NRC FORM 313
(1-84)
10 CFR 30, 32, 33, 34, 35 and 40

APPLICATION FOR MATERIAL LICENSE

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED BY OMB
3150-0120
Expires: 5-31-87

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

FEDERAL AGENCIES FILE APPLICATIONS WITH:

U.S. NUCLEAR REGULATORY COMMISSION
DIVISION OF FUEL CYCLE AND MATERIAL SAFETY, NMSS
WASHINGTON, DC 20555

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS, IF YOU ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION I
NUCLEAR MATERIAL SECTION B
631 PARK AVENUE
KING OF PRUSSIA, PA 19406

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION II
MATERIAL RADIATION PROTECTION SECTION
101 MARIETTA STREET, SUITE 2900
ATLANTA, GA 30323

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION III
MATERIALS LICENSING SECTION
799 ROOSEVELT ROAD
GLEN ELLYN, IL 60137

ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
MATERIAL RADIATION PROTECTION SECTION
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TX 76011

ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION V
MATERIAL RADIATION PROTECTION SECTION
1450 MARIA LANE, SUITE 210
WALNUT CREEK, CA 94596

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTION.

1. THIS IS AN APPLICATION FOR *(Check appropriate item)*

- [ ] A. NEW LICENSE
- [ ] B. AMENDMENT TO LICENSE NUMBER _____
- [X] C. RENEWAL OF LICENSE NUMBER 37-11152-01 Am. #11

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include Zip Code)*

Struthers Wells Corporation
1003 Pennsylvania Avenue West
Warren, Pennsylvania 16365-0008

3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED:

Permanent facility for industrial radiography and associated operations:
1003 Pennsylvania Avenue West
Warren, Pennsylvania 16365-0008

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION: Frank McElroy

TELEPHONE NUMBER: 814-726-1000 Ext. 431

SUBMIT ITEMS 5 THROUGH 11 ON 8½ x 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL
a. Element and mass number, b. chemical and/or physical form, and c. maximum amount which will be possessed at any one time: See Section 5

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED: Industrial Radiography

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE: See Section 7

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS: See Sections 8 and 8A

9. FACILITIES AND EQUIPMENT: See Section 9

10. RADIATION SAFETY PROGRAM: See Section 10

11. WASTE MANAGEMENT: See Section 11

12. LICENSEE FEES *(See 10 CFR 170 and Section 170.31)*
FEE CATEGORY: 3.0 Byproduct Material
AMOUNT ENCLOSED: $ 700.00

13. CERTIFICATION. *(Must be completed by applicant)* THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, AND 40 AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001, ACT OF JUNE 25, 1948, 62 STAT. 749, MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

SIGNATURE - CERTIFYING OFFICER	TYPED/PRINTED NAME	TITLE	DATE
J. C. Wallace	J. C. Wallace	President	9-20-85

14. VOLUNTARY ECONOMIC DATA

a. ANNUAL RECEIPTS

[ ]	< $250K	[ ]	$1M - 3.5M
[ ]	$250K - 500K	[ ]	$3.5M - 7M
[ ]	$500K - 750K	[ ]	$7M - 10M
[ ]	$750K - 1M	[X]	> $10M

b. NUMBER OF EMPLOYEES *(Total for entire facility excluding outside contractors)*: 250

c. NUMBER OF BEDS: N/A

d. WOULD YOU BE WILLING TO FURNISH COST INFORMATION *(Dollar and/or staff hours)* ON THE ECONOMIC IMPACT OF CURRENT NRC REGULATIONS OR ANY FUTURE PROPOSED NRC REGULATIONS THAT MAY AFFECT YOU? *(NRC regulations permit it to protect confidential commercial or financial proprietary information furnished to the agency.)*

[X] YES

8604090245 860109
REG1 LIC30
37-11152-01 PDR

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	COMMENTS	APPROVED BY
REN	Oct-4F	3D	"OFFICIAL RECORD COPY" ML18 104445	H Jackson
AMOUNT RECEIVED: A700	CHECK NUMBER: 9444			DATE: 10/18/85

PRIVACY ACT STATEMENT ON THE REVERSE

Struthers

SECTION 5

MATERIAL TO BE POSSESSED

SEALED SOURCES

Byproduct Material	Source Model No.	Manufacturer	Max. Activity/Source
A. Cobalt-60	A. 36907	A. Automation Ind.	A. 50 Curies (2)
B. Iridium-192	B. 200-520-010	B. Automation Ind.	B. 30 Curies
C. Iridium-192	C. 866	C. Tech/Ops	C. 30 Curies

RADIOGRAPHIC EXPOSURE DEVICES

Model Number	Name of Manufacturer
A. Model 151	A. Automation Industries
B. Model 520	B. Automation Industries
C. Model 520	C. Automation Industries

RADIOGRAPHIC SOURCE CHANGERS

Model Number	Name of Manufacturer
A. N/A	A. N/A
B. 500 SU	B. Automation Industries
C. 500 SU or 650	C. Automation Industries or Tech/Ops

LEAK TEST KIT

A. Tech/Ops, Model 518

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SECTION 6

PURPOSE FOR WHICH LICENSED MATERIAL WILL BE USED

This licensed material will be used for the purpose of industrial radiography.

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SECTION 7

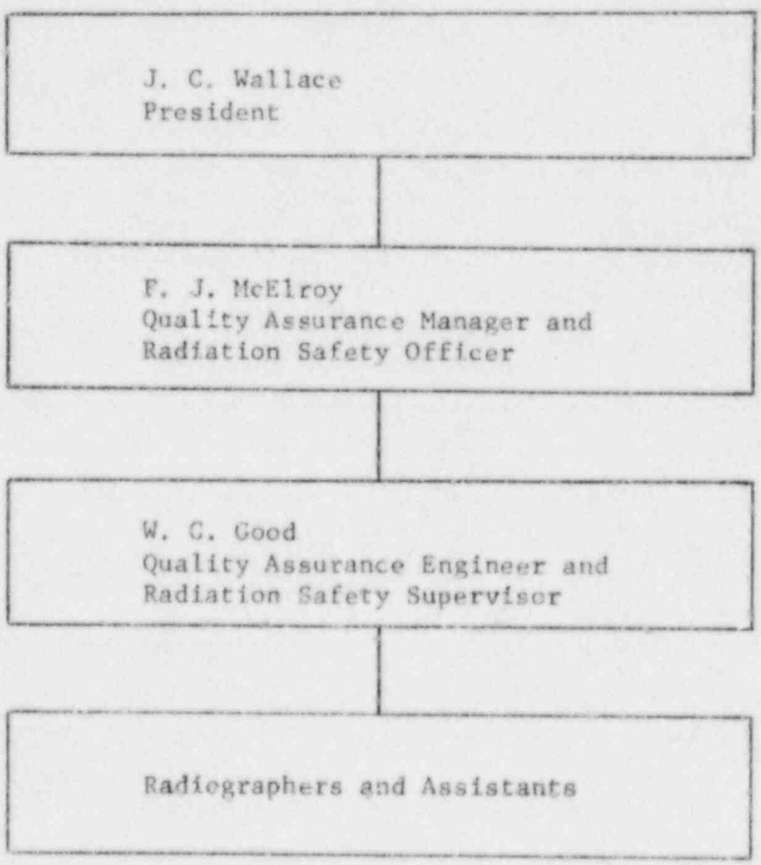
ORGANIZATIONAL STRUCTURE FOR RADIATION SAFETY PROGRAM

The Manager of Quality Assurance and Radiation Safety Officer (F. J. McElroy) has Management's responsibility for operation of this program. (See Page 2.)

The Radiation Safety Supervisor (W. G. Good) and the Radiation Safety Officer have Management's responsibility for training and supervising radiographic personnel.

Radiographic Operators have direct responsibility for strictly following the safety guidelines that have been established in this program.

The following is a chart of organizational responsibility to carry out provisions of Title 10, Parts 30 and 31, of NRC License requirements:



Struthers

SECTION 7

DUTIES OF QUALITY ASSURANCE MANAGER
AND
RADIATION SAFETY OFFICER

A. Serving as the licensee's liaison officer with the Nuclear Regulatory Commission on license matters.

B. Maintaining control of procurement and disposal of licensed material.

C. Developing and maintaining up-to-date operating and emergency procedures.

D. Establishing and maintaining a personnel monitoring program.

E. Procuring and maintaining radiation survey instruments.

F. Establishing and conducting the training program for radiographers and radiographers' assistants.

G. Examining and determining competence of radiographic personnel.

H. Establishing and maintaining storage facilities.

I. Maintaining exposure devices, radiography facilities and associated equipment.

J. Establishing and maintaining the licensee's record keeping system.

K. Reviewing and ensuring maintenance of those records kept by others.

L. Assuming control and instituting corrective action in emergency situations.

M. Investigating the cause of incidents and determining necessary preventive action.

N. Acting in an advisory capacity to the licensee's management and radiography personnel.

Struthers

SECTION 7

DUTIES OF THE RADIATION SAFETY SUPERVISOR

A. Supervising radiographers and radiographers' assistants and being responsible for their training program.

B. Establish and maintain the internal inspection system.

C. Assuring that each survey instrument is calibrated every three (3) months, and a record maintained of latest date of calibration.

D. Assuring that replacement of any sealed source fastened to or contained in a radiographic exposure device and leak testing, repairs, tagging, opening or any other modification of any sealed source shall be performed only by persons specifically authorized by the Commission to do so.

E. Assuring that each source shall be tested for leakage at intervals not to exceed six (6) months or that the source is sent back to the factory for replacement and maintaining the appropriate records. He shall also assist in performing source replacement and source tagging operations.

F. Conducting a quarterly inventory to account for all sealed sources received and possessed under the Struthers Wells Corporation license. Records shall be maintained for inspection by the Commission and shall include the quantities and kinds of by-product material, location of sealed sources and date of the inventory.

G. Keeping a log which contains:

1. Description of the radiographic exposure device and storage container in which source is located.
2. The identity of radiographer to whom assigned.
3. The plant or site when used, dates of use and exposure time.
4. Complete record of dosimeter reading for all individuals working with the radioactive isotope.

Struthers

SECTION 7

INSTRUCTOR'S AND ORGANIZATIONAL PERSONNEL QUALIFICATIONS

F. J. McElroy--Instructor and Radiation Safety Officer has over twenty (20) years experience in radiation and radiation safety. Experience includes two (2) years at U.S. Army SM-1 Nuclear Power Plant and numerous courses in radiation, including Kodak School of Industrial Radiography. Also, a qualified Examiner in Radiography for Naval Sea Systems Command and SNT-TC-1A.

