsibility of the RSO to see that the data is recorded with a copy forwarded to Radiation Records.

- a) Maintain records of operational check by serial number.
- b) Contact Radiation Records should a replacement dosimeter pencil be needed for any reason.

### 11.0 RECEIVING OF SEALED SOURCES

11.1 Sealed sources, are subject to federal, state, and NRC regulations.

11.2 It is the responsibility of the RSO to see that personnel receiving or handling sealed sources are properly trained.

11.3 The following conditions must be met when receiving:

- a) Material being received must be authorized at the licensed location.
- b) The shipment must be properly packaged and labeled in accordance with regulations.
- c) Surveys must be properly performed and documented.
- d) Receipt of shipment must be documented.
- e) Any problems with the materials being received or non-compliance with regulations must be reported to the RSC and/or proper authorities.
- f) The materials must be placed into proper storage after receipt.

11.4 Detailed instructions are contained in part "D".

#### 12.0 TRANSPORTATION AND SHIPPING OF SEALED SOURCES.

12.1 It is the responsibility of the RSC to provide each district with current information on governing regulations.

12.2 Each RSO is responsible for the following:

- a) Training of personnel on transporting and shipping requirements.
- b) Compliance with regulations.
- c) Approval of all shipments.

12.3 Detailed instructions are contained in part "D".

#### 13.0 PERMANENT RADIOGRAPHIC SHOOTING CELLS.

13.1 Rules for the installation of a radiographic shooting cell.

- a) Annotated drawing or sketch prepared.
- b) Dimension of the enclosed shooting cell.
- c) Description and dimension of shielding material.
- d) Entrance and description of closure.
- e) Description of all adjacent areas (sides, top, and bottom).
- f) Description of security safeguards.
- g) Provide for emergency exit from secured shooting cell.
- h) Description of warning lights, alarms and interlocks.
- i) Specify source(s) and maximum activity.
- j) Survey all accessible surfaces (side, top, bottom), with maximum activity exposed.
- k) List any specific limitations, ie direction or collimation.

13.2 Requirements for use of a radiographic shooting cell.

- a) The radiation level on any surface can not exceed 100 mR/hr.
- b) The shooting cell must have Radioactive Material signs prominently displayed if used for storage.

- c) High Radiation Area signs must be displayed during use as a shooting cell.
- d) Establish a radiation area if the radiation from the shooting cell exceeds 2 mR/hr.
- e) The restricted area must be within the property boundaries of the facility which contains the shooting cell.
- f) Maintenance, utilization and surveys must be recorded as in field radiography.
- g) Notice to radiographers placard must be displayed at each entrance.

#### 14.0 STORAGE PRECAUTIONS FOR LICENSE LOCATIONS.

14.1 Locked radiographic exposure devices, source changers and storage containers will be stored within a locked enclosure provided these conditions are met:

- a) Permanent radiographic shooting cells qualify as a storage enclosure without further conditions.
- b) Radiation levels of all units are within limits described by Paragraph 7.1.1 a) 1 or 2 of Part "D".
- c) Entrance(s) are posted "Caution Radioactive Materials".
- d) Maintained locked at all times except when attended.
- e) The radiation levels on the external boundry do not exceed 2 mR/hr.

#### 15.0 TRAINING OF RADIOGRAPHERS AND ASSISTANT RADIOGRAPHERS

15.1 Part B "Radiation Safety Training" of this manual establishes the program for training radiographic personnel.

15.2 Paragraph 3.0 of Part B describes personnel classification.

15.3 Upon completion of the requirements for each classification a certificate will be issued by the RSC.

#### 16.0 PERSONNEL RADIATION MONITORING

16.1 All radiographic personnel will be issued the following personal monitoring equipment.

- a) Pocket dosimeter with a range of 0 to a minimum of 200 mR.
- b) Film badges, as supplied by R.S.Landauer Inc., which will be processed monthly.

PITTSBURGH TESTING LABORATORY  
RADIATION SAFETY PROCEDURES  
" RADIATION SAFETY TRAINING "  
PART B

- 1.0 SCOPE
- 2.0 INSTRUCTORS
- 3.0 PERSONNEL CLASSIFICATION
- 4.0 PREREQUISITES FOR CLASSIFICATION EXAMINATION
- 5.0 EXAMINATION EVALUATION AND REFRESHER TRAINING
- 6.0 TRAINING COURSE OUTLINE
- 7.0 TRAINING DOCUMENTATION
- 8.0 CASE HISTORIES



## 1.0 SCOPE

1.1 This part establishes the training and examination requirements for personnel to be classified assistant radiographer and radiographer.

## 2.0 INSTRUCTORS

2.1 The training as described in paragraph 6.0 "Training Course Outline" will be administered by management personnel classified RSC, ARSC, RSO or ARSO.

2.2 These personnel and their locations are listed in table 2.2.

2.3 Radiographers may be used for instructions in field operations.

TABLE 2.2

### QUALIFIED INSTRUCTORS

----- NAME -----	--DISTRICT--	----- NAME -----	--DISTRICT--
CORPORATE		J. Burrano, ARSO	Buffalo
E.L. Andresky, RSC	Pittsburgh	D. McKee, RSO	Columbia
J.E. Nalepa, ARSC	Pittsburgh	M. Joiner, RSO	Dallas
W.H. Carnes, RSO	Pittsburgh	W. Haas, RSO	Greensboro
NRC LICENSE		R. Dovicksak, ARSO	Greensboro
D.R. Duda, RSO	Pittsburgh	D. Henning, RSO	Houston
D.T. Kaiser, ARSO	Pittsburgh	J. Cannon, RSO	Jacksonville
T. Frazier, RSO	Braidwood	J. Beckerman, RSO	Kansas City
P. Gabriel, ARSO	Braidwood	J. Solonia, ARSO	Kansas City
R. Harralson, RSO	Byron	J. Harllee, RSO	Miami
J. Green, ARSO	Byron	B. Clark, ARSO	Miami
L. Klink, ARSO	Byron	M. Deshotel, RSO	Morgan City
D. Dunn, RSO	Chicago	J. Harrison, ARSO	Morgan City
D. Stefka, ARSO	Chicago	T. Burgett, RSO	Nashville
C.L. Mason, RSO	Cleveland	F. Cerneglia, RSO	New Orleans
S. Kubacki, RSO	Detroit	D. Scott, RSO	Portland
W. McLellan, RSO	Milwaukee	R. Mathews, RSO	Salt Lake City
R. Eavey, RSO	Philadelphia	R. Mikus, RSO	San Francisco
W. Braden, ARSO	Philadelphia	M. Garduno, ARSO	San Francisco
W. Beckerman, RSO	St. Louis	R. Fisher, RSO	Seattle
AGREEMENT STATE LICENSE		D. Haley, ARSO	Seattle
B. Keeler, RSO	Atlanta	C. Brenden, RSO	Spokane
R. Pugh, ARSO	Atlanta	W. Peters, RSO	Syracuse
P. Hester, RSO	Birmingham	D. King, RSO	Tampa
D. Uptain, ARSO	Birmingham		
W. Scheiterle, RSO	Buffalo		

## 3.0 PERSONNEL CLASSIFICATION

3.1 NDE classification and definition.



- a) Trainee - An individual (experienced or inexperienced) in the process of becoming a qualified assistant radiographer or radiographer in accordance with this manual. He may not do any task which requires exposure to radiation inside a restricted area. He will be issued personal monitoring equipment and receive 2 hours orientation prior to any job assignment.
- b) Assistant Radiographer - An individual who has successfully completed the prerequisites for this classification. He may while under the personal supervision of a radiographer use radiographic exposure devices, handling tools and radiation survey instruments in radiography.
- c) Radiographer - An individual who has successfully completed the prerequisites for this classification. He may perform radiography or while in personal attendance at the site where sealed sources are being used supervise radiographic operations by an assistant radiographer. He is responsible to the licensee for assuring compliance with the requirements of the NRC and/or state regulations as applicable and to the requirements of part D of this manual.

### 3.2 Instructor classification and definition.

- a) RSC - The individual delegated to maintain active management control of the entire radiation safety program. The individual must be thoroughly familiar with the NRC and agreement state regulations to the extent necessary to develop, implement and maintain this manual. He will have experience at least equivalent to a radiographer with training covering all of the subjects described in the training course outline of this part. He will be familiar with the operation of all types of exposure devices used by PTL, the safety precautions to be observed and malfunctions which might occur. He will coordinate all records and reports, and make periodic inspections of operations at each licensed location.
- b) ARSC - The individual responsible to and trained by the RSC. He will assume the same responsibilities for maintaining compliance to this manual.
- c) RSO - The individual responsible for compliance to this manual at each license location under his supervision. He will have indoctrination in the procedure to be followed should there be malfunctions in the exposure device operation. He will be familiar with the NRC and/or agreement state regulations as pretains to this manual. He will have successfully completed a training course conducted by the RSC or ARSC on the contents of this manual and radiation safety instruction to personnel. RSO's appointed after the date of this procedure will have a minimum of one year experience as a Radiographer.
- d) ARSO - An individual who has training and experience equivalent to a radiographer. He will have demonstrated his proficiency in radiation safety and NRC/State Regulations. He will have successfully completed a training course similiar to that received by an RSO conducted by the RSC, ARSC or RSO.

