

POGUE INDUSTRIES INCORPORATED

5200 Manchester
St. Louis, Mo. 63110

Radiation Safety and Control Program

10.7.B

Training Procedure

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TRAINING PROCEDURE

1.0 OBJECTIVE

- 1.1 The objective of this procedure is to assure consistent training of personnel with materials, method, and applications and verify the understanding of training by both examination and demonstration. This verification will be by both oral review and written examination. The training procedure is outlined in detail to provide qualified training for all levels of responsibility in Radiation Safety to employees of Pogue Industries Incorporated.

2.0 REFERENCES

- 2.1 The following educational materials shall be used by PII in the preparation of lesson plans for the training of trainees, Assistant Radiographers, Radiographers and radiation Safety Monitors:
- (a) NDT Radiographics Training Manual
 - (b) Working Safely with Gamma Radiography (Steve McGuire)
 - (c) Radiation Safety Handbook
 - (d) PII E&O Procedures
 - (e) 10 CFR Chapter 1 Title 19,20,34
 - (f) NRC Case Histories

3.0 PROCEDURE

- 3.1 The PII training program is presented in the following sequence to provide training areas commensurate with the employee's responsibility and the extent of the radiation danger involved.
- (a) Trainee Radiographer - No previous experience with or in the field of radiography. Training to become an Assistant Radiographer.
 - (b) Assistant Radiographer - Training to become a Radiographer.
 - (c) Radiographer - Periodic training as outlined in 3.4.
 - (d) Radiation Safety Monitors - Periodic training as outlined in 3.5.

3.2 Levels of Certification

3.2.1 Trainee Radiographer - No previous experience. Trainee Radiographers are given a four (4) hour lecture of information instruction. This instructor may be given by a training institution such as Tech Ops, Louisiana State University, Gamma Industries, Mangnaflux Corporation, Clifford Associates or PII Radiation Safety Officer, Assistant Radiation Safety Officer or Radiation Safety Monitor. The lecture includes coverage of the following subjects:

- (a) Basic Radiation Safety. Reference Material may include NDT Radiography Training Manual (E.I. Dupont), Working Safety with Gamma Radiography (Steve McGuire) and the Radiation Safety Handbook (Tech Ops).
- (b) Needs and requirements for personnel monitoring.
 - 1) Dosimeter - its functions, necessity, how it is used and the importance of it being carried at all times when in the job.
 - 2) Film Badge - its function, necessity, how it is used and the importance of it being worn on the job at all times.
 - 3) Dose Rate - R/hr and Mr/HR.
 - 4) Radiation Survey Meters - their function, operations and necessity in Radiography.
 - 5) Controlling Radiation Dose - time, distance, and shielding.

3.2.1.1 At the time of presentation of the lecture, the Trainee is issued a film badge and a dosimeter.

3.2.1.2 Upon completion of the four (4) hours of informative instruction, the Trainee is given a written five question Basic Radiation Quiz and an oral review on basic radiation safety. This is to verify his understanding of the subjects covered as listed above.

3.2.1.3 After the four (4) hour instruction period, if qualified, the Trainee is issued a copy of the PII Operating and Emergency Procedures.

3.2.2 Assistant Radiographer

3.2.2.1 A minimum of 16 hours of additional training shall be required before a Trainee can become qualified for the position or title of Assistant Radiographer. Formal Instruction may be administered by the RSO, Assistant RSO, Radiation Safety Monitor or Training Institution such as Louisiana State University, Gamma Industries, Magnaflux Corporation, Clifford Associates or Tech. Ops. During this period of training, the Trainee shall not act in the capacity of handling and/or using sources.

3.2.2.2 Formal Training - This period of training includes coverage of the following subjects:

(a) Operating and Emergency Procedures

- 1) The trainee shall be instructed in each section of the Operating and Emergency Procedures as the text for this instruction. This instruction shall be given by the Assistant Radiation Safety Officer, Radiation Safety Officer, Radiation Safety Monitor, or Experienced Radiographer. Understanding of the Procedures shall be attested to by the successful completion of the General, Specified, and Practical Examinations for Assistant Radiographer in Radiation Safety.
- 2) The Operating and Emergency Procedures issued to the Trainee shall be available to him and referred to whenever needed for clarification and understanding of the procedures.