W. G. Good--Instructor and Radiation Safety Supervisor has over fifteen (15) years of radiation safety experience in radiation controlled areas, including decontamination, radiation monitoring, safety and respiratory equipment. NDI Instructor and Technician for U.S. Air Force conducting classroom instructions and examinations in Radiography.

C. H. Rowles--Radiographic Operator has twenty (20) years of radiation experience in conducting radiation surveys and leak tests. He has a certificate in radiation safety and completed Struthers Wells Radiographic Training Program. Also, he is a qualified Operator in Radiography for Naval Sea Systems Command and SNT-TC-1A.

Struthers

SECTION 8

TRAINING PROGRAM FOR RADIOGRAPHERS

The detailed Struthers Wells Training Program for Radiographers outlines the following major areas of coverage:

A. Training Program Outline (Radiographers)

B. On-The-Job Training (Radiographers)

C. Training of Experienced Radiographers

D. Periodic (Refresher) Training (Radiographers)

E. Testing Procedures (Radiographers)

F. Records (Radiographers)

Struthers

SECTION 8

TRAINING PROGRAM OUTLINE (RADIOGRAPHERS)

The following Training Program Outline is intended to provide instruction in the subjects outlined in Appendix A of 10 CFR Part 34. It provides a detailed outline of each item and the amount of time spent on each item.

Struthers Wells Corporation will not permit any individual to act as a Radiographer until such individual:

a. Has been instructed in the subject outlined in Appendix A of 10 CFR Part 34;

b. Has received copies of and instruction in NRC regulations contained in 10 CFR Part 34 and in the applicable sections of Parts 19 and 20, NRC License under which the Radiographer will perform radiography, and Struthers Wells Operating and Emergency Procedures;

c. Has demonstrated to the Radiation Safety Officer competence to use the Struthers Wells radiographic exposure devices, sealed sources, related handling tools, and survey instruments; and

d. Has demonstrated understanding of the above instructions by successful completion of a written test and a field examination on the subjects covered.

Struthers

SECTION 8

A. TRAINING PROGRAM OUTLINE (RADIOGRAPHERS)

I. RADIATION (10 HOURS INSTRUCTION)

A. Structure of the atom

1. Neutron, proton, electron
2. Atomic weight, number
3. Periodic table
4. Isotopes

B. Natural radioactivity

1. Disintegration mechanism

a. Alpha-ray emission

b. Beta-ray emission

c. Gamma-ray emission

2. Half-life
3. Isotope formation in the disintegration process

C. Production of artificial radioactive materials

1. The nuclear reactor
2. Neutron flux
3. Production of irradiated isotopes
4. Irradiation time as compared to half-life
5. Shape of sources
6. Encapsulation
7. Physical condition of source material
8. Fission products

Struthers

SECTION 8

A. TRAINING PROGRAM OUTLINE (RADIOGRAPHERS) (Continued)

II. FUNDAMENTALS OF RADIATION SAFETY (20 HOURS INSTRUCTION)

A. Characteristics of gamma radiation

B. Units of radiation dose (mR) and quantity of radioactivity (Curie)

C. Hazards of exposure to radiation

D. Levels of radiation from licensed material

E. Method of controlling radiation dose

1. Working time

2. Working distance

3. Shielding

III. RADIATION DETECTION INSTRUMENTATION TO BE USED (20 HOURS INSTRUCTION)

A. Use of radiation survey instruments

1. Operation

2. Calibration

3. Limitations

B. Survey instruments

C. Use of personnel monitoring equipment

1. Film badges.

2. Pocket dosimeters

IV. RADIOGRAPHIC EQUIPMENT TO BE USED (15 HOURS INSTRUCTION)

A. Remote handling equipment

B. Radiographic exposure devices

C. Storage containers

V. INSPECTION AND MAINTENANCE PERFORMED BY RADIOGRAPHERS (10 HOURS INSTRUCTION)

VI. CASE HISTORIES OF RADIOGRAPHY ACCIDENTS (5 HOURS INSTRUCTION)

Struthers

SECTION 8

ON-THE-JOB TRAINING (RADIOGRAPHERS)

The training period consists of eighty (80) hours of initial classroom training, a minimum of three (3) months on-the-job training for individuals with no previous experience in radiography, a minimum of three (3) months on-the-job training in the use of radiographic equipment by the performance of radiographic operations under the direct supervision of the fully qualified radiographic operator. Until such time as the above requirements are completed, no trainee will be qualified as a Radiographer.

Struthers

SECTION 8

TRAINING OF EXPERIENCED RADIOGRAPHERS

Experienced personnel shall be required to complete a minimum of twenty (20) hours of classroom training related to Struthers Wells specific work program and equipment and a minimum of two (2) weeks performing radiographic operations under the direct supervision of a fully qualified radiographic operator.

The competency of the above individual to use radiographic equipment and his understanding of Struthers Wells Operating and Emergency Procedures is determined by the same test examination given to qualify individuals as Radiographers.

Struthers

SECTION 8

PERIODIC (REFRESHER) TRAINING (RADIOGRAPHERS)

Each Radiographer is given monthly sessions to review new regulations, procedures, policies and equipment. Equipment functioning and maintenance is also reviewed.

Case histories of radiographic accidents distributed by the NRC are also reviewed during the above sessions.

Internal Audit--Each Radiographer shall be audited by the Radiation Safety Officer once every three (3) months to ensure they are performing radiographic operations in accordance with NRC regulations, license conditions and Struthers Wells Operating and Emergency Procedures.

Struthers

SECTION 8

TESTING PROCEDURES (RADIOGRAPHERS)

Individuals qualifying as Radiographers must demonstrate their understanding of the instructions contained in the formal classroom training by successful completion of written and field examinations on the subjects covered. A grade of 80% is required for passing. Any items missed on the examination shall be immediately reviewed with the individual before he is qualified.

The written examination consists of a minimum of fifty (50) questions covering all items in Appendix A of 10 CFR Part 34. Both examination tests enclosed (Procedures 1 and 2) are required to be given for a Radiographer. The field demonstration consists of a practical test witnessed by the Radiation Safety Officer which includes survey of the camera, facility, assembly and disassembly of the equipment and proper storage of the equipment.

SECTION 8

(Procedure 1)

TEST FOR RADIOGRAPHERS

Name_____ Date_____ Grade_____

1. Cobalt-60 used in nondestructive examinations emit:

   a. alpha particles.
   b. neutrons.
   c. gamma rays.
   d. x-rays.

2. 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 diffract alpha particles.

3. The time required for one half of the atoms in a particular sample of radioactive material to disintegrate is called:

   a. the inverse square law.
   b. a curie.
   c. a half life.
   d. the exposure time.

4. What does the term R/hr refer to when speaking of intensity?

   a. Radiation limits for humans.
   b. Roentgens per hour.
   c. X-rays per hour.
   d. Radiation in hydrogen.

5. Upon completing an x-ray exposure and turning the equipment off:

   a. personnel should wait for a few minutes before entering the exposure area.
   b. personnel should wear a lead-lined apron before entering the exposure area.
   c. personnel may enter the exposure area without fear of radiation exposure.
   d. personnel should take a reading with a Geiger counter before entering the exposure area.

SECTION 8

(Procedure 1)

TEST FOR RADIOGRAPHERS (Cont'd.)

6. The most widely used unit of measurement for measuring the rate at which the output of a gamma ray source decreases is the:

   a. curie.
   b. Roentgen.
   c. half life.
   d. MEV.

7. Small amounts of exposure to x-rays or gamma rays:

   a. will have a cumulative effect which must be considered when monitoring 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 tissues.

8. A dose of _____ would be dangerous, if not fatal, if applied to the entire body in a short period of time.

   a. 1.5 to 15 R.
   b. 25 to 70 R.
   c. 200 to 800 R.
   d. All of the above doses would most likely be fatal.

9. When doing gamma ray radiography with high-intensity emitters, 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 low-intensity emitters.

10. A Cobalt-60 capsule will have a half-life of:

   a. 1.2 years.
   b. 6 months.
   c. 5.3 years.
   d. 75 days.

11. Overexposure to x-rays or gamma rays may cause damage to human:

   a. blood tissue.
   b. skin.
   c. internal organs.
   d. all of the above.

SECTION 8

(Procedure 1)

TEST FOR RADIOGRAPHERS (Cont'd.)

12. A general rule used to define the amount of radiation exposure that is excessive is:

    a. although small amounts of radiation (0.4 R per week or less) are beneficial since they build up an immunity to these rays, anything above 0.4 R per week is excessive.
    b. any dose over 5 R per week is excessive.
    c. any dose which causes a mid-range reading on a Geiger counter is excessive.
    d. any unnecessary exposure to radiation is excessive.

13. Materials which are exposed to gamma radiation or to x-rays below a few million volts:

    a. should not be handled for at least 3 minutes after exposure has ceased.
    b. should be stored in a lead-lined room.
    c. will not be dangerous to handle after exposure to radiation has ceased.
    d. should be monitored by means of a Geiger counter.

14. A densitometer is:

    a. a meter used to measure x-ray intensity.
    b. an instrument for measuring film density.
    c. a meter used to measure the density of a material.
    d. a meter used to measure tube current.

15. The radiation quality of a gamma-ray source is:

    a. determined by the size of the focal spot.
    b. determined by the isotope involved.
    c. can be varied by the operator.
    d. is greater in Iridium-192 than in Cobalt-60.

16. A curie is the equivalent of:

    a. .001 millicuries.
    b. 1,000 millicuries.
    c. 1,000 megacuries.
    d. 100 megacuries.

17. A primary disadvantage of the fountain-pen type of ionization chamber used to measure the amount of radiation received by personnel is:

    a. the delay necessary before the results of a measurement are known.

SECTION 8

(Procedure 1)

TEST FOR RADIOGRAPHERS (Cont'd.)

b. the inaccuracy of such devices in measuring scatter radiation.
c. the inability of such a device to provide a permanent record of exposure.
d. the cost of recharging such devices.

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

a. film badges.
b. dosimeters.
c. radiation meters.
d. all of the above.

19. Short wavelength electromagnetic 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.

20. An advantage of the fountain-pen type of ionization chamber 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.

21. The intensity of x-radiation is measured in:

a. Roentgens.
b. ergs.
c. Roentgens per unit of time.
d. H & D units.

22. A Cobalt-60 gamma-ray source has an approximate practical thickness limit of:

a. 2-1/2 inches of steel of its equivalent.
b. 4 inches of steel or its equivalent.
c. 7-1/2 inches of steel or its equivalent.
d. 11 inches of steel or its equivalent.

23. The fact that gases, when bombarded by radiation, ionize and become electrical conductors make them useful in:

a. x-ray transformers.
b. x-ray tubes.
c. masks.
d. radiation detection equipment.

SECTION 8

(Procedure 1)

TEST FOR RADIOGRAPHERS (Cont'd.)