#### 4.0 PREREQUISITES FOR CLASSIFICATION EXAMINATION

##### 4.1 Assistant Radiographer

- a) Received trainee radiation safety orientation
- b) Have been issued a film badge and pocket dosimeter
- c) Have copy of Part D of this manual
- d) Received 8 hours instruction on Operating and Emergency Procedures including use of equipment.
- e) Satisfactorily completed a 25 question test on subjects covered in (d) above with a minimum grade of 80%.
- f) Have demonstrated competence to use radiographic exposure devices and survey instruments while under the personal supervision of a radiographer or instructor.
- g) Have completed and signed off form RR-10.

##### 4.2 Radiographer

- a) Have a minimum of three months experience as an assistant radiographer.
- b) Have received 40 hours instruction on subjects specified by PTL Training Course Outline and Appendix A of Part 34
- c) Have received copies of:
  - 1) NRC or Agreement State License
  - 2) PTL Operating and Emergency Procedures
  - 3) Applicable sections of Parts 19 and 20 of NRC or appropriate sections of state regulations.
- d) Satisfactorily completed a 50 question test on subjects covered in (b) above with a minimum grade of 80%.
- e) Have demonstrated competence to use PTL's radiographic exposure devices, related handling tools and survey instruments.
- f) Have completed and signed off form RR-10

##### 4.3 Radiographers with prior experience

- a) Received trainee radiation safety orientation
- b) Have been issued a film badge and dosimeter
- c) Have received the following instruction:  
6 hours Operating and Emergency Procedures
- d) Have received copies of:
  - 1) NRC or Agreement State License
  - 2) PTL Operating and Emergency Procedures
  - 3) Applicable sections of Parts 19 and 20 of NRC regulations or appropriate sections of state regulations.
- e) Satisfactorily completed a 50 question test on subjects covered in (c) above with a minimum grade of 80%.
- f) Have demonstrated competence to use PTL's radiographic exposure devices, related handling tools and survey instruments.
- g) Have completed and signed off modified form RR-10.

#### 5.0 EXAMINATION EVALUATION AND REFRESHER TRAINING

5.1 All radiographer and assistant radiographer examinations must be graded and evaluated by the RSC or ARSC.

5.2 Additional instruction will be given in those areas which indicate weakness. Individuals who fail examinations will be given a minimum of 4 hours additional instruction in the deficient areas.

5.3 Upon successful completion of all training and examination requirements, certification will be issued by the RSC.

#### 5.4 Refresher Training

5.4.1 Any changes in license, equipment or regulations, must be reviewed with all NDE personnel.

5.4.2 Annual refresher training for all radiographers is required. The subjects with the specified instruction times are as shown:

- a) 1/2 Hour - Radiographic equipment
- b) 1/2 Hour - Radiation surveys
- c) 1/2 Hour - Accidents and emergencies
- d) 1/4 Hour - Personnel monitoring

5.4.3 A refresher examination, with 15 questions must be completed following the instructions listed in 5.4.2. with a minimum grade of 80%.

5.4.4 Refresher examinations must be graded and evaluated by the RSO. Any deficient areas must be reviewed with the individual.

5.4.5 A copy of the refresher training and examination must be maintained in the branch files, and a copy submitted to the RSC.

#### 6.0 TRAINING COURSE OUTLINE

NOTE: Trainees will receive 2 hours instruction for radiation safety orientation covering: personnel monitoring, survey instruments and radiographic exposure devices.

	INSTRUCTION TIME REQ. FOR:	
	Asst. Rad. ----	Rad. Rad. ----
6.1 This training course outline shall be used to train all radiographic personnel.		
6.2 Fundamentals of Radiation Safety		
6.2.1 Characteristics of Gamma Radiation	1/4	1hr
a) Origin		
1) Alpha		
2) Beta		
3) Gamma		
b) Penetrating ability		
c) Various usages		
6.2.2 Units of radiation dose and quantity of radioactivity	1/4hr	1hr

- a) Definitions of terms associated with radiography
  - 1) Curie and millicurie
  - 2) Roentgen
  - 3) Dose and dose rate
  - 4) Half life
  
- 6.2.3 Hazards of excessive exposure of radiation      1/4hr      1hr
  - a) Biological effects
    - 1) Absorption by cells of the human body
    - 2) Effect of excessive exposure
    - 3) Psychological effect
  
  - b) Maximum permissible weekly exposure
    - 1) Thirteen week averages
    - 2) Changes resulting from over exposure in excess of established limits
  
- 6.2.4 Levels Of Radiation From Licensed Material      n/a      1hr
  - a) Gamma dose rate of isotopes
    - 1) Iridium 192
    - 2) Cobalt 60
  
  - b) Radiation levels at selected distances
  
- 6.2.5 Methods Of Controlling Radiation Dose      1/4hr      2hr
  - a) Working time
    - 1) Allowable working time in hours per week is equal to the permissible exposure in mr per week divided by the exposure rate in mR per hr.
    - 2) Hourly exposures should be as low as possible
  
  - b) Working distances
    - 1) Intensity varies inversely with the square of the distance from the source
    - 2)  $I_1/I_2 = (D_1/D_2)^2$ 
      - where  $I_1$  = Intensity at Point A
      - $I_2$  = Intensity at Point B
      - $D_1$  = Square of the distance of Point A from source
      - $D_2$  = Square of the distance of Point B from source
  
  - c) Shielding
    - 1) Controls personnel exposure in radiographic operations
    - 2) Is used to absorb or stop radiation
    - 3) Most common material used
      - a) Concrete
      - b) Iron or steel
      - c) Lead
    - 4) Tenth and half value thickness
      - 1) Thickness vary depending upon shielding

material and the energy of the gamma radiation in question.

### 6.3 Radiation Detection Instrumentation

#### 6.3.1 Use Of Radiation Survey Instruments 1/4hr 1hr

- a) Types of instruments
  - 1) Operating procedure of the instrument
    - a) Geiger-Mueller or ionization type
    - b) Use and care
- b) Calibration of survey instrument
  - 1) Self contained sources
  - 2) External calibration
  - 3) Weak power supply correction
- c) Limitations of survey instruments
  - 1) Ranges
  - 2) Capacity of the instruments for certain levels of radiation

#### 6.3.2 Survey Techniques 1/2hr 2hr

- a) Type of surveys
  - 1) Exposure devices
  - 2) Storage facilities
  - 3) Working areas
    - a) Restricted
    - b) Unrestricted
- b) Posting
- c) Surveillance
- d) Radiation survey limits
  - a) \_\_\_\_\_ x 2 = Max. allowable  
Exposure time, min/hr radiation level  
expressed as mR/hr
- e) Reporting

#### 6.3.3 Personnel Monitoring Equipment 1/4hr 1hr

- a) Film badge
  - 1) Types used
  - 2) Method of recording
  - 3) Handling and servicing
  - 4) Recording of weekly totals
- b) Pocket dosimeter
  - 1) Types used
  - 2) Method of charging
  - 3) Reading and recording
  - 4) Daily record of totals

### 6.4 Radiographic Equipment

#### 6.4.1 Exposure Devices 2hr 3hr

- a) Fixed devices
  - 1) Capacity, type of source carried

2)	Operation		
3)	Labeling		
4)	Locking and/or securing		
b)	All commercially available and NRC authorized remote controlled cable actuated flexible source tube exposure devices		
1)	Capacity, type of source carried		
2)	Operation		
3)	Labeling		
4)	Locking and/or securing		
c)	Storage containers	n/a	1hr
1)	Types of storage containers		
2)	Location of storage containers		
3)	Locking of storage containers		
4)	Marking and/or labeling of storage containers		
6.5	Instructions in the Requirements of Federal Regulations to the use of Byproduct Material	n/a	3hr
6.5.1	Title 10 - Part 19		
6.5.2	Title 10 - Part 20		
6.5.3	Title 10 - Part 21		
6.5.4	Title 10 - Part 34		
6.5.5	Agreement State Regulations comparable to the above parts when required.		
6.6	Transportation		
6.6.1	Placarding		
6.6.2	Radiation Safe Levels		
6.6.3	Securing Equipment		
6.6.4	Shipping Papers & Certifications		
6.7	Pittsburgh Testing Laboratory, Operating and Emergency Instructions		
6.7.1	Review of Operating Procedures	2hr	6hr
6.7.2	Emergency Procedures	2hr	3hr
a)	Radiographers		
b)	District Managers, Radiation Safety Officers		
6.8	Records and Reports	n/a	1hr
6.8.1	Completing radiation records		

## 6.8.2 Reports

- a) Incidents
- b) Unusual circumstances

6.9 Daily Maintenance Procedures	n/a	1hr
6.10 Case Histories (see sec. 8.0)	n/a	1hr
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## 7.0 TRAINING DOCUMENTATION

7.1 Initial training must be documented on Form RR-10 (Rev.1/1/85) as to what subject instructions were given.

7.2 RR-10 form is used to document both assistant radiographer and radiographer for the number of hours that are specified.

