POGUE INDUSTRIES INCORPORATED

5200 Manchester
St. Louis, Mo. 63110

Qualification
and

Certification Procedure

10.7.A

Rev.	Signature	Date
0	President	7/08/85
0	Q.A. Manager	6/24/85
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Qualification and Certification Procedure

1.0 OBJECTIVE

1.1 Assure personnel are conpetent in radiation safety to the level required by their job assignment.

2.0 APPLICATION

2.1 Pogue Industries Incorporated personnel.

3.0 PROCEDURE

3.1 Definitions

3.1.1 Qualification - Compliance with the requirements of certification.

3.1.2 Certification - Written testimony of qualifications.

3.1.3 Certifying Agency - Pogue Industries Incorporated.

3.1.4 Trainee Radiographer - An employee who is training for the position of Radiographer's Assistant.

3.1.5 Assistant Radiographer - An employee who uses radiographic exposure devices, sealed sources, related handling tools, or survey instruments will under the personal supervision of a Radiographer. He is certified in accordance with this Qualification and Certification section.

3.1.6 Radiographer - An individual who performs radiography or is in attendance at the radiography site to supervise radiographic operations. The Radiographer is directly responsibile to the Monitor for assuring that radiography is performed on accordance with this Qualification and Certification section.

3.1.7 Radiation Safety Monitor - An individual with extensive experience and training in radiation safety who has been apointed, to assist the Lab/Project Supervisor in maintaining a high standard of

radiation safety. Nde Radiation Safety Monitor are directly responsible to the Lab/Project NDE Supervisor for assuring that radiography is performed on accordance with the Safety Program. He is a certified Radiation Safety Monito in accordance with this Qualification and Certification section.

3.1.8 Assistant Radiation Safety Officer - An individual with experience in radiation safety, who performs training and examination of trainee Radiographers, Assistant Radiographers, Radiographers, and Radiation Safety. He shall be certified in accordance with the Qualification and Certification section for a Radiation Safety Supervisor.

3.1.9 Examiners - The RSO, Assistant RSO, Radiation SAfety Monitor or an experienced radiographer appointed by the RSO, Assisant RSO, or Radiation Safety Monitor will be considered qualified to administer general and practical examinations.

3.2 Authority - The radiation safety portion of personnel qualification and certification shall be vested in the RSO.

3.3 Levels of Qualification

3.3.1 Trainee Radiographer - All trainees shall be 18 years of age and trained in basic safety as specified in Procedure 10.7.B Training. The employee shall be required to complete a written quiz proir to starting his on-the-job training assignment.

3.3.2 Assistant Radiographer - The radiation safety requirements for an Assistant Radiographer are as follows:

(a) Minimum age - 18 years.

(b) No known history of previous radiation exposures which would prohibit or cause restriction of his activity.

(c) Free from physical handicaps which could endanger himself or others during performance of his job.

(d) Completion of the radiation safety training requirements for Assistiant Radiographer as defined in Procedure 10.7.B Training.

(e) Satisfactory completion of the Assistant Radiographers examinations.

3.3.3 Radiographer - Teh radiation safety requirements for a Radiographer are as follows:

(a) Attributes listed in 3.3.2.

(b) Previous qualification by Pogue Industries Incorporated as an Assistant Radiographer, or compliance with b, c, d, and e below.

(c) Aminimum of three months documented experience as an Assistant Radiographer.

(d) Consideration to be taken to substitute formal cocumented education education and training to fulfill the three month minimum requirement on a case basis approved by the RSO. Formal education shall have been completed by an authorized educational facility or other NRC/agreement state approved training program.

(e) Completion of the radiation safety training requirements for Radiograqpher as defined in Procedure 10.7.B Training.

(f) Satisfactory completion of the Radiographers examinations.

3.3.4 Radiographic personnel with previously qualified Radiographers previous experience, hired by PII must meet the following requirements:

3.3.4.1 The previous employer(s) is contacted by telephone, followed by written conformation of the following;

(a) Confirmation of employment

(b) Length of time employed

(c) Position and/or title held while employ ed

(d) Record of radiation safety training of experience and rating held relative to position or placement by PII.

3.3.4.2 After confirmation of employment information, the experienced personnel are issued a copy of the field manual of Operating and Emergency Procedure to study and review.

3.3.4.3 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.

3.3.4.4 The approximate time for this instruction, familiarization and examinations is eight (8) hours.

3.3.4.5 This instruction is given by Assistant Radiation Safety Officer, Radiation Safety Officer, or Radiation Safety Monitor.