24. The gamma ray intensity at one foot from a one curie source of radioactive Cobalt-60 is nearest:

a. 15 Roentgens per hour.
b. 1,000 Roentgens per hour.
c. 1 Roentgen per minute.
d. 10 milliRoentgens per day.

25. Of the following, the source providing the most penetrating radiation is:

a. Cobalt-60.
b. 220 kvp x-ray tube.
c. 15 megavolt betatron.
d. electrons from Iridium-192.

26. Which of the following isotope has the longest half-life?

a. Thulium-170.
b. Cobalt-60.
c. Iridium-192.
d. Cesium-139.

27. Almost all gamma radiography is performed with:

a. natural isotopes.
b. artificially produced isotope.
c. radium.
d. Thulium-170.

28. The specific activity of Cobalt-60 depends on:

a. the time the material has been in the atomic pile.
b. the atomic number of the material.
c. the quality of the non-activated material.
d. the Young's Modulus value of the material.

29. If an exposure time of 60 seconds and a source-to-film distance of 4 ft. is necessary for a particular exposure, what exposure time would be needed for an equivalent exposure if the source-to-film distance is changed to 5 ft.?

a. 75 sec.
b. 94 sec.
c. 48 sec.
d. 38 sec.

SECTION 8

(Procedure 1)

TEST FOR RADIOGRAPHERS (Cont'd.)

30. If it was necessary to radiograph a 7" thick steel product, which of the following gamma-ray sources would most likely be used?

a. Cobalt-60.
b. Thulium-170.
c. Iridium-192.
d. Cesium-137.

SECTION 8

(Procedure 1)

ANSWERS TO TEST FOR RADIOGRAPHERS

1.	c	16.	b
2.	b	17.	c
3.	c	18.	d
4.	c	19.	b
5.	c and d	20.	b
6.	c	21.	c
7.	a	22.	c
8.	c	23.	d
9.	b	24.	a
10.	c	25.	c
11.	d	26.	d
12.	d	27.	b
13.	c	28.	a
14.	b	29.	b
15.	a	30.	a

SECTION 8

(Procedure 2)

TEST FOR RADIOGRAPHERS

Name_____ Date _____ Grade _____

1. Why does greater distance from a gamma emitter lessen exposure received?

2. What is the weekly permissible radiation dose allowed? Daily dose?

3. How is energy of a gamma source measured?

4. What harm can an excessive dose of radiation do to the human body?

5. What is the level of radiation of Cobalt 60 from a 1 Curie source at 1 ft.?

6. What is the level of radiation of Iridium 192 from a 1 Curie source at 1 ft.?

7. What is the level of radiation of Radium 226 from a 1 Curie source at 1 ft.?

8. How does working time affect radiation dose if all other factors are equal?

SECTION 8

(Procedure 2)

TEST FOR RADIOGRAPHERS (Cont'd.)

9. How does working distance affect radiation dose if all other factors are equal?

10. What are some of the good shielding materials used in controlling radiation dose?

11. What is the purpose of our Victoreen survey meter?

12. How would you calibrate our Victoreen survey meter?

13. What would you do if you entered radiation area and your meter read at its maximum?

14. When starting a day's work, what is the first thing the operator must do?

15. At what survey meter reading must an area be roped off?

16. Why do we wear film badges?

17. Why do we wear pocket dosimeters?

18. Give a brief description of the mechanics of Gamma Radiographic equipment.

SECTION 8

(Procedure 2)

TEST FOR RADIOGRAPHERS (Cont'd.)

19. What is the most important fact we have to remember about our storage containers?

20. For what purpose are we using the radioactive isotope?

21. Will our radioactive isotope cause radioactivity on objects we plan to gamma ray?

22. In case of an emergency, whom do you notify?

23. Where is the proper storage area for our radioactive isotopes?

24. How does our Gamma Alarm work?

25. What is a sealed source?

26. How will we prevent tampering or removal of by-product material by unauthorized personnel?

27. Assume that the Isotope has become stuck with the source out somewhere in the tube. What should you do?

SECTION 8

(Procedure 2)

TEST FOR RADIOGRAPHERS (Cont'd.)

28. List necessary safety equipment for radiography?

29. Geiger type survey meters are designed to record higher or lower readings than our Victoreen Survey meter?

30. Would you allow any of your fellow workers to examine and use the isotope if they asked you?

31. What are some the things we should avoid when handling a survey meter?

PROBLEMS

32. What is the Half Value Layer for:

a. Iron using Iridium 192

b. Copper using Radium 226

33. What is the Radiation output with 10 Curies of Cobalt 60 at 10 ft. from the source.

SECTION 8

(Procedure 2)

TEST FOR RADIOGRAPHERS (Cont'd.)

34. What would be the distance in feet required to reduce Radiation intensity to 50 mr/hr for 20 Curies of Cobalt 60.

35. If I_1 without shielding, is 30,000 mr/hr and I_2 with shielding is 15 mr/hr, what is the reduction factor and thickness of lead required. Assume Cobalt 60 as the source.

36. If the shielded radiation level is 5.32 mr/hr at a distance of five (5) ft for 1 curie of Cobalt 60 , what is the unshielded radiation level at five (5) ft.and what thickness of concrete was used to reduce this unshielded radiation level.

SECTION 8

(Procedure 2)

ANSWERS TO TEST FOR RADIOGRAPHERS

1. The greater the distance from a gamma emitter, the less exposure to radiation. See Inverse Square Law.

2. Weekly average - 100 mR/hr $\frac{5000 \text{ mR/hr per year}}{50 \text{ weeks}} = 100 \text{ mR/hr}$

   Daily average - 20 mR/hr $\frac{100 \text{ mR/hr per week}}{5 \text{ days}} = 20 \text{ mR/hr}$

3. Survey meter which measures R/hrs and mR/hrs.

4. Effects blood forming organs.

5. 13.31 to 14.5 R/hr at 1 foot.

6. 5.9 R/hr at 1 foot.

7. .027 R/hr at 1 foot.

8. The shorter the time spent in radiation area, the less radiation absorbed.

9. See answer No. 1.

10. Lead screens, concrete walls, etc.

11. To measure quantity of radiation in mR/hrs.

12. Turn dial from "off" position to "on". Allow survey meter to warm up for a few minutes. Adjust meter by turning knob until needle indicates "0".

13. Quickly leave to safe area, secure safe boundary around area, alert radiation officer.

14. A. Wear film badge.
    B. Wear a calibrated pocket dosimeter.
    C. Survey (with meter) whether source is in storage container.

15. 2 mR/hr.

16. To record weekly accumulation of exposure to radiation.

17. In case of accident, to immediately monitor amount of exposure to radiation.

18. The storage container (camera) provides shielding from radiation, the source tube guides the source to a position; a crank assembly to move the source from the camera through the tube remotely.

19. That the Isotope is in the storage container when it should be there.

    A. Between exposures.

    B. Locked when not in use and in designated storage area.

(Procedure 2) SECTION 8

ANSWERS TO TEST FOR RADIOGRAPHERS (Cont'd.)

20. Radioactive Isotopes are ideal for industrial radiography of thick metal specimens.

21. No. Since radioactive Isotopes give off Gamma waves, radiation is not present after source is withdrawn.

22. Your Radiation Safety Supervisor.

23. In designated area in Lineac Room under lock and key.

24. Gamma alarm has one (1) flashing light and loud horn. When radiation intensity exceeds 2 mR/hr, the flashing light goes off and the horn sounds.

25. A sealed source is always contained in a tube, adapter or storage container and never exposed to air.

26. A. Keep source locked in container.
B. Keep storage area locked.
C. Post area with proper radiation warning signs.

27. If radiography is being performed in Lineac Room, lock room and notify Radiation Safety Supervisor, Q.A. Engineer and/or Q.A. Manager.

If "open air" radiography is being performed, post guards and notify proper supervision.

28. 1. Film Badges.
2. Pocket Dosimeters.
3. Gamma Alarms.
4. Shielding.
5. Survey Meters.

29. Geiger type survey meters are designed to read in R/hrs. Victoreen Survey Meters will show radiation intensity in mR/hrs, therefore, are more sensitive.

30. No. Only qualified personnel, familiar with radiation safety regulations are authorized to be in high radiation areas.

31. Survey meters are very delicate instruments. Every precaution should be taken not to bump, shake, jar or abuse the instruments in any way. To ensure accuracy, each survey meter is recalibrated every three (3) months or sooner when there is reason to question the accuracy of readings.

32. Half Value Layer .61 for iron with Iridium-192.
.87 for cooper with Radium-226.

33. 1 Ci @ 1' = 14.5 R/hr
10 Ci @ 1' = 145 R/hr

thus $I_1 : I_2 = D_2^2 : D_1^2$

$145 : I_2 = 100 : 1$

$I_2 = \frac{145}{100} = 1.45$ R/hr

(Procedure 2) SECTION 8

ANSWERS TO TEST FOR RADIOGRAPHERS (Cont'd.)

34. 20 Ci of Cobalt-60 @ 1' = 290 R/hr (14.5 x 20)

290 x 1000 = 290,000 mR/hr

$I_1 = 290{,}000$; $I_2 = 50$; $D_1^2 = 1^2$

$50 : 290{,}000 = 1 : D_2^2$

$50\ D_2^2 = 290{,}000$ $\left(\frac{290{,}000}{50} = D_2^2\right)$

$D_2^2 = 5800$

$D_2 = 76$

$\sqrt{5800} = 76$

49

900

876

35. I_1 = 30,000 mR/hr $\frac{30{,}000}{15} = 2000$ reduction factor.

I_2 = 15 mR/hr 2000 w/Cobalt-60 = 5.4" Pb.

36. 1 Ci of Cobalt-60 @ 1' = 14.5 R/hr.

1 Ci of Cobalt-60 @ 5' = .57 R/hr = 570 mR/hr.

Concrete to reduce 570 mR/hr to 5.32 mR/hr = 107.5 reduction factor.

107.5 reduction factor = 19" concrete.

Struthers

SECTION 8

RECORDS (RADIOGRAPHERS)

A complete documented history on each individual is maintained showing training, results of tests, etc.

Struthers

SECTION 8A

TRAINING PROGRAM FOR RADIOGRAPHER'S ASSISTANT

The detailed Struthers Wells Training Program for Radiographer's Assistant outlines the following major areas of coverage:

A. Training Program Outline (Radiographer's Assistant)

B. On-The-Job Training (Radiographer's Assistant)

C. Training of Experienced Radiographer's Assistant

D. Periodic (Refresher) Training (Radiographer's Assistant)

E. Testing Procedures (Radiographer's Assistant)

F. Records (Radiographer's Assistant)

Struthers

SECTION 8A

TRAINING PROGRAM OUTLINE (RADIOGRAPHER'S ASSISTANT

The following Training Program Outline is intended to provide instruction as outlined in Section 34.31(b) of 10 CFR Part 34. It provides a detailed outline of each item and the amount of time spent on each item.