7.3 Individuals receiving training must sign the RR-10 form to certify that the training was given on dates specified.

7.4 Record of training must be completed by a qualified instructor.

## 8.0 CASE HISTORIES

8.1 Over exposures to radiation is for the most part a direct result of improper utilization of a radiation survey instrument. See case histories 1, 2, 3, and 4.

8.2 Over exposures not attributable to 8.1 are mostly the result of bad judgement. See case history 5.

### CASE HISTORIES

CASE #1 - Shows what happens when NO SURVEY is made

Radiographer Overexposes Extremities (Hand) While  
Disconnecting Guide Tube

#### EVENT:

An experienced radiographer failed to fully retract a 94 curie iridium-192 source into its shielded position in the exposure device, and failed to make a survey of the exposure device or guide tube. When the radiographer disconnected the source the source guide tube he saw the end of the pigtail. His hand had closed around the section of the guide tube holding the source while making the disconnect. He realized the source was exposed. He checked his pocket dosimeter and found it read off-scale.

#### DOSIMETRY:

A Reenactment of the incident indicated a whole body exposure of 5.4 rems and an extremity (hand) exposure of 3700 rems.



#### CAUSE:

The incident occurred because the source was not retracted and the radiographer failed to make a survey.

#### PREVENTION:

The incident would have been avoided if a survey had been made. Personnel alarming devices could have alerted the individual to the high radiation levels.

You will note that a reenactment was performed. What happened to the film badge data? Also, what about the dosimeter reading? We must ask ourselves: Can an overexposure occur only if a film badge shows an exposure in excess of limits? A film badge is only one method to determine an exposure.

What kind of exposures can one get from handling an iridium-192 sealed source? If one actually picks up the capsule, he could get about 3.2R/Ci/sec or for the 94 curie source this would be about 300 R/sec for a significant volume of tissue. This is defined as 1 cm<sup>2</sup> of tissue. It might also be of interest to know the exposure to the surface of the hand. This would be about four times the dose to a significant volume of tissue or would be about 1,200 R/sec for the 94 curie source of iridium-192.

CASE #2 - Shows what happens when meter carried but not read

Radiographer Overexposed After Failing to Make a Survey When Entering Radiography Cell

#### EVENT:

After completing an exposure using a 71 curie cobalt-60 source, the radiographer failed to retract the source to its safely shielded position. The radiographer entered the shielded radiography cell with a survey meter in hand but failed to look at the meter. He remained in the cell and proceeded to set up the next exposure. As he picked up the survey meter prior to leaving the cell, he noticed that the meter was off-scale. He immediately left the cell, read his pocket dosimeter, and found it read off-scale.

#### DOSIMETRY:

A reenactment of this incident indicated that the exposures were 11 rems to the lens of the eye, 5.5 rems to the abdomen, and 2.9 rems to the extremities (hands). The radiographer's film badge did not indicate an overexposure since the beam was highly collimated and the film badge was worn to the side of the radiographer.

#### CAUSE:

The direct cause was the failure to make the required survey. This man entered the radiation area "blind". Carrying a survey meter offers no protection unless it is used. A proper survey would have discovered the fact that the source had not been retracted into the shield.



#### PREVENTION:

This incident would have been prevented if a survey had been made and if the cell had been equipped with an interlock which activates an alarm upon opening the cell door when a high radiation condition exists. Additionally, management training reviews might have impressed the worker of the importance of the survey.

#### CASE #3 - Survey made but not adequate

##### Radiographer Overexposed After Making an Inadequate Survey

#### EVENT:

A radiographer failed to fully retract a 74.2 curie iridium-192 source after making an exposure. He approached the exposure device while reading his survey meter; he passed the meter in close proximity to the device and noted no unusual readings. He proceeded to set up the next exposure. When he picked up his meter he noted the meter was off-scale when it passed in front of the device.

He returned to the crank and retracted the source with about a quarter of the crank. He read his pocket dosimeter and found it read off-scale.

#### DOSIMETRY:

A reenactment of the incident indicated the radiographer received a whole body exposure of 4.1 rems.

#### CAUSE:

The incident occurred because the radiographer failed to fully retract a radiographic source and failed to make an adequate survey. The survey was inadequate in that he did not include the guide tube and front of the exposure device.

#### PREVENTION:

The incident would have been avoided if the radiographer had been trained to make an adequate survey. A personnel alarming device would have alerted the radiographer to high radiation levels.

CASE #4 - Shows what can happen when proper training, surveys, and good supervision are all neglected; exposures occurred not only to employees but to members of the public.

##### Whole Body Exposure of Radiographer's Trainee and Company Secretary

#### EVENT:

A radiographer and trainee were performing weld analysis in the field using a 50 curie iridium-192 source. At the beginning of the operation the trainee attempted to connect the source control cable to the source pigtail. However, the connection was not made correctly and when the source was cranked out into the guide tube it disconnected from the drive cable.

The source remained in the guide tube at various positions throughout the day. Neither the radiographer nor the trainee used his survey instrument to confirm safe return of the source to the shield after each shot or at the end of the last shot. During the day neither checked his pocket dosimeter. At the end of the shooting the trainee disconnected the guide tube from the radiography device after he had cranked the control cable back to the safe position. The source was in the guide tube. The guide tube, camera, and control assembly were placed in the bed of an open pickup truck. During transport the source was dislodged from the guide tube and fell into the bed of the truck. The truck was used several times by a company secretary over a weekend for routine errands. The source remained in the truck for the entire weekend during which time the truck was parked in several public places. The source was discovered when the device was to be used on the Monday after the weekend.

#### DOSIMETRY:

The trainee's film badge indicated a 93.4 rem exposure. Reenactment of the incident involving the Secretary indicated a whole body exposure of 55 rems.

#### CAUSE:

The incident resulted from poor supervision of the trainee, the failure of the trainee and radiographer to make the required surveys, and the failure to read their pocket dosimeters. A trainee was permitted to connect drive cable to source pigtail.

#### PREVENTION:

The incident would have been avoided by proper supervision of the trainee and would have resulted in minimal exposure of personnel had the required surveys been run. Further protection would have been provided by radiation activated alarms worn by radiographic personnel and producing an audible and/or visual signal. Trainees are prohibited from performing any radiographers functions.

#### CASE #5 - Radiographers Overexposed While Failing to Follow Emergency Procedures

#### EVENT:

A radiographer entered an enclosed radiography cell and noted his survey meter indicated a high radiation level. He correctly deduced that the radioactive source was outside its safe storage position. He discussed the problem with his partner and they tried to remedy the situation by cranking the source out and then back. When this failed, they entered the room and attempted to reconnect the pigtail to the cable. Failing again, they pushed the source out of the cable onto the floor and, using a pair of pliers, they picked up the source and placed it into the source changer. Using another set of cables, they were able to return the source to its camera. They noted that both pocket dosimeters were off-scale and notified their supervisor of the incident.

DOSIMETRY:

Reenactment of the incident indicated that each man received 6.9 rems whole body exposure and an extremity exposure of 100 rems.

CAUSE:

The incident resulted from failure to properly maintain the source cables and to properly train radiographers in emergency procedures.

PREVENTION:

The incident would not have occurred if cables had been properly maintained. The over exposure would have been avoided if the radiographers had followed proper emergency procedures including notification of their supervisor as soon as the problem was noted.

PITTSBURGH TESTING LABORATORY

RADIATION SAFETY PROCEDURES

" INSPECTION , MAINTENANCE AND CALIBRATION "  
PART C

CONTENTS

- 1.0 SCOPE
- 2.0 QUARTERLY INSPECTION AND MAINTENANCE OF RADIOGRAPHY  
DEVICES
- 3.0 QUARTERLY INSPECTION OF RADIATION ALARM SYSTEMS
- 4.0 CALIBRATION OF SURVEY INSTRUMENTS
- 5.0 POCKET DOSIMETER RADIATION RESPONSE CHECK

## 1.0 SCOPE

1.1 This part of the PTL Radiation Safety Manual outlines the program for:

- a) Inspection and maintenance of radiographic equipment and permanent alarm systems.
- b) Calibration of radiation survey instruments and pocket dosimeters.

1.1.1 Quarterly inspection and maintenance procedures for radiographic equipment and alarm systems are established in this part.

1.1.2 Daily utilization inspection procedures are established by Part "D" of this manual.

1.1.3 Radiation survey instruments will be calibrated quarterly or after servicing. The procedure is established in this part.