3.3.4.6 Radiographic personnel with previous experience shall be required to pass the examinations that are applicable to the osition being filled. The examinations shall apply in the same manner as outlined in 3.3.2, 3.3.3 and 3.3.5.

3.3.4.7 Upon completion of these requirements, the Radiographic personnel with previous experience will be eligible for certification to the level for which they are qualified.

3.3.5 Radiation Safety Monitor - The radiation safety requirements for a Monitor are as follows:

(a) Certified Radiographer.

(b) A minimum of two years experience in industrial radiography involved in isotope handling.

NOTE: If the RSO apoints a Laboratory Manager or Supervisor to carry out the duties of Radiation Safety Monitor on a temporary basis, the qualification requirements may be modified by the RSO, provided that the Manager or Supervisor has sufficient radiography background to be considered a qualified Radiographer. A permanent appointment of an individual with the above qualifications shall be made as soon as possible.

(c) Completion of the radiography training requirements for Radiation Safety Monitor as defined in Procedure 10.7.B Training.

(d) Satisfactory completion of the Radiation Safety Monitor examinations.

3.4 Examinations

3.4.1 Trainee Radiographer - A five question written quiz given to each Trainee. It will be directed toward avoiding accidental exposure. An oral reveiw will also be used to assure the points are understood. The quiz will be conducted and evaluated by a qualified individual. A sample quiz is included in Appendix A.

3.4.2 Assistant Radiographer

(a) General - The general examination shall contain a minimum of 25 questions on basic radiation safety and the Emergency and Operating Procedures. A sample is included in Appendix B.

(b) Practical - The practical examination shall measure the employee's proficiency in performing his required functions. He will be required to demonstrate competence to use the radiographic exposure device, sealed source, related handling tools, and survey instruments.

(c) Oral Review - An oral review shall be conducted with the employee to clarify any questions and correct misunderstandings.

(d) The test will be conducted and evaluated by a qualified individual (experienced Radiographer as a minimum).

(e) The RSO sahll review the examinations prior to issuance of certification.

3.4.3 Radiographer

(a) General- The examination shall contain at least 50 questions on basic radiation safety, (closed book). A sample is included in Appendix C.

1) Basic Radiation Safety

2) Operating and Emergency Procedure

3) 10 CFR 20 and 10 CRF 34 (or applicable state regulations) and

4) Exposure Devices and Survey Meters

(b) Practical - The practical examination shall measure the employee's proficiency in performing his required functions. He will be required to demonstrate competence to use the radiographic exposure device, sealed source, related handling tools, and survey instruments.

(c) Oral Review - An oral review shall be conducted with the employee to clarify any questions and correct misunderstandings.

(d) The test will be conducted and evaluated prior to issuance certification.

(e) The RSO sahll review the examinations prior to issuance of certification.

3.4.4 Radiation Safety Monitor

(a) General - The general examination shall contain 20 questions covering:

1) Principles of Radiation Safety

2) Pogue Industries Incorporated Radiation Safety and Control Program,

3) 10CFR19, 10CFR20 and 10CFR34, (or applicable state regulations), the license, and

4) conducting and evaluating examinations

(b) Practical - The practical examination shall measure the Radiation Safety Monitor's proficiency in performing his required functions as defined in the Operating and Emergency Procedure, including instructing personnel in the safe use of radiographic equipment.

(c) Oral Review - An oral review shall be conducted to evaluate the Radiation SAfety Monitor's understanding of the radiation safety philosophy is implemented through the Operating and Emergency Procedure.

(d) The test will be conducted and evaluated by the RSO, or ASSistant RSO.

3.5 Passing Grade - Passing grade for the general and practical examinations for all certifications will be 80% or greater. Certification shall be disapproved for inability to demonstrate their understanding and/or knowledge of safety requirements.

3.6 Re-examiantion - Re-examiantion, after failure of an employee to satisfactorily complete a certification examination, shall not be conducted without a reasonable retraining period. The period shall be determined by the person who conducted the original examination and approved by the RSO. Re-examination shall not be conducted using the same examination. A different exam shall be developed for re-examination.

3.7 Certification - The RSO or Assistant RSO has authority for issuing certifications for all certifications and shall not be delegated.

3.7.1 Candidates which have successfully met the certification requirement outlined in 3.3.2 and and 3.3.3 shall have their certification documented in Forms RSC 6 and RSC 5 Respectively (Attachments #1 and #2).

3.7.1.1 Candidates who have been previously certified by another company as a radiographer will be certified on Form RSC 4 after meeting the requirements of 3.3.4 (Attachment #3).