Struthers Wells Corporation will not permit any individual to act as a Radiographer's Assistant until such individual:

a. Has received copies of and instruction in Struthers Wells Operating and Emergency Procedures;

b. Has demonstrated competence to use, under the personal supervision of the Radiographer, the radiographic exposure devices, sealed sources, related handling tools and radiation survey instruments that the Assistant will use; and

c. Has demonstrated understanding of the above instructions by successfully completing a written or oral test and a field examination on the subjects covered.

Struthers

SECTION 8A

A. TRAINING PROGRAM OUTLINE (RADIOGRAPHER'S ASSISTANT)

I. FUNDAMENTALS OF RADIATION SAFETY (15 HOURS INSTRUCTION)

A. Characteristics of gamma radiation

B. Units of radiation dose (mR) and quantity of radioactivity (Curie)

C. Hazards of exposure to radiation

D. Levels of radiation from licensed material

E. Method of controlling radiation dose

1. Working time

2. Working distance

3. Shielding

II. RADIATION DETECTION INSTRUMENTATION TO BE USED (10 HOURS INSTRUCTION)

A. Use of radiation survey instruments

1. Operation

2. Calibration

3. Limitations

B. Survey instruments

C. Use of personnel monitoring equipment

1. Film badges

2. Pocket dosimeters

III. RADIOGRAPHIC EQUIPMENT TO BE USED (10 HOURS INSTRUCTION)

A. Remote handling equipment

B. Radiographic exposure devices

C. Storage containers

IV. INSPECTION AND MAINTENANCE PERFORMED BY RADIOGRAPHERS (5 HOURS INSTRUCTION)

V. CASE HISTORIES OF RADIOGRAPHY ACCIDENTS (5 HOURS INSTRUCTION)

Struthers

SECTION 8A

ON-THE-JOB TRAINING (RADIOGRAPHER'S ASSISTANT)

The training period consists of a minimum of forty-five (45) hours of initial classroom training in Struthers Wells Operating and Emergency Procedures as specified in the Training Program Outline. Radiographer's Assistant shall demonstrate competence to use the radiographic equipment to the Radiation Safety Officer (limited to demonstration only). Until such time as the above requirements are completed, no individual will be qualified as a Radiographer's Assistant.

Struthers

SECTION 8A

TRAINING OF EXPERIENCED RADIOGRAPHER'S ASSISTANT

Experienced personnel shall be required to complete a minimum of twenty (20) hours of classroom training related to Struthers Wells specific work program and equipment and a minimum of two (2) weeks performing radiographic operations under the direct supervision of a fully qualified Radiographer.

The competency of the above individual to use radiographic equipment and his understanding of Struthers Wells Operating and Emergency Procedures is determined by the same test examination given to qualify individuals as a Radiographer's Assistant.

Struthers

SECTION 8A

PERIODIC (REFRESHER) TRAINING (RADIOGRAPHER'S ASSISTANT)

Each Radiographer's Assistant is given monthly sessions to review new regulations, procedures, policies and equipment. Equipment functioning and maintenance is also reviewed.

Case histories of radiographic accidents distributed by the NRC are also reviewed during the above sessions.

Internal Audit--Each Radiographer's Assistant shall be audited by the Radiation Safety Officer once every three (3) months to ensure they are performing radiographic operations in accordance with NRC regulations, license conditions and Struthers Wells Operating and Emergency Procedures.

Struthers

SECTION 8A

TESTING PROCEDURES (RADIOGRAPHER'S ASSISTANT)

Individuals qualifying as Radiographer's Assistant must demonstrate their understanding of the instructions contained in the formal classroom training by successful completion of a written and a field examination on the Operating and Emergency Procedures and the use of the radiographic equipment. A grade of 80% is required for passing. Any items missed on the examination shall be immediately reviewed with the individual before he is qualified.

The written examination consists of a minimum of thirty (30) questions on the Operating and Emergency Procedures and the use of radiographic equipment. The field demonstration to determine the competency of the individual to use radiographic equipment shall be witnessed by the Radiation Safety Officer and includes survey of the camera, facility, assembly and disassembly of the equipment and proper storage of the equipment.

SECTION 8A

TEST FOR RADIOGRAPHER'S ASSISTANT

Name _____ Date _____ Grade _____

1. Cobalt^{60} used in nondestructive examinations emit:

   a. alpha particles.
   b. neutrons.
   c. gamma rays.
   d. x-rays.

2. 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 diffract alpha particles.

3. The time required for one half of the atoms in a particular sample of radioactive material to disintegrate is called:

   a. the inverse square law.
   b. a curie.
   c. a half life.
   d. the exposure time.

4. What does the term R/hr refer to when speaking of intensity?

   a. Radiation limits for humans.
   b. Roentgens per hour.
   c. X-Rays per hour.
   d. Radiation in hydrogen.

5. Upon completing an x-ray exposure and turning the equipment off:

   a. personnel should wait for a few minutes before entering the exposure area.
   b. personnel should wear a lead-lined apron before entering the exposure area.
   c. personnel may enter the exposure area without fear of radiation exposure.
   d. personnel should take a reading with a Geiger counter before entering the exposure area.

6. The most widely used unit of measurement for measuring the rate at which the output of a gamma ray source decreases is the:

   a. curie.
   b. Roentgen.
   c. half life.
   d. MEV.

SECTION 8A

TEST FOR RADIOGRAPHER'S ASSISTANT (Cont'd.)

7. Small amounts of exposure to x-rays or gamma rays:

   a. will have a cumulative effect which must be considered when monitoring 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 tissues.

8. A dose of _____ would be dangerous, if not fatal, if applied to the entire body in a short period of time.

   a. 1.5 to 15 R.
   b. 25 to 70 R.
   c. 200 to 800 R.
   d. All of the above doses would most likely be fatal.

9. When doing gamma ray radiography with high-intensity emitters, 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 low-intensity emitters.

10. A Cobalt^{60} capsule will have a half-life of:

   a. 1.2 years.
   b. 6 months.
   c. 5.3 years.
   d. 75 days.

11. Overexposure to x-rays or gamma rays may cause damage to human:

   a. blood tissue.
   b. skin.
   c. internal organs.
   d. all of the above.

12. What is the weekly permissible radiation dose allowed? Daily dose?

13. How is energy of a gamma source measured?

14. What harm can an excessive dose of radiation do to the human body?

SECTION 8A

TEST FOR RADIOGRAPHER'S ASSISTANT (Cont'd.)

15. What is the level of radiation of Cobalt^{60} from a 1 Curie source at 1 ft.?

16. What is the level of radiation of Iridium^{192} from a 1 Curie source at 1 ft.?

17. How does working time affect radiation dose if all other factors are equal?

18. How does working distance affect radiation dose if all other factors are equal?

19. What are some of the good shielding materials used in controlling radiation dose?

20. What is the purpose of our Victoreen survey meter?

21. When starting a day's work, what is the first thing the operator must do?

22. At what survey meter reading must an area be roped off?

23. Why do we wear film badges?

24. Why do we wear pocket dosimeters?

25. Give a brief description of how the gamma radiographic equipment is used.

26. For what purpose are we using the radioactive isotope?

27. Will our radioactive isotope cause radioactivity on objects we plan to gamma ray?

SECTION 8A

TEST FOR RADIOGRAPHER'S ASSISTANT (Cont'd.)

28. In case of an emergency, whom do you notify?

29. Where is the proper storage area for our radioactive isotopes?

30. How will we prevent tampering or removal of by-product material by unauthorized personnel?

31. Assume that the isotope has become stuck with the source out somewhere in the tube. What should you do?

32. List necessary safety equipment for radiography.

SECTION 8A

ANSWERS TO TEST FOR RADIOGRAPHER'S ASSISTANT

1. c
2. b
3. c
4. c
5. c and d
6. c
7. a
8. c
9. b
10. c
11. d
12. Weekly average - 100 mR/hr $\frac{5000 \text{ mR/hr per year}}{50 \text{ weeks}} = 100 \text{ mR/hr}$

    Daily average - 20 mR/hr $\frac{100 \text{ mR/hr per week}}{5 \text{ days}} = 20 \text{ mR/hr}$
13. Survey meter which measures R/hr and mR/hr.
14. Effects blood forming organs.
15. 13.31 to 14.5 R/hr at 1 foot.
16. 5.9 R/hr at 1 foot.
17. The shorter the time spent in radiation area, the less radiation absorbed.
18. The greater the distance from a gamma emitter, the less exposure to radiation. See Inverse Square Law.
19. Lead screens, concrete walls, etc.
20. To measure quantity of radiation in mR/hr.
21. A. Wear film badge.
    B. Wear a calibrated pocket dosimeter.
    C. Survey (with meter) whether source is in storage container.

SECTION 8A

ANSWERS TO TEST FOR RADIOGRAPHER'S ASSISTANT (Cont'd.)

22. 2 mR/hr.

23. To record weekly accumulation of exposure to radiation.

24. To immediately monitor amount of exposure to radiation.

25. In storage, isotope is locked in an apparatus which is shielded with lead. To use source for industrial radiography, the following steps must be taken:

    A. At all times, ensure that isotope is inside the apparatus when entering storage area by checking with survey meter.

    B. Position source tube (flexible hose) for intended radiograph.

    C. Position control assembly so that hand crank is behind shielding.

    D. Unlock apparatus with key.

    E. Retreat behind shielding and crank the isotope out of the camera into the source tube. Exercise care not to ram isotope against end of source tube. Observe numbers on counter attached to crank assembly before pushing isotope into source tube and after retracting.

26. Radioactive isotopes are ideal for industrial radiography of thick metal specimens.

27. No. Since radioactive isotopes give off gamma waves, radiation is not present after source is withdrawn.

28. Your immediate supervisor, Quality Assurance Engineer or Quality Assurance Manager.

29. In designated area, under lock and key.

30. A. Keep source locked in container.
    B. Keep storage area locked.
    C. Post area with proper radiation warning signs.

31. If radiography is being performed in Cobalt Room, lock room and notify immediate supervisor Quality Assurance Engineer and/or Quality Assurance Manager.

    If "open air" radiography is being performed, post guards and notify proper supervision.

32. 1. Film badges.
    2. Pocket dosimeters.
    3. Gamma alarms.
    4. Shielding.
    5. Survey meters.

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SECTION 8A

RECORDS (RADIOGRAPHER'S ASSISTANT)

A complete documented history on each individual is maintained showing training, results of tests, etc.