1.1.4 Pocket dosimeters will be calibrated annually. The procedure is established in this part.

## 2.0 QUARTERLY INSPECTION AND MAINTENANCE OF RADIOGRAPHY DEVICES

2.1 Quarterly inspections shall be conducted by the RSC, ARSC, RSO or ARSO with the results recorded on Form RR-M-2.

2.1.1 Maintenance and repair of source containing components will be conducted by the RSC, ARSC, RSO, or ARSO.

- a) At least two survey meters will be utilized when repairing components containing sources.
- b) When possible remove source to a source changer when working on component.

2.1.2 Maintenance or repair of support equipment may be conducted by competent technicians.

2.2 Inspection and repair of Radiography Devices.

2.2.1 General (For All Radiography Devices)

- a) Conduct a physical radiation survey.
- b) Check unit for proper identification, ie, model and serial number.
- c) Check unit for proper assay label information.
  - 1) Type of radioactive material.
  - 2) Quantity of radioactive material.
  - 3) Date loaded.
  - 4) Sealed source model number.
  - 5) Sealed source serial number.
- d) Check unit for proper radiation material label.
- e) Check unit for proper leak test.

Note: Ascertain that all labels are discernable and securely fixed to the unit. Replace as necessary.

- f) Check lock assembly for proper operating condition.

- 1) Ascertain that the lock can only be locked in the safe position.
  - 2) Repair or replace as necessary.
- g) Check unit for general appearance and note evidence of physical damage.
- 1) Physical damage shall be thoroughly investigated, any that affects the safety of the Device shall be repaired or replaced.
- 2.2.2 Remote control radiography devices.

- a) Check unit for safety plugs. Check for fit and condition. Repair or replace as necessary.
- b) Check position of pigtail in locked condition. Take survey reading to ascertain safe radiation levels at forward and back tolerance.
- c) Ascertain that the pigtail cannot be removed through the lock box. Either locked or unlocked. Replace lock housing if necessary.
- d) Check control cables as follows:
  - 1) Conduit for wear and damage
  - 2) Swivel adapters both ends
  - 3) Quick disconnect connector on drive cable
  - 4) Mate connector to pigtail
  - 5) Inner drive cable entire length
  - 6) 6" of drive cable at connector for corrosion
  - 7) Crank handle operation
 Repair or replace parts as necessary.
- e) Check length(s) of source tube as follows:
  - 1) Look for cuts, dents, crimps or frays that could distort the ID cross section. Replace if necessary.
  - 2) Check connecting adaptor for thread damage and free swivel. Replace as necessary.
  - 3) Be sure source tube has a source tip, either removable or fixed.

#### 2.2.3 Beam Type Radiographic Exposure Devices

- a) Check for positive stop in both safe and exposure position.
- b) Feel shaft rotation for hangups or excess friction. Apply dry lubricant to lock and shaft where accessible.
- c) Audit that all screws are in their proper place and tight. Replace or tighten as necessary.
- d) Return to supplier if further correction is necessary.

### 3.0 QUARTERLY INSPECTION OF RADIATION ALARM SYSTEMS.

3.1 Licenses which have established permanent radiographic shooting cells require radiation alarm systems.

3.1.1 Procedure for inspection of "Mars" radiation alarm systems.

- a) Be sure unit has power turned on.
- b) Operate check button, observe audible and visible alarms.
- c) Set up for radiation exposure.

- d) Verify that radiation activates the alarm on all ranges.
- e) This will require a momentary opening of the HRA entrance.
- f) Observe that no alarm is activated when source is retracted.

#### 3.1.2 Record results of inspection on Form RR-M-2.

- a) Should there be a malfunction cease radiographic operations until corrected or the unit is replaced.

#### 3.2 Maintenance and repair of radiation alarm systems.

- a) Should there be a malfunction, repairs will be made by a qualified electronics technician.
- b) Notify the RSC if replacement is required.

### 4.0 CALIBRATION OF SURVEY INSTRUMENTS

4.1 Calibrated and operable survey instruments must be maintained at each location where radiography is performed.

4.2 Survey instruments must be capable of detecting 2 mR/hr through 1 R/hr.

4.3 Survey instruments must be returned to Pittsburgh Radiation Records for repair and calibration.

4.3.1 Repair will be performed by a qualified electronics technician.

4.3.2 In certain cases, repair and calibration services may be provided by the manufacturer or other authorized agencies.

4.4 Records of transfer, receipt and calibration must be maintained at each license location for 2 years.

#### 4.5 Calibration Requirements

4.5.1 Each survey instrument must be calibrated at intervals not to exceed 3 months or after each instrument servicing.

4.5.2 Each instrument must be calibrated so that the readings are a maximum of  $\pm 20\%$  of the actual radiation intensities.

4.5.3 A minimum of 2 points must be checked, encompassing each working range.

#### 4.6 Calibration Source

4.6.1 By-product materials acceptable for calibration sources are:

- a) Radium 226
- b) Cesium 137
- c) Cobalt 60

NOTE: Cobalt 60 and Cesium 137 sources must be recalculated at reasonable intervals to account for decay.



4.6.2 The calibration source activity must provide intensities acceptable for calibration of each working range.

4.6.3 Calibration sources must be provided with a certificate of the following:

- a) Radioisotope
- b) Model and Serial Number
- c) Activity
- d) Accuracy

4.6.4 Check sources are not acceptable calibration sources.

#### 4.7 Calibration

4.7.1 Calibration will be performed by a technician trained in the use and handling of radioactive materials.

4.7.2 All safety procedures set forth by the NRC and PTL should be followed in order to minimize any exposure.

4.7.3 A DISTANCE vs INTENSITY calibration will be performed using either an exposure device or a calibrator.

4.7.4 Calibration will be performed per manufacturers specifications.

#### 4.8 Documentation

4.8.1 A record of the following information shall be maintained for each instrument.

- a) Servicing
- b) Calibration and Calibration Due dates
- c) Readings used for calibration
- d) Ranges calibrated
- e) Accuracy
- f) Person calibrating

4.8.2 Each instrument shall be labeled with the following information:

- a) Calibration and Calibration Due dates
- b) Accuracy
- c) Person calibrating

### 5.0 POCKET DOSIMETER RADIATION RESPONSE CHECK

5.1 Dosimeters shall be checked at periods not to exceed one year for correct response to radiation.

- a) This response check may be performed by a Radiographer, ARSO, RSO, ARSC OR RSC.

5.1.1 Each dosimeter shall be zeroed and isolated from radiation in a static condition for a period of 12 to 24 hours. The hairline drift should not exceed 4mR per 24 hours.



5.1.2 Each dosimeter shall be zeroed then subjected to gamma radiation so that the dosimeter indicates having received an exposure of 50 to 150 mR.  
NOTE: All personnel monitoring must be worn during this part.

5.1.3 The true radiation exposure shall be determined by using the inverse square law, radiation intensity of source and curie strength from the decay curve.

5.1.4 The indicated radiation exposure of the dosimeter (Par. 5.1.2) shall be within  $\pm 30\%$  of the calculated true radiation exposure (Par. 5.1.3).

5.2 The data collected during this check will be recorded and a copy forwarded to Radiation Records.

5.2.1 Data to be recorded.

- a) Dosimeter SN
- b) Results of drift test (Par. 5.1.1)
- c) Gamma device used to irradiate dosimeter (Par. 5.1.2)
- d) Show distance and time of exposure.
- e) Calculated true radiation exposure (Par. 5.1.3)
- f) Actual dosimeter reading.
- g) Acceptable range
- h) Date of response check

5.2.2 Remove from service if defective.

EXAMPLE:

An Iridium source of 50 curies (as determined from the decay curve) is used to expose a dosimeter. The time of exposure is determined by the inverse square law and exposure time. ie;  $50 \text{ curies} \times 5900 \text{ mR/hr} = 295000 \text{ mR/hr}$  at 16 feet. The intensity would be  $1152 \text{ mR/hr}$  or  $17.2 \text{ mR/min.}$  Therefore, a 6 min. exposure at 16 feet would result in a calculated true radiation exposure of  $115 \text{ mR}$ . Any reading obtained on the dosimeter between 81 and  $150 \text{ mR}$  would be acceptable.

NOTE: Multiple pocket dosimeters may be checked concurrently.