3.7.1.2 Candidates who have sucessfully met the certification requirements outlined in 3.3.1 for Trainee Radiographers and 3.3.5 for Radiation SAfety Monitors shall be certified by formal letter.

3.7.2 Certification Restrictions and Extensions

(a) Restrictions may be placed on a certifica-tion as deemed necessary by the RSO. Typical examples are "glasses required at all times", and "Lifting Limit - 50 lbs". Restrictions shall, in no case, constitite a waiver of the requirements of 10CFR20, 10CFR34, or the Operating and Emergency Procedure. The restrictions will appear on the employee's Certification.

(b) Extensions may be added to the certification as testimony of capabilities beyond the requirements of that level. Extensions may include that the employee be trained and demonstrate to

the RSO his competence in understanding and performing the required function. The documentation of such capability shall become a part of the employee's personnel record.

3.7.3 Personnel Records - The personnel records of Trainee Radiographer shall contain:

(a) Name of certied individual

(b) Level of certification

(c) Statement indicating satisfactory completion of requirements of Procedure 10.7.B Training.

(d) Date of certification

(e) Signature of RSO

(f) Copy of examination taken.

3.7.4 Personnel Records - The personnel records of all other certified individuals shall include:

(a) Name of certified individual

(b) Level of certification

(c) Educational background and experience

(d) Statement indicating satisfactory completion of the requirements for Procedure 10.7.B Training

(e) Actual grades obtained in each examination

(f) Date of certification and/or recertification

(g) Signature of RSO.

3.8 Recertifications - All certified personnel at least once every three years by one of the following criteria:

3.8.1 Evidence of continuing satisfactory performance as substantiated by audits. If extensions have been added to the certification, the audit must substantiate each extension.

3.8.2 Re-examination in accordance with the original examination requirements.

3.9 Certification Withdrawals - The RSO shall have the autority to withdram certifications for:

3.9.1 Violation of safety procedures or disregard for safe practices.

3.9.2 Inability to demonstrate correct procedures during audits.

3.9.3 Reassignment to functions no longer requiring the certification.

3.9.4 Termination of the emploee.

4.0 DOCUMENTATION

4.1 Copies of examinations, training records, certifications, etc., as outlined in this procedure must be maintained for a period of three years.

ATTACHMENT 1

FORM RSC 5

POGUE INDUSTRIES INCORPORATED

RADIATION SAFETY PROGRAM

RADIOGRAPHER
RADIATION SAFETY TRAINING CERTIFICATION

I. NAME_____EMP. NO._____LAB/PROJECT_____
DATE OF BIRTH_____SOCIAL SECURITY NO._____
DATE EMPLOYED_____
(Month-Day-Year)

II. The above named individual has satisfactorily completed Pogue Industries Incorporated Radiographer Training Program and has received Radiation Safety Training and testing as specified below.

1. Attend instruction on the topics outlined in the Training Procedure Paragraph 3.2.1

a.	Origin and Nature of Radiation (Min. one (1) hour	Firm, School or Instructor	No. of Hrs.	Date
b.	Characteristics of x-rays and gamma rays (Min. one-half (½) hour)	Firm, School Instructor	No. of Hrs.	Date
c.	Interaction of Radiation with Matter (Min. one (1) hour)	Firm, School or Instructor	No. of Hrs.	Date
d.	Biological Effects of Radiation (Min. one and one-half (1-½) hours)	Firm, School or Instructor	No. of Hrs.	Date
e.	Units of Radiation Dose (Min, one (1) hour	Firm, School or Instructor	No. of Hrs.	Date
f.	Methods of Controlling Radiation (Min. two (2) hours)	Firm,School or Instructor	No. of Hrs.	Date
g.	Radiation Detection and Measurements (Min. two (2) hours)	Firm, School or Instructor	No. of Hrs.	Date
h.	Radiographic Equipment (Min. one (1) hour)	Firm, School or Instuctor	No. of Hrs.	Date
i.	The Requirements of Federal or Agreement States Regulations (Min. two (2) hours)	Firm, school or Instructor	No. of Hrs.	Date

2. Received instruction on the requirements of Pogue Industries Incorpcrated Radiation Safety Program with emphasis on the O & EP. This instruction is in addition to that given during the on-the-job training period.

(Min. two (2) hours)

Instructor	No. of Hrs.	Date

3. Received instruction on the subjects described in the US NRC Case Histories of Radiography Accidents.

(Min. two (2) hours)

Instructor	No. of Hrs.	Date

4. Completed on-the-job training as Radiographer's Assistant under the direct spervision and guidance of a qualified Radiographer during the period from _____ (Date) to _____ (Date).