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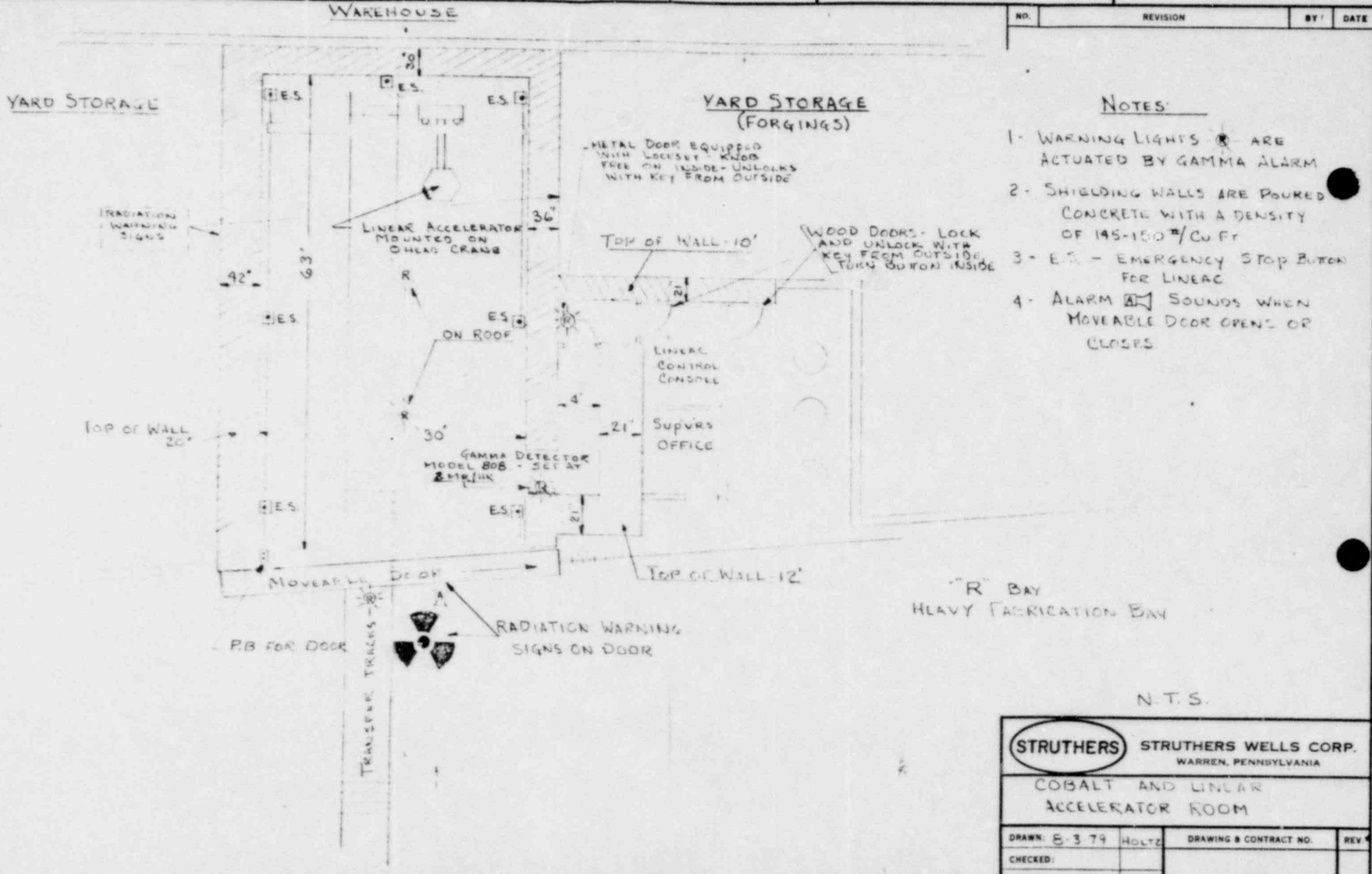
SECTION 9

PERMANENT SHIELDED RADIOGRAPHY FACILITY

The Linear Accelerator Room consists of concrete walls 36" - 42" which are continually monitored with film badges to ensure a radiation level of not more than 2 mR/hr. at a distance of 18" from the external surface. The roof is a metal corrugated structure 20' high with a large rotating warning light that is actuated by radiation. Access to the roof is restricted; there is no ladder to get to the roof and also, there are large signs painted on the outside of the facility restricting access to the roof without specific approval. Access to the facility is controlled by a double set of locked doors and an alarm and flashing light system which remains on when radiation is present. In addition, a loud audible alarm sounds when the movable door opens or closes. The isotopes, $Cobalt^{60}$ (50 Curies) and $Iridium^{192}$ (30 Curies), are used in the center of the facility.



NO.	REVISION	BY	DATE

NOTES

1. WARNING LIGHTS (R) ARE ACTUATED BY GAMMA ALARM
2. SHIELDING WALLS ARE POURED CONCRETE WITH A DENSITY OF 145-150 #/Cu Ft
3. E.S. - EMERGENCY STOP BUTTON FOR LINEAC
4. ALARM (A) SOUNDS WHEN MOVEABLE DOOR OPENS OR CLOSES

N.T.S.

STRUTHERS WELLS CORP.
WARREN, PENNSYLVANIA

COBALT AND LINEAR ACCELERATOR ROOM

DRAWN: 8-3-79	HOLTZ	DRAWING & CONTRACT NO.	REV
CHECKED:			
APPROVED:			

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SECTION 10

RADIATION SAFETY PROGRAM

Section 10.1 Personnel Monitoring Equipment

Section 10.2 Radiation Detection Instruments

Section 10.3 Internal Inspection Program

Section 10.4 Operating and Emergency Procedures

- 10.4.1 Handling and Use of Sealed Sources and Radiographic Exposure Devices
- 10.4.2 Methods and Occasions for Conducting Radiation Surveys
- 10.4.3 Methods for Controlling Access to Radiographic Areas and Radiation Exposure Outside Radiographic Areas
- 10.4.4 Methods and Occasions for Locking and Securing Radiographic Exposure Devices, Storage Containers and Sealed Sources
- 10.4.5 Personnel Monitoring and the Use of Personnel Monitoring Equipment
- 10.4.6 Transporting Sealed Sources, Securing Exposure Devices and Storage Containers in Vehicles, Posting of Vehicles, and Control of Sealed Sources During Transportation
- 10.4.7 Minimizing Exposure of Persons in the Event of an Accident
- 10.4.8 Notification of Proper Persons in the Event of an Accident
- 10.4.9 Maintenance of Records
- 10.4.10 Daily Inspection and Quarterly Maintenance of Exposure Devices and Storage Containers.
- 10.4.11 Off-Scale Pocket Dosimeter Readings
- 10.4.12 Procedure for Identifying and Reporting Defects and Non-compliance as Required by 10 CFR Part 21

Section 10.5 Leak Testing Procedure

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SECTION 10.1

PERSONNEL MONITORING EQUIPMENT

A. Pocket Dosimeters

1. A direct-reading pocket dosimeter, Model No. 541A, 541F or 541R, with range 0-200 mR from Victoreen Instrument Company, Cleveland, Ohio, shall be worn on the chest by the operator whenever the sealed source is used.
2. The dosimeter should be calibrated daily with charging unit, Model No. 2000A. Records will be kept by the Radiation Safety Supervisor.
3. The manufacturer's instructions for charging and reading of the dosimeters shall be followed.
4. Dosimeters shall be issued to each individual Radiographer.

B. Film Badges

1. Film badges will be issued in accordance with the policy and procedures for employees engaged in and exposed to ionizing radiations by the Radiation Safety Officer. Film badges shall be worn on the chest by the operator whenever the sealed source is used.
2. Permanent records of the exposure of each individual assigned a badge will be maintained by the Radiation Safety Officer.
3. Film badges are supplied and analyzed by R. S. Landauer, Jr. and Company, Glenwood, Illinois, on a weekly basis for each individual involved in radiography. When a high reading of radiation is suspected, film badge is sent to R. S. Landauer, immediately, for analysis.

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SECTION 10.2

RADIATION DETECTION INSTRUMENTS

A. A Survey Meter, Model No. 592B, from Victoreen Instrument Company, Cleveland, Ohio, shall be used at each radiography site. The instrument is capable of measuring gamma-rays from less than one (1) mR/hr to one (1) R/hr. For operation of the instrument, the manufacturer's instructions shall be followed. Seven (7) Survey Meters are in our possession.

B. A Gamma Alarm, Model No. 808B or 808D, from Victoreen Instrument Company, Cleveland, Ohio, shall be situated on the wall in the personnel entrance of the Cobalt Room and Lineac Room exposed to radiation. This instrument is capable of measuring from less than 0.1 mR/hr to 100 mR/hr and the audio sound is triggered at 2 mR/hr. For operation of the instrument, the manufacturer's instructions shall be followed. Four (4) Gamma Alarms are in our possession.

C. The radiation detection instruments will:

1. be calibrated so that the readings are $\pm$ 20% of the actual values of the range of the instrument;
2. have a chart showing the results of calibration, the date of the last calibration, and the due date of the next calibration affixed to the instrument;
3. be calibrated at least every three (3) months or after each servicing; and
4. be calibrated and repaired by Applied Health Physics, Inc., Bethel Park, Pennsylvania.

D. Records of calibration will be kept for a minimum of two (2) years after each calibration by the Radiation Safety Officer.

Struthers

SECTION 10.3

INTERNAL INSPECTION PROGRAM

1. Receipt of radioactive material shall be controlled as outlined on Form X74.
2. Possession and use of radioactive material shall be controlled as outlined in the Operating and Emergency Procedures.
3. Internal inspection shall be conducted by the Radiation Safety Officer for each Radiographer and Radiographer's Assistant at intervals not to exceed three (3) months. If a Radiographer or Radiographer's Assistant does not perform radiography for a period that exceeds three (3) months, the inspection shall be carried out the first time that person engages in radiographic operations. Internal inspections shall be carried out in accordance with Quarterly Performance Checklist (Radiographers), Form X79.
4. The Nondestructive Examination Supervisor or Radiation Safety Officer shall make a continuing review of quarterly inventories, utilization logs, records of receipt and disposal of licensed material, personnel monitoring results and surveys.
5. Deficiencies discovered during the internal inspections by the Nondestructive Examination Supervisor shall immediately be recorded and reported to the Radiation Safety Officer. If the deficiency is not minor, it shall be reported to the President; otherwise, the Radiation Safety Officer will take immediate corrective action as required. Corrective action will consist of personnel training and procedure changes, where applicable, to ensure against additional deficiencies.