PITTSBURGH TESTING LABORATORY

RADIATION SAFETY PROCEDURES

" OPERATING AND EMERGENCY PROCEDURES "  
PART D

CONTENTS

- 1.0 SCOPE
- 2.0 GUIDELINE FOR THE USE OF RADIOGRAPHIC EXPOSURE DEVICES
- 3.0 PERSONNEL MONITORING AND PERSONNEL MONITORING EQUIPMENT
- 4.0 DAILY INSPECTION AND MAINTENANCE OF SURVEY METERS
- 5.0 DAILY INSPECTION AND MAINTENANCE OF RADIOGRAPHIC EXPOSURE DEVICES INCLUDING REMOVAL FROM AND RETURN TO STORAGE
- 6.0 TRANSPORTATION OF RADIOGRAPHIC EXPOSURE DEVICES
- 7.0 METHOD AND OCCASION FOR CONDUCTING RADIATION SURVEYS
- 8.0 METHODS FOR CONTROLLING ACCESS TO RADIOGRAPHIC AREAS
- 9.0 METHODS AND OCCASIONS FOR LOCKING AND SECURING RADIOGRAPHIC EXPOSURE DEVICES
- 10.0 OPERATING PROCEDURES FOR RADIOGRAPHIC EXPOSURE DEVICES
- 11.0 STEPS TO BE TAKEN SHOULD A DOSIMETER PENCIL GO OFF SCALE
- 12.0 MINIMIZING EXPOSURE IN THE EVENT OF AN ACCIDENT
- 13.0 NOTIFICATION IN THE EVENT OF AN ACCIDENT
- 14.0 INSTRUCTIONS FOR SHIPPING AND RECEIVING RADIOGRAPHIC EXPOSURE DEVICES
- 15.0 LEAK TESTING RADIOGRAPHIC EXPOSURE DEVICES
- 16.0 METHOD FOR SOURCE REPLACEMENT IN RADIOGRAPHIC EXPOSURE DEVICES
- 17.0 PERMANENT RADIOGRAPHIC SHOOTING CELLS
- 18.0 STORAGE FACILITIES FOR UNATTENDED RADIOGRAPHY DEVICES
- 19.0 REPORTING DEFECTS AND NONCOMPLIANCE
- 20.0 MAINTENANCE OF RECORDS

## 1.0 SCOPE

1.1 This part provides radiography personnel with specific instructions and responsibilities for all operations they will perform.

1.2 Radiography personnel classified Radiographer shall be qualified to conduct radiographic operations in accordance with this procedure and;

- a) Operate radiographic exposure devices.
- b) Hook up related exposure device handling equipment.
- c) Surveys required to determine source is returned to its shielded position.

1.3 Radiography personnel classified Assistant Radiographer shall be qualified to conduct radiographic operations in accordance with this procedure under the supervision of a radiographer except that the functions described by 1.2 a) b) and c) must be conducted while in the direct personal presence of the radiographer.

1.4 Trainees may perform no function other than physical assistance.

## 2.0 GUIDELINE FOR THE USE OF RADIOGRAPHIC EXPOSURE DEVICES

2.1 The following is a guideline list, more complete instructions appear in the referenced paragraph.

### 2.1.1 Removal from storage.

- a) Wear prescribed personnel monitoring equipment. (Ref. 3.0)
- b) Check out survey meter, fill out form RR 12-3. (Ref. 4.0)
- c) Perform maintenance inspection, fill out form RR 12-3. (Ref. 5.0)
- d) Fill out ground transportation on form RR 12-3.
- e) Form RR 12-3 distribution.
  - 1) Leave gold copy for removal from storage record.
  - 2) Pink copy is ground transportation shipper papers, place in vehicle.
  - 3) Keep white and yellow together for job survey and exposure time data. All future entries are to appear on both copies.
  - 4) When returned to storage, record data on white and yellow only, destroy the gold and pink copies.
  - 5) The yellow is filed at the district. The white is sent to Radiation Records in Pittsburgh.

Note: If the radiographic exposure device is removed from storage for use without leaving the facility mark ground transportation N/A.

### 2.1.2 Use.

- a) Transport radiographic exposure devices in approved containers, secured within the vehicle, properly placarded and surveyed. (Ref. 6.0)

- b) Job site. Survey and post radiation area, high radiation area. Exposure time per/hr record on form RR 12-3. (Ref. 7.0 and 8.0)
- c) Use survey meter at prescribed times. (Ref. 7.0)
- d) Lock radiographic unit between exposures. (Ref. 9.0)
- e) Read dosimeter pencil periodically.
- f) Apply fundamental concept, time, distance, shielding for minimum radiation exposure.

#### 2.1.3 Return to storage.

- a) Repeat 2.1.2 a) when transporting back to storage.
- b) Survey exposure device, finish record on form RR 12-3.
- c) Check to assure unit is locked and plugs are in place if applicable.
- d) Complete dosimeter report RR-16.

#### 2.1.4 Under no circumstances shall radiographic personnel attempt operations involving source retrieval or recovery without the consent and direction of the RSO, ARSC or RSC.

### 3.0 PERSONNEL MONITORING EQUIPMENT

#### 3.1 All radiographic personnel will be issued a film badge and direct reading pocket dosimeter.

##### 3.1.1 Film badges are assigned by serial number and are processed and replaced monthly.

##### 3.1.2 Pocket dosimeter pencils are assigned by serial number and replaced only if defective, lost or returned for recalibration.

#### 3.2 Procedure for use of film badge.

- a) Film badges must be worn by all personnel when assigned to radiographic operations.
- b) Film badges must be worn on the portion of the body most likely to receive the maximum radiation.
- c) Film badges are assigned by serial number with results recorded to that individuals accumulated exposure. There is no provision for transfer of results from person to person.
- d) Film badges must be turned in and new ones received on the monthly issue date.
- e) Cautionary notes for film badge handling.
  - 1) Do not immerse in liquid.
  - 2) Keep away from solvents.
  - 3) Do not store in excessive heat.
  - 4) Do not store in direct sunlight.

#### 3.3 Procedure for use of dosimeter pencils.

- a) Pocket dosimeter pencils must be worn by all personnel when assigned to radiographic operations.
- b) Pocket dosimeter pencils must have a range of 0 to a minimum of 200 millirems.

- c) Dosimeter pencils must be worn on the same general area of the body as the film badge.
- d) Dosimeter pencils shall be zeroed prior to the start of the working day.
- e) Monitor the dosimeter pencil results frequently when working near or in a radiation area.
  - 1) If hairline approaches the scale capacity record on RR 16 and zero dosimeter.
  - 2) Determine cause of high reading.
- f) Should a dosimeter pencil register off scale, cease radiographic operations by securing the radiographic source utilizing the survey meter. See Par. 11.0

#### 3.4 Procedure for zeroing the pocket dosimeter pencil.

- a) Place dosimeter lightly on charging contact of charger.
- b) Look thru dosimeter, press against contact or push rod enough to illuminate dosimeter scale.
- c) Turn zeroing knob to adjust hairline to zero.
- d) View scale with external light to verify zero.
- e) Dosimeter pencil hairline should be on zero prior to beginning daily radiographic operations.

#### 4.0 DAILY INSPECTION AND MAINTENANCE OF SURVEY INSTRUMENTS.

4.1 Radiation survey instruments shall be calibrated at intervals not to exceed 3 months and after each instrument servicing. The instrument shall have a range capable of measuring 2 MR thru 1R.

4.1.1 Prior to use, each survey instrument must be checked for proper operation.

4.2 The following are items which must be checked before use:

##### 4.2.1 Calibration (Ref. Part C, Par 5.0)

- a) Each instrument must be labeled with calibration and calibration due dates.
- b) Instrument must be within calibration dates listed.

##### 4.2.2 Operational check.

- a) Move the selector switch to the "test" position. The pointer should move to the "test" position on the meter. If the instrument does not have a "test" selection, refer to manufacturers instructions for operational test.
- b) Move the selector switch to the "battery" test position to insure that the batteries are acceptable for use.
- c) If the instrument is supplied with an internal check source, select the appropriate range(s) on the instrument and expose the source to insure that the instrument is capable of detecting ionizing radiation.

4.3 Any malfunctions should be reported to the RSO and the instrument taken out of service.

#### 4.4 Maintenance.

4.4.1 All instruments should be handled like your portable stereo, kept clean and stored away from moisture.

4.4.2 Instruments must be in the off position during storage and while not in use.

4.4.3 If the instrument becomes erratic or malfunctions for any reason it must be removed from service and RSC or ARSC contacted for instructions.

4.4.4 No calibration adjustments may be made.

#### 5.0 DAILY INSPECTION AND MAINTENANCE OF RADIOGRAPHIC EXPOSURE DEVICES INCLUDING REMOVAL FROM AND RETURN TO STORAGE

5.1 These inspections are the responsibility of the radiographer. Should a inspection reveal a potential hazardous condition, remove the device from service and notify the RSO.

5.1.1 Inspections common to all types of radiographic exposure devices. Record on Form RR 12-3.

- a) Conduct a physical radiation survey. See Par. 7.1.1
- b) Record make, model, serial number, isotope type, source strength and date leak tested.
- c) Date loaded at supplier is also the initial leak test date, after six months the new leak test data is attached by a pressure sensitive sticker.
- d) Check unit for general appearance.
- e) Check lock for operation.

5.2 Inspection requirements for remote control, source tube type exposure devices. Record on Form RR 12-3.

- a) Check for safety plug workability and fit.
- b) Visually examine remote control unit for obvious damage.
- c) Check crank for free turning.
- d) Do a drive cable hook-up to pigtail to assure the working condition of both ends of the connector.
- e) Observe and flex the inner drive cable within 6" of the connector. Corrosion and stiffness cause fatigue breaks. Lubricate if necessary.
- f) Visually examine the source tube from end to end for kinks and dents.
- g) If practical do a hook-up and live crank out before going to a field assignment.