5. Passed a written examination to determine his knowledge of topics outlined in Pogue Industries Incorporated Training Program and Operating and Emergency Procedures. (Examination to follow 14 hours of instruction.)

Date	Exam Score

6. Demonstrated satisfactorly his competence to perform industrial radiography and to use the necessary tools and equipment associated with such operations.

Date Exam was Taken	Exam Score

7. Received a copy of Pogue Industries Incorporated Radioactive Material License, Operating and Emergency Procedures and Agreement State or Federal Regulations for Control of Radiation.

Date

III. I hereby certify the information is correct to the best of my knowledge.

(Signature of Radiographer) Date

(Signature of Lab/Project Manager) Date

Approved as Radiographer

(Signature of Radiation Safety Officer) Date

Date Certification Expires: _____

ATTACHMENT 2

FORM RSC 6

POGUE INDUSTRIES INCORPORATED

RADIATION SAFETY CONTROL PROGRAM

ASSISTANT RADIOGRAPHER
RADIATION SAFETY TRAINING CERTIFICATION

I. NAME _____ EMP. NO. _____ LAB/PROJECT _____
DATE OF BIRTH _____ SOCIAL SECURITY NO. _____
DATE EMPLOYED _____
(Month-Day-Year)

II. The above name individual has satisfactorily completed Pogue Industries Incorporated informative instructions and testing for Radiographer Trainee as specified below.

1. Attend informative instruction on the topics outlined in the Training Procedure Paragraph 3.2.

   a. Basic Radiation Safety

   b. Needs and requirements for personnel monitoring.

   (Min. four (4) hours) _____ _____ _____
   Instructor No. of Hrs. Date

2. Passed a written examination and an oral review on basic radiation safety at the conclusion of the four (4) hours of informative instructions (Basic Radiation Quiz). _____
   Date

III. Completed a minimum of two (2) weeks of on-the-job training as a Radiogrpher Trainee from _____ to _____.
Date Date

IV. The above named individual has satisfactorily completed Pogue Industries Incorporated Assistant Radiographer Training Program and has received Radiation Safety Training and testing as specified below.

1. Attend instruction on the topics outlined in the Training Procedure Paragraph 3.2.5 (Min. sixteen (16) hours)

   a. Operating and Emergency Procedures

   b. Radiography Equipment

   _____ _____ _____ to _____
   Instructor No. of Hrs. Date Date

2. Succesfully completed the written examination, oral review and demonstration to use the necessary tools and equipment associated with the position of Radiographer's Assistant.

   _____ _____
   Date Exam Score

V. I hereby ceritfy the above information is correct to the best of my knowledge.

_____ _____

(Signature of Assistant Radiographer) Date

_____ _____

(Signature of Lab/Project Manager) Date

Approved as Assistant Radiographer

_____ _____

(Signature of Radiation Safety Officer) Date

ATTACHMENT 3

FORM RSC 4

POGUE INDUSTRIES INCORPORATED

RADIATION SAFETY AND CONTROL PROGRAM

CERTIFICATION OF RADIATION SAFETY TRAINING FOR PREVIOUSLY TRAINED RADIOGRAPHERS

I. NAME_____EMP.NO._____LAB/PROJECT_____
DATE OF BIRTH_____SOCIAL SECURITY NO._____
DATE EMPLOYED_____
(Month-Day-Year)

II. The above named Radiographer has been previously certified to use radioactive sources as a fully qualified Radiographer prior to employment with Pogue Industries Incorporated. However, to ensure that he has received adequate radiation safety prior to being designated as a fully qualified Radiographer with this Company, the following training and examinations were given:

1. Informative instructions on Pogue Industries Incorporated operating and Emergency Procedures, instruments, sources, devices and equipment used in the course of performing their duties in radiographic inspection.

   (Min. eight (8) hours) _____ _____ _____
   Instructor No. of Hrs. Date

2. Passed a written examination to determine his knowledge of topics outlined in Pogue Industries Incorporated Training Procedure and Operating and Emergency Procedures.

   _____ _____
   Date Examination Score

3. Demonstrated satisfactorly his competence to perform industrial radiography and use and the necessary related tools and equipment associated with such operations.

   _____
   Date

4. Received a copy of this Company's Radioactive Material License, Operating and Emergency Procedures, and Agreement State or Federal Regulations for Control of Radiation.