QUARTER[illegible] PERFORMANCE CHECKLIST (RADIOGRA[illegible]ERS)

Radiographic Location _____ Date _____

Radiographer _____ Inspector _____

Radioisotope _____ Curies _____

Projector Serial No. _____

Survey Meter Serial No. _____ Calibration Due Date _____

	Yes	No
1. Was the Radiographer wearing a film badge and a charged and zeroed dosimeter?	___	___
2. Were other individuals working within the restricted area wearing film badges and dosimeters?	___	___
3. Was the restricted area posted with "CAUTION (or DANGER) RADIATION AREA" signs?	___	___
4. Was the restricted area properly controlled to prevent unauthorized entry?	___	___
5. Was the radiation area controlled by a calibrated and properly operating, mounted Gamma Alarm?	___	___
6. Was the high radiation area posted with "CAUTION (or DANGER) HIGH RADIATION AREA" signs?	___	___
7. Did the Radiographer have a calibrated and properly operating Survey Meter?	___	___
8. Were the utilization log and other required daily logs properly filled out?	___	___
9. Did the Radiographer have sufficient knowledge of safety rules? (Oral questions.)	___	___
10. Was the Radiographer working with defective equipment?	___	___
11. Did the Radiographer properly survey the source projector and source tube and take a radiation reading one foot (1')(0.3m) in front of the source following the radiographic exposure?	___	___
12. Were radioactive isotopes stored properly and kept locked to prevent unauthorized removal?	___	___
13. Was the storage area posted with "CAUTION (or DANGER) RADIOACTIVE MATERIAL" signs?	___	___
14. Did the Radiographer possess a copy of the applicant's Operating and Emergency Procedures and, as applicable, state or NRC rules and regulations for protection against radiation?	___	___
15. Were there any items of noncompliance other than those listed on this form? (If any, explain in remarks below.)	___	___

REMARKS: _____

Form X79, Rev. 1

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SECTION 10.4

OPERATING AND EMERGENCY PROCEDURES

REFERENCE: Paragraph 34.11(c) of 10 CFR Part 34 and Section 34.32 of 10 CFR Part 34.

10.4.1 Handling and Use of Sealed Sources and Radiographic Exposure Devices

10.4.2 Methods and Occasions for Conducting Radiation Surveys

10.4.3 Method for Controlling Access to Radiographic Areas and Radiation Exposure Outside Radiographic Areas

10.4.4 Methods and Occasions for Locking and Securing Radiographic Exposure Devices, Storage Containers and Sealed Sources

10.4.5 Personnel Monitoring and the Use of Personnel Monitoring Equipment

10.4.6 Transporting Sealed Sources, Securing Exposure Devices and Storage Containers in Vehicles, Posting of Vehicles, and Control of Sealed Sources During Transportation

10.4.7 Minimizing Exposure of Persons in the Event of an Accident

10.4.8 Notification of Proper Persons in the Event of an Accident

10.4.9 Maintenance of Records

10.4.10 Daily Inspection and Quarterly Maintenance of Exposure Devices and Storage Containers

10.4.11 Off-Scale Pocket Dosimeter Readings

10.4.12 Procedure for Identifying and Reporting Defects and Noncompliance as Required by 10 CFR Part 21

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10.4.1 HANDLING AND USE OF SEALED SOURCES AND RADIOGRAPHIC EXPOSURE DEVICES

A. The following step-by-step instructions shall be followed in operating the Automation Industries cameras in setting up radiographic operations:

(1) The Radiographic Operator shall acquire at least one (1) suitable survey instrument, such as Victoreen Model No. 592B. The instrument must be calibrated and in good working order. The Radiographic Operator shall then check the camera for safe 2 mR/hr reading.

(2) The Radiographic Operator shall then properly connect the source tube and control assembly to the camera.

(3) The Radiographic Operator shall then unlock the camera. The camera is then ready for use.

(4) The Radiographic Operator shall move outside the Lineac Room and turn the control handle clockwise moving the source to the end of the source tube for the desired exposure time. The control assembly indicates the position of the source at all times to the nearest inch.

(5) The Radiographic Operator shall retract the source into the camera, turning the control handle in the opposite direction after the desired exposure time.

(6) The Radiographic Operator shall then take his survey meter, Victoreen Model No. 592B, and enter the Lineac Room.

(7) The Radiographic Operator shall then check with his survey meter on all four (4) sides of the camera and the entire length of the guide tube to ensure the source has been properly positioned, and then he will lock the camera. This will be confirmed by a reading of less than 10 mR at the camera.

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10.4.1 (Continued)

Gamma Radiography shall be performed in the Lineac Room, where possible. If, under certain conditions, equipment to be radiographed cannot be moved, lead screens 90" x 90" x 1/4" thick are to be used to reduce radiation. The control shall be operated at the maximum possible distance from the source and the Radiographic Operator shall remain at the control only to operate the source and then retire speedily to a safe distance first determined by calculation and then checked with a survey meter. Rope barriers and "Caution-High Radiation Area" signs shall be placed at the estimated 100 mR/hr boundary and the "Caution-Radioactive Material" and "Caution-Radiation Area" signs shall be placed at the estimated 2 mR/hr boundary. Guards shall be posted continually during exposure time to prevent violation of the barrier. Complete records of the radiography including the names and exposures of the personnel shall be kept.

B. The following step-by-step Automation Industries operating instructions shall be followed in the Lineac Room for Source Changer 500SU or 43868 by Radiographic Supervisor when changing short-lived Iridium isotopes:

(1) The Radiographic Operator will have an operating survey meter, Victoreen Model No. 592B, on hand.

(2) Locate the source changer within two (2) feet of the shielded head.

(3) Remove the plug or source tube from the machine outlet.

(4) Remove ROUND PLUG from source changer. Save (new) source number plate.

(5) Connect the short source tube supplied to machine outlet and source changer outlet.

Struthers

10.4.1 (Continued)

(6) Connect source position indicator control to machine lock box and extend control so that operator is positioned full twenty-five (25) feet from machine.

(7) Run decayed source into source changer by turning control handle clockwise until source stops in the changer.

(8) At this point, the survey meter should be employed to ensure that source has been safely located in shielded position by monitoring the source tube and container. This will be confirmed by a reading of less than 10 mR at the camera.

(9) Disconnect short source tube at source changer and disengage disconnects, being careful not to pull out source.

(10) Replace ROUND PLUG, securing decaved source in changer.

(11) Remove HEX HEAD PLUG from source changer, being careful not to pull out source cable inside.

(12) Carefully pull the source cable disconnect only enough to allow joining of disconnects.

(13) Join disconnects on control cable and source cable.

(14) Connect short source tube to source changer outlet.

(15) Pull source into machine by turning control handle counter-clockwise.

(16) After a monitor check around all four (4) sides of the container and the entire guide tube has been made with a survey meter, remove short source tube. Proper safety source location will be confirmed by a reading of less than 10 mR at the camera.

Struthers

10.4.1 (Continued)

(17) Replace HEX HEAD PLUG on empty source changer hole.

(18) Remove decayed source number plate from plate holder on machine and replace with new source number plate attached to lead seal wire. Attach old source number plate to source changer cap plug by lacing seal wire provided through number plate when sealing returned source.

Struthers

10.4.2 METHODS AND OCCASIONS FOR CONDUCTING RADIATION SURVEYS

A. The following radiation surveys are examples of surveys required during radiography and associated operations:

(1) A physical radiation survey of all four (4) sides of the container and the entire length of the guide tube shall be made by the Radiographic Operator after each radiographic exposure during a radiographic operation to determine that the sealed source has been returned to its shielded condition. This will be confirmed by a reading less than 10 mR at camera.

(2) A physical radiation survey of all four (4) sides of the container and the entire length of the guide tube shall be made by the Radiographic Operator to determine that each sealed source is in its shielded condition prior to securing the radiographic device and storage container. This will be confirmed by a reading of less than 10 mR at camera. Records shall be kept of these surveys on Form X61 for inspection by the Commission.

(3) Daily radiographic surveys shall be conducted at each site where radiographic exposures are made and shall be recorded on Form X72 for record purposes. Surveys shall ensure that outer limits at site are less than 2 mR/hr.

(4) If the exposure device is moved from the exposure site to another location for storage, a survey prior to securing the device shall be made in addition to the survey made upon completion of the last exposure.

Struthers

10.4.2 (Continued)

(5) Surveys that ensure containers prepared for shipment comply with Department of Transportation regulations.

These surveys and others required are discussed in more detail under the appropriate sections. In general, surveys shall be made whenever a source is manipulated or moved.

Struthers

10.4.3 METHODS FOR CONTROLLING ACCESS TO RADIOGRAPHIC AREAS AND RADIATION EXPOSURE OUTSIDE RADIOGRAPHIC AREAS

A. The Radiation Safety Officer must authorize the use of the source after evaluation of need, location of use, exposure times and levels to all personnel and manipulation techniques.

B. Prior to obtaining the source from the storage area:

(1) All equipment required to assure safe operation shall be secured. This equipment shall include:

Radiation Signs

Survey Instruments

Pocket Dosimeters

(2) The distance from the source at which the dose rate levels do not exceed 2 mR/hr must be determined and this radiation area established with magenta and yellow tape and "Caution-Radioactive Material" and "Caution-Radiation Area" signs. The "Caution-High Radiation Area" signs shall be placed at the estimated 100 mR/hr boundary.

(3) The survey instrument must be checked for response with the source still in the shield.

C. When using the source in the radiation area:

(1) The operator must not leave the radiation area unattended.

(2) A survey must be made of the perimeter of the radiation area after the source is in place and the tapes and signs adjusted accordingly to confirm the 2 mR/hr level.

Struthers

10.4.3 (Continued)

(3) Access to the radiation area is limited to x-ray personnel wearing film badge and dosimeter and approved by the Radiation Safety Officer.

(4) Upon completion of each exposure, a survey of all four (4) sides of the camera and the entire length of the guide tube must be made to assure that the source has been returned to the shield.

D. Upon completion of the work in the radiation area:

(1) The source in the shield must be locked and returned to the storage area.

(2) A survey made of the storage area to assure that the radiation levels are compatible with storage limits of 2 mR/hr.

(3) The exposure of the operator as measured by the dosimeter must be logged.

E. The Radiographic Operator shall maintain direct surveillance of the radiographic operation to ensure unauthorized personnel do not enter the high radiation area. The majority of radiographic operations are done in the Lineac Room where access to the room is restricted by a locked door at all times.

Struthers

10.4.4 METHODS AND OCCASIONS FOR LOCKING AND SECURING RADIOGRAPHIC EXPOSURE DEVICES, STORAGE CONTAINERS AND SEALED SOURCES

A. In order to assure that radioactive sources do not become radiation hazards during periods of storage and transfer, the following rules shall be followed:

(1) Sources shall be stored in the Lineac Room. This room must be locked when source containers are in storage. Source containers shall be locked.