5.3 Inspection requirements for beam type exposure devices. Record on Form RR 12-3.

- a) Check for ease of shaft rotation.
- b) Check for positive stop position in open and safe positions.
- c) Visually verify that all screws are properly present.

#### 5.4 Removal from storage.

- a) Indicate removal on upper right corner of form RR 12-3.
- b) Fill in client, location, order number and type or radiographic job.
- c) The left column down to survey readings device in should be completed as appropriate.
- d) Leave the back (gold color) copy as the record of removal from storage.

#### 5.5 Return to storage.

- a) Indicate return on upper right corner of form RR 12-3.
- b) Conduct a physical radiation survey record on form RR 12-3.
- c) White and yellow copies are for distribution.
- d) Destroy pink and gold copies.

### 6.0 TRANSPORTATION OF RADIOGRAPHIC EXPOSURE DEVICES

6.1 The transportation of radiographic devices is subject to PTL, NRC, State and Federal DOT requirements.

6.2 Requirements apply to the following items:

- a) Packaging
- b) Marking and labeling
- c) Placarding
- d) Securing and monitoring
- e) Shipping papers
- f) Accidents

#### 6.3 Packaging.

6.3.1 Radiographic devices, such as the following, must be transported in D.O.T. approved shipping containers:

- a) Gamma Century
- b) Pipeliner (PIL, Gamma, etc.)
- c) Source changers

6.3.2 Larger cobalt-60 devices (such as those on wheels) must be properly secured in the vehicle and must meet all other transportation requirements but do not require a shipping container.

#### 6.4 Marking and labeling.

6.4.1 Each device and shipping container must have the proper marking and labeling. All labels and marking must be readable.

#### 6.4.2 Device

- a) Radioactive material labels
- b) Source I.D.



- c) Device I.D.
- d) Leak test date

#### 6.4.3 Shipping container

- a) D.O.T. specificatin marking
- b) Radioactive yellow II or yellow III labels (2 required)

#### 6.4.4 Placarding

- a) Any vehicle used for transportation of radioactive materials must be placarded on all 4 sides.
- b) Placards used must be D.O.T. approved type signs, bearing the word "Radioactive".

#### 6.4.5 Securing and monitoring

- a) The radioactive device in its shipping container must be secured in the vehicle to prevent shifting during transportation.
- b) A survey must be made of the passenger compartment to insure a dose of less than 2mR in any one hour.
- c) A survey must be made of the exterior of the vehicle to insure a dose rate less than 2 mR/hr at one meter from any surface.
- d) Results of surveys must be recorded on form RR 12-3.

#### 6.4.6 Shipping papers.

- a) The bottom portion of form 12-3 must be completed prior to transportation.
- b) Instructions with current D.O.T. regulations will be supplied by the RSC.
- c) Follow distribution as shown in par. 2.2.1 of this part.

#### 6.4.7 Accident.

- a) Detailed instructions are as shown in sections 12.0 and 13.0 of this part.

### 7.0 METHOD AND OCCASION FOR CONDUCTING RADIATION SURVEYS.

7.1 A minimum of one radiation survey instrument must be utilized when a radiographic exposure device is used.

- a) Radiation surveys must be conducted with an instrument meeting the requirements of paragraph 4.0.

#### 7.1.1 Surveys requiring documentation by the radiographer.

- a) Initial installation of source in exposure device - forms RR-11 and RR-18.



- 1) Devices which measure less than 4" from the source safe position to the external surface shall have no radiation level in excess of 50 mR/hr at 6" from any external surface.
- 2) Devices which measure a minimum of 4" from the source safe position to the external surface shall have no radiation level in excess of 200 mR/hr on the surface and 10 mR/hr at 1 meter from any exterior surface.
- b) Removal from storage - Form RR 12-3.
  - 1) Same as a) 1) above
  - 2) Same as a) 2) above
- c) Transporting vehicle - Form RR12-3.
  - 1) Storage container for exposure device meets radiation requirements of a) 2) above.
  - 2) Radiation from vehicle external surfaces shall comply with a) 2) above.
  - 3) Radiation level in passenger compartment must be less than 2 mR in any one hour.
- d) Survey after each source exposure to determine that the source has returned to its shielded position. Form RR-16.
  - 1) Survey entire length of source tube and 360 degrees around exposure device.
  - 2) Always survey device in locked position.
- e) Surveys made to establish restricted area. Form RR12-3.
  - 1) Establish preliminary restricted area using radiation levels determined by calculation or obtain from table 7.1.1e.
  - 2) Restricted area boundaries are established at 2 mR/hr using the survey meter.
  - 3) Should it not be practical to establish a 2 mR/hr radiation level at the restricted area, a higher level may be permitted provided no more than 2 mR total radiation reaches the area boundary in any one hour.
  - 4) Establish restricted area based on survey meter readings, exposure time and this equation.

2 times 60 divided by exposure time per hr = allowable survey meter reading in mR/hr at restrictive area boundary.

$$2 \times 60 / ET = SM$$

where:

2 = MR allowed at the restricted area boundary in any one hour  
 SM = Allow survey meter reading in mR/hr at restricted boundary  
 60 = Minutes in one hour  
 ET = Total exposure time (minutes) per hour

Example: Three 2 minutes exposures will be made in one hour.

$$2 \times 60 / (ET = 6) = 120/6 = 20 \quad (\text{Therefore the restricted boundary can be established at a meter reading of 20 mR/hr})$$

APPROXIMATE DISTANCES (FEET) IN AIR  
REQUIRED TO REDUCE RADIATION INTENSITIES:

This table is to be used as a guide only, and is not to be relied upon without verifying the distances by making a complete survey of the restricted area.

Effective Source Strength: Curies	Cobalt 60		Iridium 192	
	2mR/hr	5mR/hr	2mR/hr	5mR/hr
1	86	54	56	35
5	190	120	124	77
10	270	170	174	109
20	310	241	245	154
30	465	295	300	188
50	610	381	390	243
100	865	539	550	344

TABLE 7.1.1(e)(1)

7.1.2 Required use of survey meter without documentation.

- a) During daily inspection.
- b) During trial hook ups of drive cable to pigtail.
- c) During crank out.
- d) During any maintenance of radiation shield package.
- e) If practical use survey meter any time there is physical movement of the radiographic exposure device.

8.0 METHODS FOR CONTROLLING ACCESS TO RADIOGRAPHIC AREAS.

8.1 Temporary radiographic areas established at other than PTL facilities.

8.1.1 For restricted area perimeter radiation level of no more than 2mR in any one hour.

- a) Post "Caution Radiation Area" signs at all accessible entrances.
- b) Post "Caution Radiation Area" signs at other intervals as necessary to be readily seen.

8.1.2 Use figure 7.1.1(e)(1) to pre-position "Caution High Radiation Area" placards at 100 mR/hr level.

- a) After exposing radiographic source retreat to the position of least radiation exposure while keeping all access to the "High Radiation Area" and surrounding restricted area under constant surveillance.
- b) Return source to the shielded position should the "High Radiation Area" boundary threaten to be violated.

8.2 Permanent radiographic shooting cells located at PTL facilities.

8.2.1 As a minimum the shooting cell must be constructed so that no radiation in excess of 100 mR/hr can be detected outside the area confined and equipped with a visible and audible alarm (See par.17.0)

- a) With the confined area locked, alarm energized by radiation and the external boundary placarded with "Caution High Radiation Area" signs constant surveillance is not required.

8.2.2 Should the radiation level, with the radiographic source in the exposed position, exceed 2mR/hr at any external boundary of the shooting cell, restricted areas must be established in accordance with pars. 7.1.1(e) and 8.1.1.

#### 9.0 METHODS AND OCCASIONS FOR LOCKING AND SECURING RADIOGRAPHIC EXPOSURE DEVICES

9.1 Radiographic exposure devices are equipped with locks which allow the sealed source to be secured in the shielded position.

9.2 Radiographic exposure devices are kept in their locked, shielded position with the key removed except when making a radiographic exposure or performing daily or quarterly maintenance and inspection procedures. Forms RR 12-3 and RR-M-2.

9.3 Survey meters shall be utilized whenever the exposure device is unlocked.

9.4 Storage facilities for radiography devices are described in Par. 18.0 of this Part.

#### 10.0 OPERATING PROCEDURES FOR RADIOGRAPHIC EQUIPMENT

10.1 Remote control radiographic exposure device description.

10.1.1 Operated by a manual crank which drives a sheathed control cable attached to the source pigtail in a shielded device out of the device into a flexible closed end source tube to a prepositioned exposure point.