(b) Radiography Equipment

1) The Trainee shall be instructed in the use of radiography equipment by using the manufacturer's operations manuals as a text for his instruction. This instruction shall be given by the Assistant Radiation Safety Officer, Radiation Safety Officer, Radiation Safety Monitor, or Experienced Radiographer.

2) The Trainee shall be assigned to a Radiographic inspection team and he will observe the operations, procedures, and techniques used by the team. He shall not act in the capacity of handling or using radioactive sources during this 16 hour training period.

3.2.2.3 After completion of 2 weeks of on-the-job training and 16 hours of formal training, the trainee will be eligible for a 25 question written examination followed by an oral review. In addition, he must satisfactorily demonstrate his competence to use, under the instructions of the Radiographer, the radiographic exposure devices, radiation survey instruments, sealed sources, and related handling tools which will be used in performing his duties as an Assistant Radiographer.

3.2.2.4 Upon successful completion of the written examination, oral review, and demonstration, the Radiographer Trainee becomes eligible for certification as an Assistant Radiographer.

3.3 Radiographer - After three (3) months employment in radiography as an Assistant, the employee becomes eligible for advancement to the position of Radiographer, upon successful completion of the following training procedure:

3.3.1 Twenty (20) hours duration of instruction and demonstration is given to all Assistants before they can become a Radiographer. Formal instruction shall be administered by the Assistant Radiation Safety

Officer, Radiation Safety Officer, Radiation Safety Monitor or training institution such as Louisiana State University, Gamma Industries, Magnaflux Corporation, Clifford Associates or Tech Ops. This instruction and demonstration includes coverage of the following subjects:

(a) Origin and Nature of Radiation

- 1) Structure of the atom
- 2) Periodic table of elements
- 3) Isotope
- 4) Radioactive isotopes
- 5) Curie
- 6) Roentgen
- 7) Decay and half-life

This is a description of Basic Radiation Physics with emphasis placed on the origin of Gamma radiation and the Radioisotope decay process. The approximate time for this presentation is two and one half (2 ½) hours.

(b) Characteristics of X-Rays and Gamma Rays

- 1) Energy
- 2) Wave length
- 3) Intensity
- 4) Electromagnetic Spectrum

This is a discussion of the relationship between Energy and Penetration characteristics. The approximate time for this presentation is two (2) hours.

(c) Interaction of Radiation with Matter

- 1) Penetration
- 2) Absorption

- 3) Scatter
- 4) Ionization
- 5) Bremsstrahlung
- 6) Half and tenth value layers (shielding)

A general description of the various forms of ionization and the use of half and tenth value layer calculations for shielding. The approximate time for this presentation is two and one half (2 ½) hours.

(d) Biological Effects of Radiation

- 1) Effect of radiation on the organs and tissues of the body.
- 2) Nature and consequences of radiation exposure.

The approximate time for this presentation is two (2) hours.

(e) Units of Radiation Dose

- 1) Dose Rate R/hr
- 2) Levels of radiation from licensed material
- 3) REM

The approximate time for this presentation is one and one-half hours.

(f) Methods of Controlling Radiation Dose

- 1) Inverse square law
- 2) Time
- 3) Distance
- 4) Shielding

The approximate time for this presentation is two and one-half (2 ½) hours.

(g) Radiation Detection and Measurement

- 1) Purpose of Dosimetry
- 2) Dosimeters
- 3) Film Badges
- 4) Survey Techniques
- 5) Survey Techniques
- 6) Equipment Calibration
- 7) Operations
- 8) Limitations

A general description of dosimetry, monitoring, devices, and techniques. The approximate time for this presentation is two (2) hours.