(2) Each source container shall bear a durable, clearly visible label bearing a standard radiation warning symbol and the following information:

Caution-Radioactive Material

Kind of Material

Amount of Material

(3) Transfer of the source from storage area to the radiation area of operation must be made with the source in the camera. recautions shall be taken to assure that, in transportation, the source cannot be released from the camera even in the event of collision or spills.

(4) A survey instrument shall be available with the transfer vehicle.

(5) As stated earlier in this procedure, the devices must be secured in the shielded position each time the source is returned to that position and the device must be locked at the end of each exposure. A radiation survey, including the guide tube and device itself, shall be performed to confirm that the source is in the safe shielded position.

Struthers

10.4.5 PERSONNEL MONITORING AND THE USE OF PERSONNEL MONITORING EQUIPMENT

A. All radiographic personnel shall wear a film badge on the chest and a pocket dosimeter at all times during radiographic operations.

B. Pocket dosimeter shall be capable of measuring doses from zero to at least 200 mR and shall be calibrated daily before use.

C. Pocket dosimeters shall be checked twice daily and shall be recorded at the beginning and end of each workday.

D. A film badge shall be worn by one person only and shall be the specific badge assigned to that individual.

E. The film badge shall be immediately processed if the pocket dosimeter is discharged beyond its 200 mR/hr range. The Radiographic Operator will notify the Radiation Safety Officer immediately. The Radiation Safety Officer in turn will:

(1) Terminate Radiographer's participation in duties which require exposure to radiation.

(2) Arrange to have Radiographer's film badge processed immediately.

(3) Determine from accumulative dose records whether additional exposure to radiation exceeds maximum permissible limits.

F. Film badges are supplied and analyzed by R. S. Landauer, Jr. & Company, Glenwood, Illinois, on a weekly basis for each individual involved in radiography. When a high reading is suspected, film badge is sent to R. S. Landauer immediately for analysis.

G. The dosimetry devices are maintained in the Radiographic Analyst's office to avoid against adverse environmental conditions.

H. The Radiographic Operator shall complete the required Radioactive Isotope Checklist, Form X60, before starting work.

Struthers

10.4.6 TRANSPORTING SEALED SOURCES, SECURING EXPOSURE DEVICES AND STORAGE CONTAINERS IN VEHICLES, POSTING OF VEHICLES, AND CONTROL OF SEALED SOURCES DURING TRANSPORTATION

A. Struthers Wells Corporation (SWC) does not transport sealed sources for field use and would only be involved in transporting a sealed source when the sealed source is to be replaced by a new source. All the Automation Industries equipment are designed as shipping containers as well as radiographic equipment. However, in transporting such sources in containers by truck, the following safety precautions shall be strictly adhered to:

(1) The equipment should be placed as far as possible from the driver or occupants. Pack the equipment to prevent movement and damage in transit. The equipment should be secured by locking so that the source cannot be in exposed position. After packing in the vehicle, both the equipment and the vehicle, including passenger compartment, shall be surveyed to ensure less than 2 mR/hr at both truck surface and passenger compartment. The vehicle shall be locked to protect against accidental or unauthorized removal of the source.

(2) The vehicle shall be posted with placards as described in Department of Transportation regulations and specified by the Radiation Safety Officer.

(3) The maximum permissible radiation level of the equipment (in closed position) shall be not more than 200 mR/hr on the surface or 10 mR/hr one meter from the device. Since the equipment has more than sufficient protection, normally no more than half this

Struthers

10.4.6 (Continued)

amount should be found. Radiation levels on the surface of the vehicle or passenger compartment cannot exceed 2 mR/hr.

(4) The sources shall be securely locked within the vehicle during transportation and keys stay on person.

(5) Both the sending and receiving terminals shall be notified of the expected arrival time. Immediate steps are to be taken to locate the vehicle if the expected arrival time has elapsed in case of accident to the vehicle or source. Immediate notification of one of the supervisors is required in case of accident. Every possible precaution should be taken in case of accident including roping off the possible hazardous area.

B. An accident is reportable if large-scale damage results or anytime cargo breaks loose because of impact. In case of an accident, loss, theft or radiation:

(1) Call State Police----------Local

(2) Call Struthers Wells--------814-726-1000 (Night or Day)

(3) Call Nuclear Regulatory Commission,
Regional Compliance Office--215-337-5000 (Night or Day)

The following information must be given:

(1) The source size, source material, maximum activity in Curies, housed in approved container (gamma camera or changer model number).

(2) What the actual circumstances of the situation are. Exact location, nature of incident, people involved.

Struthers

10.4.6 (Continued)

(3) State our plan for recovery of material.

(4) State method adopted to keep the incident from recurring.

(5) List names and addresses of people involved and/or who may have had exposure.

The driver shall follow these rules:

(1) No riders.

(2) Call Struthers Wells when:

(a) Stopping for gasoline or meals.

(b) Destination is reached.

(c) Starting return trip.

(d) Arriving at motel when overnight trip.

(3) Shall know where the truck is at all times.

(4) Never leave truck without checking to determine that doors are locked and that all radiation signs are in place.

NOTE: All calls shall include what activity driver is engaged in, location and timetable.

(5) Shall wear his radiation badge at all times. A meter, monitoring radiation leakage, shall remain in the cab.

Struthers

10.4.7 MINIMIZING EXPOSURE OF PERSONS IN THE EVENT OF AN ACCIDENT

A. Personnel shall follow the below listed instructions in the event of any accident (i.e., source stuck in source tube, etc.):

(1) If exposure is in the Lineac Room, the operator shall lock the door and immediately notify the Radiation Safety Officer who will notify Tech/Ops for assistance in retrieving the source.

(2) If exposure is on shop floor, the Radiographic Operator will:

(a) Immediately proceed outside of the 2 mR/hr posted area.

(b) Post additional guards.

(c) Notify Radiation Safety Officer who will maintain direct surveillance and control over the area until the situation is corrected. Temporary shielding shall be set up to allow source to be safely moved to the Lineac Room and maintained until Tech/Ops can be contacted for assistance.

During removal operations, dosimeters shall be checked each half hour.

NOTE: Struthers Wells does not transport licensed material to field locations as a part of Struthers Wells operations.

Struthers

10.4.8 NOTIFICATION OF PROPER PERSONS IN THE EVENT OF AN ACCIDENT

A. In case of an accident involving a sealed source, e.g., if the gamma radiographic equipment fails to operate properly, immediately proceed to outside of the posted area, post additional guards about the area, and notify one (1) of the following:

(1) NAME	BUSINESS PHONE	HOME PHONE
Mr. F. J. McElroy 19 Kamp Street Warren, PA 16365	726-1000 Ext. 431	723-3170
Mr. W. G. Good 31 South Street Warren, PA 16365	726-1000 Ext. 436	N/A
Mr. C. H. Rowles 208 Davis Street Youngsville, PA 16371	726-1000 Ext. 437	563-7740
Mr. K. A. Holtz 104 Hill Street Warren, PA 16365	726-1000 Ext. 429	723-8734

(2) The area shall be cleared of all personnel and a radiation area established to the 2 mR/hr dose rate level.

(3) No access to the area will be allowed without approval of the Radiation Safety Officer.

(4) Evaluation of conditions and actions to be taken to return conditions to normal shall be accomplished by the Radiation Safety Officer. In case of fire in the vicinity of a sealed source:

(a) Remove source camera to a safe area and establish a temporary radiation area.

(b) Notify fire chief of location of sources and provide monitoring services.

Struthers

10.4.9 MAINTENANCE OF RECORDS

A. The Radiation Safety Officer is responsible for maintaining the below listed required records. These records shall be retained in the Radiation Safety Officer's file for review by the Commission.

(1) Radiographic Log, Form N34, for each radiographic exposure.

(2) Checklist For Personnel Using Radioactive Isotopes, Form X60, for each Radiographic Operator taken daily.

(3) Radiation Surveys, Form X61, at one (1) foot from camera with each source in storage taken daily.

(4) Leak Test Record, Form X65, on each sealed source taken every six (6) months.

(5) Calibration Record, Form X66, on each radiation detection instrument taken every three (3) months.

(6) Quarterly Inventory Of Byproduct Materials, Form X67, on each sealed source.

(7) Radiation Exposure Report, Form X68, for each radiographic accident.

(8) Radiation Survey Report, Forms X72-A, X72-B and X72-C, on each radiation area.

(9) Daily Isotope Equipment Maintenance Inspection Checklist, Form X73, on each sealed source camera and equipment.

(10) Isotope Equipment Detailed Quarterly Maintenance Inspection Checklist, Form X73-A, on each sealed source camera and equipment.

(11) Procedure And Record Form For Receiving Packages Of Radioactive Material, Form X74, taken upon receipt of each new source.

Struthers

10.4.9 (Continued)

(12) Calibration Of Dosimeters, Form X77, on each dosimeter taken every six (6) months.

(13) Daily Log - Dosimeter Readings, Form X78, for each Radiographic Operator to record each time he works in an x-ray area.

(14) Current Occupational External Radiation Exposure, Form NRC-5, for each individual involved in radiography taken weekly.

(15) Annual Report For Radiation Exposure Monitoring (letter form) for each individual involved in radiography.

Struthers

10.4.10 DAILY INSPECTION AND QUARTERLY MAINTENANCE OF EXPOSURE DEVICES AND STORAGE CONTAINERS

A. The Radiographic Operator shall inspect daily before performing any radiographic exposures all equipment and record on Form X73. Any item that may be suspect shall be reported immediately to the Radiation Safety Officer and the equipment is to be taken out of service until approved by the Radiation Safety Officer.

B. A detailed inspection and maintenance check of equipment shall be made by the Radiation Safety Officer, or his delegated representative, at least every three (3) months using Form X73-A.

Struthers

10.4.11 OFF-SCALE POCKET DOSIMETER READINGS

A. The film badge shall be immediately processed if the self-reading pocket dosimeter is found to be off-scale. There are no exceptions to this requirement. The Radiographic Operator will notify the Radiation Safety Officer immediately. The Radiation Safety Officer in turn will:

(1) Have work stopped immediately and place source in the safe storage position in the exposure device.

(2) Terminate Radiographer's participation in duties which require radiation.

(3) Arrange to have Radiographer's film badge processed immediately.

(4) Determine from accumulative dose records whether additional exposure to radiation exceeds maximum permissible limits.

Struthers

10.4.12 PROCEDURE FOR IDENTIFYING AND REPORTING DEFECTS AND NONCOMPLIANCE AS REQUIRED BY 10 CFR PART 21

A. Radiography personnel who discover any malfunctions or defects in radiographic equipment are required to notify the Radiation Safety Officer so that appropriate corrective action can be taken. The Radiation Safety Officer shall be the contact for the NRC when specific action is necessary per the requirements of 10 CFR Part 21.