10.1.2 Remove from storage, follow the instructions of paragraph 5.0 ie survey, inspect, record on form RR 12-3.

10.1.3 Assembly and use of remote exposure device.

- a) Place exposure device at the desired location, make sure it is "On Firm Ground".
- b) Lay out the control cable and source tube as straight as possible relative to their attachment to the exposure device.
- c) Remove the lock box safety cap from the lock box assembly exposing the pigtail connector.

- d) Crank the control cable out approximately 6" and connect to pigtail.
- e) Crank control in so that male connecting thread can be screwed into lock box.
- f) Remove safety plug from source tube nipple and connect source tube.
- g) Place free end of source tube in desired position keeping as straight as possible.
- h) Always use collimators when not making panoramic exposures unless high radiation can be controlled otherwise.
- i) Stretch control crank away from exposure device in as straight a line as possible.
- j) Take advantage of any available shielding, ie columns, corners, beams, dirt mounds etc.
- k) Unlock the unit, crank source out as smoothly as possible. Count the crank turns until the source stops at the end of source tube.
- l) On future crankouts the count will allow for slowing the turning speed so that the source capsule does not strike the end of the source tube with undue force.
- m) Survey to adjust radiation area and high radiation area placards if necessary. See par. 7.0.
- n) At the end of the exposure, retract source into device. Watch survey meter to be sure that source has returned to shielded position.
- o) Lock exposure device, survey 360 degrees around and the source tube from end to end.
- p) Repeat as necessary for subsequent exposures.
- q) Dismantling steps.
  - 1) Conduct final survey to assure source in shielded position.
  - 2) Disconnect drive cable from pigtail, replace safety cap.
  - 3) Disconnect source tube, insert safety plug.
- r) Audit area to be sure all signs, barricades and radiographic equipment is removed.
- s) Return to storage, complete forms RR 12-3 and RR-16.

## 10.2 Directional radiation beam type exposure device description.

10.2.1 Device has generally equal shielding on all surfaces. The radiation source being installed in a shielded wheel positioned within the device so that when the wheel is rotated 180 degrees it transports the radiation source from the center of the devices shielding to an outside surface. The wheel rotation is controlled by positive stops at the safe and exposed positions. The safe position can be secured by a keyed lock.

10.2.2 Remove from storage. Follow the instructions of paragraph 5.0 ie survey, inspect, record on form RR 12-3.

## 10.2.3 Preparation and use of beam type exposure device.

- a) Remove from storage container.
- b) Place exposure device at the desired location, make sure it is "On Firm Ground".

- c) Rotate the device so that the operating knob is in the most assessable position possible.
- d) Use method described in par. 7.0 to establish radiation area and high radiation area. Adjust after source is exposed with survey meter.
- e) When ready to make radiographic exposure unlock the pin lock freeing the rotative action.
- f) Rotate the operating knob to the on position, while using the stretch technique.
- g) The stretch technique means that every portion of the body is stretched away from the device beam direction except that absolutely necessary to manipulate the operating knob.
- h) Retreat to a safe area.
- i) Use the stretch technique to rotate control knob to off position, lock device and survey 360 degrees.
- j) Repeat as applicable for additional exposures.
- k) After final exposure record surveys on RR-16.
- l) Replace exposure device in shipping container.
- m) Audit area to be sure all signs, barricades and radiographic equipment is removed.
- n) Return to storage, complete forms RR 12-3 and RR-16.

#### 11.0 STEPS TO BE TAKEN SHOULD A DOSIMETER PENCIL GO OFFSCALE

11.1 Should a dosimeter indicate off scale for any reason while working with radiographic exposure devices.

- a) Immediately check survey meter for proper operation.
- b) Use survey meter or other monitored personnel to secure radiographic device.
- c) If survey meter is inoperable and no monitored personnel are available, zero dosimeter and use to secure device.
- d) Cease radiographic operations, notify RSO for instructions.

#### 12.0 MINIMIZING EXPOSURE IN THE EVENT OF AN ACCIDENT

12.1 An emergency or accident situation is considered to exist whenever an abnormal event occurs and causes or threatens to cause an exposure to any individual.

12.1.1 Under no circumstances shall radiographic personnel attempt operations involving source retrieval or recovery without the consent and direction of the RSO, ARSC or RSC.

12.2 In the event of a malfunction, damage or accident involving a radiographic exposure device, the following guidelines shall be followed in order to minimize any exposure to any individual.

12.2.1 Secure the area and establish a restricted boundary of 2 mR/hr or less, post "Caution--Radiation Area" signs around the perimeter.

12.2.2 Maintain surveillance of restricted area to prevent unauthorized entry.

12.2.3 Assess the situation and gather all facts.

12.2.4 Periodically check your dosimeter pencil.

12.3 Unauthorized entry to restricted area.

12.3.1 Remove the person immediately. Explain the situation and collect the following information.

- a) Name
- b) Address
- c) Telephone number

12.4 If your survey instrument becomes inoperable, one may be obtained from the following:

- a) RSO
- b) College or University
- c) Fire Department
- d) Civil Defense Facility

12.5 Follow notification procedures as prescribed in the following section. (13.0)

### 13.0 NOTIFICATION IN THE EVENT OF AN ACCIDENT OR EMERGENCY.

13.1 The guidelines established in section 12.0 must be used where applicable.

13.2 The immediate notification of an accident or emergency involving a radioactive device to proper management personnel or authorities shall be as follows.

13.2.1 Loss or theft.

- a) Notify job foreman and/or plant guard.
- b) Notify RSO or ARSO.

13.2.2 Malfunction or damage.

- a) Notify RSO or ARSO.

NOTE: Under no circumstances shall radiographic personnel attempt operations involving source retrieval or recovery without the consent and direction of the RSO, ARSC or RSC.

13.2.3 Fire

- a) Notify fire department.

Note: Fire department must be warned of the potential hazards and that a radiation area may exist.

- b) Notify RSO or ARSO.

13.2.4 Vehicle accident (assuming you are physically able)

- a) Notify local authorities.
- b) Notify RSD or ARSO.

13.2.5 Unauthorized entry to restricted area.

- a) Notify RSD or ARSO.
- b) Notify job or plant foreman.

13.3 Persons to notify.

13.3.1 Complete the following listing at time of issue of these procedures. They will be your reference for notification purposes.

(1) Radiation Safety Officer      (2) Asst. Radiation Safety Officer

Name _____	Name _____
Address _____	Address _____
City _____	City _____
Work Phone _____	Work Phone _____
Home Phone _____	Home Phone _____

13.4 If you are unable to contact the RSD or ARSO the following management personnel should be contacted.

Pittsburgh Office Telephone: (412) 922-4000

NAME	TITLE	HOME TELEPHONE
E.L. ANDRESKY	RSC	(412) 835-0793
J.E. NALEPA	ARSC	(412) 937-1595
W.H. CARNES	PGH RSD	(412) 276-1404
K.D. DRAKE	EXEC. VICE PRESIDENT	(412) 833-1724
M.Y. RUYAN	PRESIDENT	(412) 341-3740

14.0 INSTRUCTIONS FOR SHIPPING AND RECEIVING RADIOGRAPHIC EXPOSURE DEVICES

14.1 Shipping.

14.1.1 Shipping of radiographic exposure devices must be done in accordance with this paragraph and paragraph 6.0 of this part.

14.1.2 The following are steps to be taken when preparing radiographic exposure devices for shipment.

- a) The exposure device must be locked and safety plugs in place.

Note: Place several layers of tape around the lock to secure it during shipment.

- b) Place the device in its D.O.T. approved shipping container.



- c) Use a calibrated survey instrument to survey the entire exterior surface of the shipping container at 6 inches and at 1 meter for labeling purposes.
- d) Find the maximum dose rate at the above distances.

#### 14.1.3 Labeling and limitation requirements for shipping.

- a) Radioactive Yellow II label: Less than 50 mR/hr at 6" from surface of shipping container and less than 1 mR/hr at 1 meter.
- b) Radioactive Yellow III label: Greater than 50 mR/hr at 6" from surface of shipping container or greater than 1 mR/hr at 1 meter.
- c) Type "A" quantity.
  - 1) Iridium 192 - Less than 20 curies

2) Cobalt 60 - Less than 7 curies

Note: Quantities greater than the above mentioned are considered type "B" for transport or shipment.

- d) Transport index - Dose rate at 1 meter.
- e) Maximum dose rates allowable on exterior of shipping container; 200 mR/hr at the surface and 10 mR/hr at 1 meter.

Note: If readings exceed the above mentioned the device cannot be shipped and the RSO must be notified.

#### 14.1.4 Prepare shipping certification per instructions from RSC or ARSC.

#### 14.1.5 Complete P.T.L. radioactive material transfer papers and place proper copy inside shipping container prior to sealing.

#### 14.2 Receiving.

##### 14.2.1 Each radioactive shipment must be surveyed as soon after receiving as possible and dose rates recorded on transfer papers.

##### 14.2.2 Surveys must be performed within the prescribed times shown:

- a) 3 hours - If received during normal working hours.
- b) 18 hours - If received after normal working hours.