   _____
   Date

5. Recieved instructions of the subjects described in the USNRC Case Histories of Radiography Accidents

(Min. two (2) hours) _____ _____ _____
Instructor No. of Hrs. Date

III. Previous training and experience as a Radiographer using radioactive sources is as follows:

1. Employed as Radiographer's Assistant from _____ to _____ working for _____.
Company Name

2. Received formal instruction of topics outlined in Pogue Industries Incorporated Services Training Procedure.
_____ on _____
Company name Date

3. Was first qualified as a Radiographer at _____
Company Name

on _____.
Date

4. Has worked as a Radiographer for the following companies on the dates shown:

_____ FROM _____ TO _____

_____ FROM _____ TO _____

_____ FROM _____ TO _____

IV. I hereby certify the above information is correct to the best of my knowledge.

_____ _____
(Signature of Radiographer) Date

_____ _____
(Signature of Lab/Project Manager) Date

Approved as Radiographer

_____ _____
(Signature of Radiation Safety Officer) Date

Date Certification Expires: _____

APPENDIX A

BASIC RADIATION QUIZ

Name_____
Date_____
Score_____
Graded By_____

Select the most correct answer to the following:

1. Those people who are exposed to and receive radiation during their lifetime are:

   a. Radiation workers.
   b. Medical x-ray technicians.
   c. General population.
   d. All of the above.

2. Areas designated by magenta and yellow signs should be:

   a. Entered slowly and carefully.
   b. Hurried through to reduce radiation exposure.
   c. Not entered (except in attendance of a Radiographer).

3. You can work safety with radiation if you:

   a. Use statistics to compute the probability of radiation hazards on each job.
   b. Follow the simple rules devised for your protection.
   c. Use your common sense, intelligence, and intuition.
   d. Have a PHD in Radiation Physics.

4. When a person is working near a radiation source, he should always:

   a. Wear personal clothing.
   b. Wear a respirator.
   c. Wear lead-lined clothing provided.
   d. Wear pocket dosimeter and film badge.

5. You can always reduce your radiation exposure by:

   a. Time.
   b. Distance.
   c. Shielding.
   d. All of the above.

TRAINEES BASIC RADIATION QUIZ

Examination BRQ-0285

1. D
2. C
3. B
4. D
5. D

POGUE INDUSTRIES INCORPORATED

RADIOGRAPHER'S ASSISTANTS TEST

Examination AR0385

Name: _____
Date: _____
Score: _____
Graded by: _____

1. How many survey meters are required before any exposure begins?

   a) 1
   b) 3
   c) 2
   d) None

2. How far away are survey readings taken from the exposure device?

   a) 3 inches
   b) 6 inches
   c) 10 inches
   d) 12 inches

3. The exposure device may be removed from the storage area only in the readings are less than:

   a) 50 mr/hr
   b) 100 mr/hr
   c) 250 mr/hr
   d) 150 mr/hr

4. If a survey of the exposure device is taken and limits are exceeded, what action must be taken:

   a) take exposure device out of storage area
   b) contact NRC
   c) report it to the RSO or his designee for further instructions
   d) call site engineer

5. At the beginning of each shift, all radiographers and assistants shall:

   a) survey exposure device.
   b) calculate intensity of source.
   c) pick up his/her film badge or FLD, high and low range pocket dosimeter and indicate reading on daily dosimeter log.
   d) load film for exposure.

6. A "Radiation Incident" is considered when:

   a) an exposure is about to take place.
   b) loss, damage, or inability to control a radiographic source material.
   c) exposure device is removed from storage area.
   d) source is being cranked out for exposure.

7. While surveying an area during a radiation incident, you find that the readings are above 2 mr/hr in the unrestricted area. You should:

   a) leave area immediately.
   b) adjust roped boundaries so that readings in unrestricted area is kept at 2 mr/hr or less.
   c) call RSO.
   d) call NRC.

8. If any person has sustained any exposure as a result of a radiation incident, you should:

   a) take name and social security number
   b) call police
   c) inform RSO or designee
   d) A & C

9. You are in a restricted radiation area. Your dosimeteris off scale. You should:

   a) remove yourself immediately from restricted radiation area.
   b) rezero dosimeter.
   c) get new dosimeter.
   d) get dosimeter re-calibrated.

10. In the event of an emergency or fire in a restricted radiation area, you shall:

   a) call fire department
   b) call NRC
   c) call RSO
   d) secure source material immediately.

11. When it is believed that the source material capsule has been ruptured or crushed or opened to allow the source to contaminate surrounding areas, you shall:

   a) clear area of all personnel, cover the source material with items available at hand and stop all ventilation to area as much as possible.
   b) leave area immediately.
   c) crank source back to exposure device.
   d) disconnect drive cable.