(h) Radiographic Equipment

- 1) Exposure Devices
- 2) Storage Containers
- 3) Remote handling equipment
- 4) Operation and control of X-Ray equipment (if applicable)

This is a description and demonstration of devices. The approximate time for this presentation is one and one-half (1 ½) hours.

(i) The requirements of Federal or Agreement States Regulations.

- 1) This is on the interpretation of pertinent regulations. The approximate time for this presentation is two and one-half (2 ½) hours.

3.3.2 Upon completion of the twenty (20) hours of instruction and demonstration and examination, the Assistant is eligible for certification as a Radiographer.

3.3.3 The mandatory guidelines for conducting the training by PII for the instructor will be as follows:

- (a) The course of instruction will be completed within ten working days. In the event the course is not completed within this time frame, it will be necessary to begin the instruction over again.
- (b) Conduct the course in the sequence outlined in Procedure 10.7.B Training Procedure, Paragraph 3.2.
- (c) Each subject in the outline will be covered in the scope specified.
- (d) Each item in the outlined will be covered to the extent specified.

3.4 Radiographer - Radiographers shall complete a refresher training/examination every three (3) years in areas of training initially required for certification and/or when deemed necessary by the Radiation Safety Officer because of changes in commission and/or Agreement States Regulations, equipment, and Operating and Emergency System Procedures of PII. Upon satisfactory completion of the refresher examination, the Radiographer is eligible for recertification.

3.4.1 This is a formal refresher course and re-examination and is in addition to the quality training sessions conducted by the Radiation Safety Monitor.

3.5 Radiation Safety Monitor - Training requirements for Radiation Safety Monitors include, but are not limited to the following:

3.5.1 The satisfactory completion of requirements in accordance with Procedure 10.7.A "Qualification and Certification" are required prior to issuance of certification as a Radiation Safety Monitor by the Radiation Safety Officer.

3.5.2 Satisfactory completion of training covering general and specific are as follows:

- (a) Principles of Radiation Safety

- (b) Operating and Emergency Procedures
 - (c) State and Federal Regulations
 - (d) Conducting and evaluating examinations
 - (e) Expected radiation levels during various operations
 - (f) Detection of Equipment defects or malfunctions
 - (g) Identification of hazardous situations
- 3.5.3 Successful completion of the written examination, oral review, and demonstration, the employee becomes eligible for certification as a Radiation Safety Monitor.
- 3.5.4 Radiation Safety Monitors shall complete a refresher training/examination every three (3) years in areas of training initially required for certification and/or when deemed necessary by the Radiation Safety Officer because of changes in Commission and/or Agreement State Regulations, equipment, and Operating and Emergency Procedures of PII. Upon satisfactory completion of the refresher examination the Radiation Safety Monitor is eligible for recertification.
- 3.6 Experienced Radiographic Personnel - Radiographic personnel with previous experience, hired by PII must met the following requirements:
- 3.6.1 The previous employer(s) is contacted by telephone, followed by written confirmation for the following:
- (a) Confirmation of employment
 - (b) Length of time employed
 - (c) Position and/or title held while employed
 - (d) Record of radiation safety training of experience and rating held relative to position or placement by PII.

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- 3.6.1.1 After confirmation of employment information, the experienced personnel are issued a copy of the field manual of Operating and Emergency Procedures to study and review.
- 3.6.2 Radiographic personnel with previous experience are given informative instructions of PII Operating and Emergency Procedures, instruments, sources, devices and equipment used in the source of performing their duties in Radiographic Inspection.
 - 3.6.2.1 The approximate time for this instruction, familiarization, and examinations is eight (8) hours.
 - 3.6.2.2 This instruction is given by Assistant Radiation Safety Officer, Radiation Safety Officer, or Radiation Safety Monitor.
- 3.6.3 Radiographic personnel with previous experience shall be required to pass the examinations that are applicable to the position being filled. The examinations shall apply in the same manner as outlined in the Qualification and Certification Procedure 10.7.A.
 - 3.6.3.1 Upon completion of these requirements the radiographic personnel with previous experience will be eligible for certification to the level for which they are qualified.