##### 14.2.3 Should the dose rates upon survey exceed the limits as shown below, follow the procedures in paragraph 13.0.

- a) 200 mR/hr at the surface of the shipping container.
- b) 10 mR/hr at 1 meter from the shipping container.

### 15.0 LEAK TESTING RADIOGRAPHIC EXPOSURE DEVICES

15.1 Each sealed source containing by-product material shall be tested for leakage and/or contamination at intervals not to exceed 6 months.

15.2 The leak test limit is 0.005 microcuries of removable contamination.

15.3 Leak tests will be performed with the Applied Health Physics, Mark V Leak Test Kit.

15.4 Survey the exposure device prior to leak testing to insure that the source is in the safe position and locked.

15.5 Survey the completed and packaged leak test kit prior to mailing. Dose rate must be less than 0.5 mR/hr.

15.6 Instructions for preparing Mark V leak test kit.

- a) Remove the plastic cap with its cotton swab from the plastic test tube. Add a few drops of water to dissolve the powdered wetting agent. Slightly dampen the swabs' cotton tip with the wetting agent solution. Discard any unused solution in the tube.
- b) Complete the information required on the self-sticking, leak test label included in the kit. Securely attach it to the test tube.
- c) Complete the leak test data form included in the kit to identify the source and the device being tested.

15.7 Methods of leak testing.

15.7.1 Instructions for leak testing beam type exposure devices.

- a) Prepare leak test kit per instructions in paragraph 15.6.
- b) Swab around any openings, such as the screw mounted access plates.
- c) Return the swab to the plastic test tube.

15.7.2 Instructions for leak testing remote type exposure devices.

- a) Prepare leak test kit per instructions in paragraph 15.6.
- b) Remove the safety plug from the source tube end of the exposure device.
- c) Swab the interior of the device opening by rotating and inserting 2 to 3 inches.
- d) Return swab to the plastic test tube.

15.8 After completion of leak test be certain not to touch the swab.

15.9 Mail completed leak test to Applied Health Physics for processing.

16.0 METHOD FOR SOURCE REPLACEMENT IN RADIOGRAPHIC EXPOSURE DEVICES.

16.1 Beam type exposure devices must be returned to the supplier of by-product material for source replacement.

16.2 Devices containing cobalt 60 must be returned to the supplier for source replacement.

16.3 Remote type devices containing iridium 192 may have sources replaced via a source changer or returned to the supplier for replacement.

16.4 Instructions for source replacement.

- a) Wear all prescribed personnel monitoring.
- b) Establish a restricted area.
- c) A calibrated and operable survey instrument must be utilized.
- d) Extend remote control cable assembly and connect the inner drive cable to the pigtail connector as described in paragraph 10.1.3.
- e) Connect source tube between remote device and empty side of source changer. Be sure to keep source tube straight.
- f) Unlock source changer and remote device. Retreat with survey instrument and utilizing time, distance, and shielding to minimize exposure, crank old source into the source changer.
- g) With survey instrument, approach the changer and survey to assure the source is in the safe position and locked.
- h) Connect the inner drive cable and the source tube to the new source side of the changer and reverse the operation to pull the new source into the remote device, survey and lock as above.
- i) Remove the old source I.D. tag from the remote device and affix the new I.D. tag, compare with shipping papers and decay curve for correct data.
- j) Complete the source change report (RR-18) and return the source changer and old I.D. tag to the supplier as soon as possible per par. 14.0

#### 17.0 PERMANENT RADIOGRAPHIC SHOOTING CELLS.

17.1 A Permanent radiographic shooting cell is defined as an installation constructed so that when a radiography device is exposed within its boundaries;

- a) No radiation levels of 100 mR/hr or greater can be detected at any boundary.
- b) Each entrance is equipped with a visible alarm activated by the exposing of a radiation source.
- c) Each entrance is equipped with an audible signal activated when an attempt is made to enter the cell while a source is exposed.

17.2 The audible-visible alarm system shall be tested at intervals not to exceed 3 months. See part C par. 4.0.

- a) Prior to conducting radiography in a shooting cell observe mars unit to see that the "ON" indicator is lighted.

- b) Periodically press the test button to confirm proper function.

17.3 Radiation surveys must be performed and recorded on forms RR 12-3 and RR-16.

17.3.1 Should the radiation level at the shooting cell boundary exceed 2 mR/hr a restricted area must be established per pars. 7.1.1(e) and 8.1.1.

- a) Maintain surveillance of the "Restricted Area" during exposure

17.4 Entrances must be locked when not in use.

#### 18.0 STORAGE FACILITIES FOR UNATTENDED RADIOGRAPHY DEVICES

18.1 A storage facility may consist of a room, enclosure, pit, box or vehicle provided that;

- a) Radiation levels on the external boundary do not exceed 2 mR/hr.
- b) The facility is being kept locked and secured against removal except when in use.
- c) "Caution Radioactive Materials" placards are posted at all entrances and all other accessible sides.
- d) Dual purpose areas (Radiographic shooting cells, and vehicles) will be properly placarded for the dual purpose.
- e) Records of survey will be recorded on form RR 12-3.
- f) Vehicles are storage facilities in connection with temporary work sites only.
- g) Park vehicles in locked condition in a secure area.

#### 19.0 REPORTING DEFECTS AND NONCOMPLIANCE.

19.1 Section 206 of the Energy Reorganization Act of 1974 reads as follows.

- a) Any individual director, or responsible officer of a firm constructing, owning, 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 of 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.

19.2 To implement the requirements of section 206, the NRC promulgated regulations under 10CFR21. This document requires notification to the NRC of any incident which causes a substantial safety hazard.

19.3 Substantial safety hazard is defined in 10CFR 21 as "moderate exposure to or release of, licensed material."

19.4 Under the requirements of PTL Radiation Safety Procedures, Management Responsibilities, Part A, Section 8, the following must be reported to the RSO or RSS for subsequent reporting to the NRC.

- a) Loss or theft of source.
- b) Release of source material.
- c) Whole body exposure of 5 Rems or more.
- d) Skin exposure of 30 Rems or more.
- e) Extremity exposure of 75 Rems or more.
- f) Loss of operation in facility affected of one day or more.
- g) Damage to property in excess of \$2,000.00

19.5 The RSO or ARSO must report to the RSC, ARSC on others listed in Management Responsibilities, Part A.

19.6 Other hazards, and reporting requirements are defined in 10CFR 20.105, 10CFR20.403, PTL Management Radiation Safety Procedures and Radiographic Personnel Operating and Emergency Procedures.

19.7 Responsibilities.

- a) Every employee, supervisor, district manager, department manager or officer has the responsibility to report any defined hazard, thru channels, or directly to corporate management.

- b) K.D. Drake, Executive Vice President is the PTL officer responsible for reporting to the NRC under the requirements of 10CFR21.

19.8 A copy of 10CFR21 is available for reading from your supervisor or manager.

## 20.0 MAINTENANCE OF RECORDS.

20.1 Each individual performing radiographic operations or handling radiographic equipment is responsible for the proper maintenance of all associated records.

20.2 Radiographic personnel must maintain records in the following areas and in accordance with the prescribed times listed in the "Radiation Records Requirements" chart 20.2 (a).

- a) Maintenance, Inspection, Location, Surveys and Transportation (RR 12-3)
- b) Radioactive Material Transfer (RR-11)
- c) Survey and Dosimeter Report (RR-16)
- d) Source Installation Report (RR-18)

# RADIATION RECORDS REQUIREMENTS

FORM NUMBER	TITLE	WHEN COMPLETED	DESCRIPTION
NRC-4	Occupational Ex- ternal Radiation Exposure History	Employment	Individuals whole-body exposure history from former employers. Establish maximum exposure requirements
NRC-5 (RR-15)	Current Occupational External Radiation Exposure	Weekly & Monthly	Running exposure total for monitored personnel. Film badge and dosimeter pencil record.
R12-3	Radioactive Material Report of Maintenance, Inspection, Location Surveys and Transportation	Each Job	Sketch of restricted area Title is adequate discription
RR-4	Quarterly Alarm System Inspection	Quarterly Report	Alarm system inspection for shooting cells
RR-9	Film Badge Assignment Report	Monthly	To show when badges are assigned, to whom, date returned to supplier
RR-10	Training Record	As Required	Individuals record of training received
RR-11	Radioactive Material Transfer Report	When Transferring to authorized licensees	Identification of material transfered
RR-16	Survey & Dosimeter Report	Weekly	Cumulative daily rad- iation dose, utilization log and survey record
RR-17	Radioactive Material Inventory	Quarterly	Physical count of all radioactive material
RR-18	Source change report	As Required	Record of source replace- ment and transfer
RR-19	Unannounced Radiation Inspection Reports.	Quarterly One for each radiographer	Inspection of Radio- grapher in field
RR-22	Pocket Dosimeter Response Check	Annually	Response Check Data