12. When setting up to make an exposure, the source guide tube shall be positioned so that:

    a) there is the shortest distance between the exposure device and the film.
    b) there are no kinks and sharp turns.
    c) the collimator is directly over the film.
    d) the crank handle is outside the restricted radiation area.

13. The control cable is positioned away from the exposure device so that:

    a) you can see the restricted radiation area.
    b) you can see all monitors.
    c) maximum advantage is being taken of the shielding afforded by the surroundings.
    d) source guide tube can be seen.

14. Before cranking out the source, you must be assured that:

    a) the film is in place.
    b) no unauthorized personnel have entered the restricted radiation area.
    c) RSO has been contacted.
    d) the NRC is notified.

15. You have reached the area where exposure is to take place. Before unloading equipment and exposure device, you must:

    a) survey exposure device.
    b) check pocket dosimeter.
    c) determine whether a restricted radiation area can be maintained.
    d) check calibration of survey meters.

16. What must be done before any exposure begins?

    a) retest the survey meters.
    b) place film.
    c) notify RSO.
    d) set timer.

17. Just before the end of the normal exposure time, the individual at the control crank shall:

    a) crank source in.
    b) check survey meter.
    c) alert persons conducting surveillance.
    d) unlock exposure device.

18. When hearing that the end of the normal exposure time is coming to an end, persons on surveillance shall:

a) seek immediate shielding from any surrounding obstacles.
b) leave area immediately.
c) check pocket dosimeters.
d) turn off survey meters.

19. The individual who will attempt to lock the exposure device will carry a survey meter set at what scale?

a) 50X
b) 10X
c) 25X
d) 100X

20. After the source has been returned to the stored position in the exposure device and radiation levels which indicate the source is not properly stored, you will:

a) check pocket dosimeter.
b) retreat to safety immediately.
c) crank source back out.
d) lock exposure device.

21. If the exposure set-up is moved within a radius of three (3) feet from the original set-up, you may:

a) leave the roped lines unchanged.
b) not have to survey area again.
c) not have to check pocket dosimeters again.
d) b and c

22. If the exposure set-up is moved outside a three (3) foot radius of the original set-up, you must:

a) survey area.
b) re-evaluate and make correct change to roped lines.
c) check pocket dosimeters.
d) recheck survey meters.

23. Before moving exposure device to next location, you must make sure that:

a) lines have been taken down.
b) survey meters are turned off.
c) exposure device has been locked and key removed.
d) pocket dosimeters are checked.

24. When your dosimeter goes off scale, what do you do with your film badge?

a) Throw it away.
b) Turn it in and have it processed as soon as possible.
c) Return it to storage area.
d) Throw it in water.

25. What is the most penetrating type of radiation from an isotope source?

a) ALPHA
b) BETA
c) GAMMA
d) NEUTRON

RADIOGRAPHER'S ASSISTANT TEST

Examination AR0385

ANSWER SHEET

1.	C	11.	A	21.	A
2.	B	12.	B	22.	B
3.	A	13.	C	23.	C
4.	C	14.	D	24.	B
5.	C	15.	C	25.	C
6.	B	16.	A		
7.	B	17.	C		
8.	D	18.	A		
9.	A	19.	D		
10.	D	20.	B		

APPENDIX C

RADIATION SAFETY TEST FOR RADIOGRAPHERS

Examination RO385

Name: _____
Date: _____
Score: _____
Graded by: _____

1. List three factors of radiation safety.

2. What is the most penetrating type of radiation from an isotope source?

   a) Alpha
   b) Beta
   c) Gamma

3. The term milliroentgen is expressed as:

   a) one-hundredth
   b) one-thousandth
   c) 1/1,000,000
   d) one-millionth

4. For Co^{60} what is a H.V.L. lead in inches?

   a) 1.75"
   b) 0.125"
   c) 0.49"
   d) 0.31"

5. What is the half life of IR^{192}?

   a) 30 days
   b) 75 days
   c) 100 days
   d) 45 days

6. Fifty-six (56) curies of IR^{192} would produce how many R/H_r at one foot?

   a) 330.4 R/hr
   b) 550.25 R/hr
   c) 105.85 R/hr
   d) 87 R/hr

7. What would be the dose rate of one curie of Co^{60} at one foot?

a) 14.5 R/hr
b) 17.8 R/hr
c) 5.9 R/hr
d) 11.2 R/hr

8. While in a radiation area, you check your Pocket Dosimter. You see it has gone off scale. You should:

a) continue working in radiation area.
b) leave and tell no one.
c) leave area immediately, notify proper individuals and have film badge developed as soon as possible.
d) throw film badge away.

9. Which of the following is the <u>probable</u> early effect of a 25 RFM radiation dose to the whole body?

a) No physical effect.
b) Blood changes; no serious injury.
c) Injury; possible disability.
d) Fatal to 50% of those receiving the dose.

10. What is the half-life of Co^{60}?

a) 75 days
b) 10 years
c) 5.3 years
d) 3.5 years

11. A curie is a unit of:

a) decay
b) time
c) distance
d) volume

12. Under normal circumstances, do radioisotopes used for gamma radiography induce any radioactivity in the test object?

a) no
b) yes

13. Given the formula 5 (n-18), what would be the permissible accumulated dose for a person 46 years of age?

a) 30 RFM
b) 120 RFM
c) 250 RFM
d) 140 RFM

14. A survey meter will measure:

a) total exposure
b) radiation rate
c) physical size of source
d) how many curies

15. When should a pocket dosimeter be re-zeroed?

a) while in radiation area
b) at the beginning of each shift
c) before cranking out source
d) after cranking out source

16. An IR^{192} source had an original activity of 80 curies. After 225 days, what will be the activity of this source.

a) 60 curies
b) 40 curies
c) 10 curies
d) 20 curies

17. Given: The dose rate is 100 mr/hr at 8 feet from a source.
Find: The dose rate at one (1) foot from the source.

a) 2200 mr/hr
b) 6400 mr/hr
c) 640 mr/hr
d) 6400 R/hr

18. Given: The dose rate 400 mr/hr at 20 feet from a source.
Find: The dose rate at 30 feet from the source.

a) 1777 mr/hr
b) 2.5 mr/hr
c) 177.7 mr/hr
d) 1.777 mr/hr

19. Given: The dose rate at 2 mr/hr at 10 feet from a source.
Find: The distance at which the source would be 100 mr/hr.

a) 40.41 ft.
b) 3 ft.
c) .5 ft.
d) 1.414 ft.

20 Given: A half valve layer of material is 0.5 inches.
Find: The thickness of material needed to reduce the radiation level from 128 mr/hr to 2 mr/hr.

a) 1.5 inches
b) 3.0 inches
c) 0.5 inches
d) 2.5 inches

21. You survey the exposure device before removing it from the storage area. You find that the readings exceed the limits. What must you do?

a) Remove it from storage area.
b) Call the NRC.
c) Report it to Radiation Safety Supervisor, RSO or his/her designee
d) set up radiation lines.

22. How far away are survey readings taken from exposure device?

a) 20 inches
b) 6 inches
c) 2 inches
d) 10 inches

23. The exposure device may be removed only if the survey readings are equal to or less than:

a) 50 mr/hr
b) 100 mr/hr
c) 25 mr/hr
d) 500 mr/hr

24. The individual who will attempt to lock the exposure device will carry a survey meter set at what scale?

a) 10X
b) 25X
c) 100X
d) 50X

25. The source guide tube shall be placed as to:

a) have the shortest distance from the exposure device and the film.
b) avoid kinks and sharp turns.
c) place the crank handle outsie of the restricted radiation area.
d) be able to see the film.

26. A half valve layer of lead for IR^{192} is:

a) 0.49 inches
b) 0.64 inches
c) 0.127 inches
d) 0.19 inches

27. What type of license does PII. have to perform radiography?

a) State of Indiana
b) USNRC
c) State of West Virginia
d) All of the above.

28. Each radiation survey instrument shall be calibrated at intervals not to exceed:

a) 6 months.
b) 1 year.
c) 3 months.
d) 8 months.

29. Each sealed source shall be tested for leakage at intervals not to exceed:

a) 3 months.
b) 1 year.
c) 6 months.
d) 90 days.

30. In the absense of a certificate from a transferer that a leakage test has been made within the last six (6) months, prior to the transfer, the sealed source may be used for 1 month.

TRUE_____ FALSE_____

31. If the range control of a survey meter was set at X10 and the meter read 10 mr/hr, the actual radiation level would be:

a) 10 mr/hr
b) 100 mr
c) 100 mr/hr
d) 10 mr

32. Survey meters may give false readings if subjected to which of the following:

a) shock
b) excessive moisture
c) weak batteries
d) all of the above

33. The greater the distance from an exposed source:

a) the least of a dose will be received.
b) the greater of a dose will be received.
c) the dose will be the same.
d) none of the above.

34. The proper placement of boundary lines and signs marking a radiation area is at:

a) 100 mr/hr
b) 2 mr/hr
c) 50 mr/hr
d) 10X scale

35. The proper placement of boundary lines and sign marking a high radiation area is at:

a) 100 mr/hr
b) 2 mr/hr
c) 50 mr/hr
d) None of the above

36. The penetrating ability of an isotope is governed by:

a) curies
b) exposure time
c) half-life
d) source to film distance

37. Lead is frequently employed in shielding against radiation from x-ray and gamma ray sources because of its:

a) extremely low cost.
b) high absorption for a given thickness and weight.
c) ability to emit electrons when irradiated.
d) ability to defract alpha particles.

38. The time required for one-half (1/2) on the atoms in a particular sample of radioactive material to disintegrate is called:

a) the Irvare Square Law.
b) a curie.
c) a half-life.
d) the half-value layer.

39. As the kilo-voltage applied to the x-ray tube is raised:

a) x-rays of longer wavelength and more penetrating power are produced.
b) x-rays of shorter wavelength and more penetrating power are produced.
c) x-rays of shorter wavelength and less penetrating power are produced.
d) x-rays of longer wavelength and less penetrating power are produced.

40. Two (2) x-ray machines operating at the same nominal kilo-voltage and milliamperage settings:

a) will produce the same intensities and qualities of radiation.
b) will produce the same intensities but may produce different qualities of radiation.
c) will produce the same intensities but may produce different intensities of radiation.
d) may give not only different intensities but also different qualities of radiation.

41. Small amounts to x-rays or gamma rays:

a) will have an accumulative effect which must be considered when mo nitoring for maximum permissible dose.
b) will be beneficial since they build up an immunity to radiation poisoning.
c) will have no effect on human beings.
d) will have only a short term effect on human beings.

42. A dosage of _____ if applied to the entire body in a short period of time would likely cause distinguishable injury.

a) 1.0 - 5.0 r
b) 25 - 100 r
c) 400 - 800 r
d) all of the above

43. The exposure of personnel to x-ray and gamma ray radiation can be determined by means of:

a) film badges
b) dosimeters
c) pocket chambers
d) all of the above

44. An advantage of the fountain pen type dosimeter used to monitor radiation received by personnel is:

a) it provides a permanent record of accumulated dosage.
b) it provides an immediate indication of dosage.
c) it is the most sensitive detector available.
d) all of the above are advantages.

45. When making an exposure with a gamma source, you observe an individual violating your roped-off area, you should first:

a) call out to violator to leave the area.
b) notify your supervisor.
c) retract the source and interrupt shot.
d) enter area and forcible remove violator yourself.

46. Upon completing a gamma source exposure and locking exposure device:

a) personnel may enter the exposure area without fear of radiation.
b) personnel should use survey meter when entering exposure area.
c) personnel should wear a lead lined apron before entering the exposure area.
d) personnel should wait a few minutes before entering the exposure area.

47. When doing gamma ray radiography, the sources are best handled:

a) directly by personnel equipped with special protective clothing.
b) by remote handling equipment which permits the operator to remain several yards away at all times.
c) directly by personnel with special protective clothing except when radiographs are being made.
d) by the same methods used for x-ray equipment.

48. Radiation produced when electrons traveling at high speeds collide with matter is called:

a) x-radiation
b) beta-radiation
c) gamma radiation
d) all of the above

49. In making an isotope exposure in an unshielded area, you find the dose rate six (6) feet from the source in 1600 mr/hr. What would be the dose rate at twenty-four (24) feet?

a) 75 mr/hr
b) 100 mr/hr
c) 200 mr/hr
d) 400 mr/hr

50. Radiation produced during the disintegration of nuclei of radioactive substances is called:

a) x-radiation
b) gamma radiation
c) scatter radiation
d) back scatter radiation

ANSWER SHEET FOR

RADIATION SAFETY TEST FOR RADIOGRAPHERS

Examination RO385

1. Time
   Distance
   Shielding
2. C
3. B
4. C
5. B
6. A
7. A
8. C
9. B
10. C
11. A
12. A
13. D
14. B
15. B
16. C
17. B
18. C
19. D
20. B
21. C
22. B
23. B
24. C
25. B
26. D
27. B
28. C
29. C
30. False
31. B
32. D
33. A
34. B
35. A
36. A
37. B
38. C
39. B
40. D
41. A
42. B
43. D
44. B
45. C
46. B
47. B
48. A
49. B
50. B