Form N34, Rev. 2

Struthers

RADIOGRAPHIC LOG

☐ Linear Accelerator
☐ Cobalt^{60}
☐ Iridium^{192}

Thick-ness	Order Number	Date	Matl.	Shim Thk.	Penny	Rads	KV / MA	FFD	Expo-sure Time	Type & Size Of Film	Radio-grapher	Component Type Of Joint

Struthers

CHECKLIST FOR PERSONNEL USING RADIOACTIVE ISOTOPES

1. Are you wearing a film badge?
2. Are you wearing a pocket dosimeter?
3. Do you have a survey meter?
4. Are instructions from NDE Supervisor specific and clear?
5. Do you check to make sure that sealed source is in shielded position after each exposure?
6. Are you keeping a log of each exposure?
7. Do you check to see that source containers are locked during periods of inactivity?

Record the amount of radiation received by reading pocket dosimeter at the end of each shift.

DATE	CHECKS 1 - 7	DOSIMETER READING	RADIOGRAPHER	DATE	CHECKS 1 - 7	DOSIMETER READING	RADIOGRAPHER

In case of an emergency, immediately notify: Mr. F. J. McElroy Home Phone: 723-3170
Mr. K. A. Holtz Home Phone: 723-8734

Form X60, Rev. 7

Struthers

RADIATION SURVEYS
(10CFR34.43)

☐ Iridium^{192}
☐ Cobalt^{60} 1546 / 151H
☐ Cobalt^{60} 1518 / 151

DATE	* STARTING SURVEY READING	** FINAL SURVEY READING	*** STORAGE SURVEY READING	RADIOGRAPHER	COMMENTS

* Starting Survey Reading--Reading when first approaching exposure device for use.
** Final Survey Reading--Reading of the last survey of the exposure device and guide tube prior to locking the device and ending direct surveillance of the operation.
*** Storage Survey Reading--Reading when exposure device is placed in storage.

NOTE: All above surveys shall be made around the entire circumference of the radiographic exposure device including source outlet port with the safety plug installed.

Form X61, Rev. 3

STRUTHERS WELLS CORPORATION

LEAK TEST RECORD

FREQUENCY - EVERY SIX (6) MONTHS

Per Approved Source Leak Procedure - Exhibit I

Date Of Last Test	Performed By	Contamination Level	Retest Date Due	Remarks

Form X65, Rev. 1

STRUTHERS WELLS CORPORATION

CALIBRATION RECORD

RADIATION DETECTION INSTRUMENTS

FREQUENCY - EVERY THREE (3) MONTHS

TYPE OF INSTRUMENT _____ MODEL NUMBER _____

MANUFACTURER _____ SERIAL NUMBER _____

Recalibrated By	Date Due For Recalibration	Sent Out For Recalibration	Date Recv'd. By Struthers	Date Recalibrated

Form X66, Rev. 1

Struthers

STRUTHERS WELLS CORPORATION

QUARTERLY INVENTORY
OF
BYPRODUCT MATERIALS

Byproduct Material License and Amendment Number _____

The following Byproduct Materials are on hand at Struthers Wells Corporation (SWC) as of the dates indicated below:

DATE OF INVENTORY	PRESENT SOURCE ACTIVITY	SOURCE NUMBER	INVENTORY BY	COMMENTS

Form X67, Rev. 2

STRUTHERS WELLS CORPORATION

RADIATION EXPOSURE REPORT

This form is to be filled out when:

(a) Radiographer loses Film Badge in radiation area.

(b) Pocket Dosimeter exceeds 100 mR/hr reading.

(c) Any other incident which may result in questionable Film Badge readings.

Radiographer _____ Film Badge No. _____

Date _____ Time _____ A.M. _____ P.M. _____

Nature of Incident: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

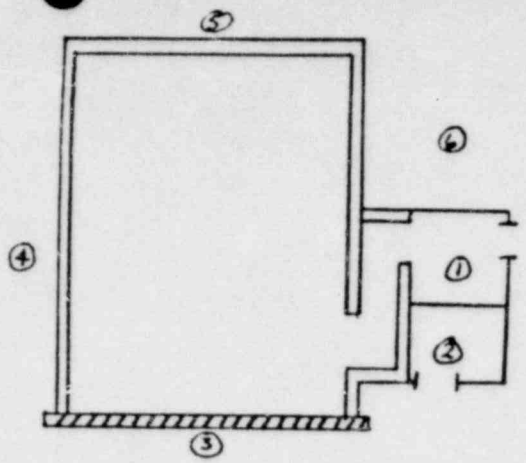
_____

_____

NDE Supervisor

Form is to be filled out in duplicate. Original is to be forwarded to Quality Assurance Manager without delay. Copy is to be retained in X-Ray Department files.

Form X68, Rev. 1



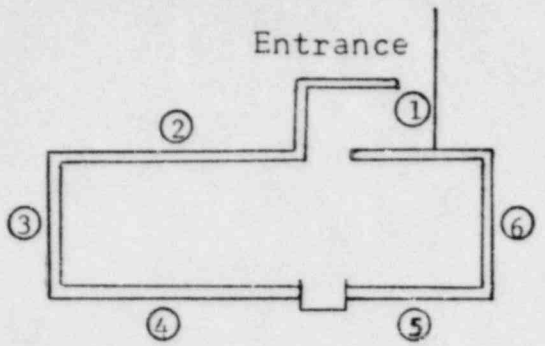
RADIATION SURVEY REPORT

(LINEAC ROOM)

DATE	SOURCE	MAXIMUM (mR/HR) READING						OPERATOR	COMMENTS
		1	2	3	4	5	6		

Form X72-A, Rev. 0

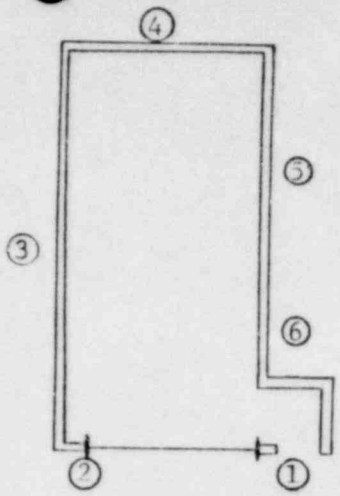
_____E-Bay



RADIATION SURVEY REPORT

DATE	SOURCE	MAXIMUM (mR/HR) READING						OPERATOR	COMMENTS
		1	2	3	4	5	6		

Form X72-B, Rev. 0



RADIATION SURVEY REPORT

M.S. CLEAN ROOM

DATE	SOURCE	MAXIMUM (mR/HR) READING						OPERATOR	COMMENTS
		1	2	3	4	5	6		

Form X72-C, Rev. 0

Struthers

DAILY
ISOTOPE EQUIPMENT MAINTENANCE INSPECTION CHECKLIST

The following items are to be inspected to determine working condition and recorded below with (X) when satisfactory.

ITEMS:
1. Safety source lock.
2. Source drive cable and crank.
3. Source tube.
4. Capsule cable disconnect.
5. Radiation check at source lock (mR).

DATE	ITEMS					SOURCE CAMERA			RADIOGRAPHER	COMMENTS
	1	2	3	4	5	Ir	Co 1546	Co 1518		

Form X73, Rev. 2

Struthers

STRUTHERS WELLS CORPORATION

ISOTOPE EQUIPMENT DETAILED QUARTERLY MAINTENANCE INSPECTION CHECKLIST

The Isotope equipment listed is to be inspected to determine working condition and recorded on this form.	Cobalt-60 Source #_____ Model #_____ Size _____		Cobalt-60 Source #_____ Model #_____ Size _____		Iridium-192 Source #_____ Size _____	
OPERATIONS TO BE PERFORMED	SATIS.	UNSATIS.	SATIS.	UNSATIS.	SATIS.	UNSATIS.
1. Check for changes in operating characteristics of the device.						
2. Check proper operation of source position indicator mechanism.						
3. Check proper operation of locking mechanism.						
4. Check proper operation of crank.						
5. Check source and drive cable for wear or damage.						
6. Check for damaged or worn source and drive cable tube and connector wear and damage.						
7. Check for rust, dirt or sludge buildup in the source tube.						
8. Check proper positioning of source inside the shield.						
9. Check shifting of shield inside projector housing.						
10. Check proper connection of all mating components.						
11. Check for damage to device which may impair operation.						
12. Check for cable drive gear box damage and wear.						
13. Check proper labeling on equipment.						
14. Check Lineac Room doors and interlocks.						
15. Check Lineac Room audible and visible warning devices. (Per 10 CFR 34.29(c))						
16. Check access door locking devices.						
17. Check rooms for properly posted warning signs.						

Comments:

Inspected By _____

Title _____

Date _____

Form X73-A, Rev. 1

Struthers

STRUTHERS WELLS CORPORATION

PROCEDURE AND RECORD FORM FOR
RECEIVING PACKAGES OF RADIOACTIVE MATERIAL

1. Upon receipt of a package containing quantities of radioactive material, the Radiation Safety Officer (R.S.O.), or his delegated representative, shall monitor the radiation levels external to the package.

2. This package shall be monitored as soon as practicable after receipt, but no later than three (3) hours after the package is received during normal 8 to 5 p.m. working hours. If received after normal working hours, up to eighteen (18) hours is allowed.

3. If radiation levels are found on the external surface of the package in excess of 200 millirems per hour, or at three (3) feet from the external surface of the package in excess of 10 millirems per hour, the Radiation Safety Officer shall be immediately informed, and he in turn will notify by telephone and telegraph, the final delivering carrier and the appropriate NRC Regional Office.

Radiation Record

Source and Quantity _____

Source Number _____

Number Millirems on External Surface _____

Number Millirems at 3' From Surface _____

R.S.O. or Delegated Representative _____

Form X74

STRUTHERS WELLS CORPORATION

RADIATION DETECTION INSTRUMENTS
CALIBRATION OF DOSIMETERS

Manufacturer _____ Frequency _____

Dosimeter Serial Number (Issued To)	Due Dates						Comments
	Feb. 1980	Feb. 1981	Feb. 1982	Feb. 1983	Feb. 1984	Feb. 1985	
	July 1980	July 1981	July 1982	July 1983	July 1984	July 1985	

Form X77

DAILY LOG
DOSIMETER READINGS

Month _____

If you worked in an x-ray area, record the Dosimeter Reading in the block.
If you did not work in an x-ray area, mark the block with a slash (/).

Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

Name	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

Form X78

Form NRC-5
(5-78)
10 CFR 20

U. S. NUCLEAR REGULATORY COMMISSION

Approved by GAO
B-180225 (R0064)
Expires 4-30-79

CURRENT OCCUPATIONAL EXTERNAL RADIATION EXPOSURE

See Instructions on Back

IDENTIFICATION

1. NAME (PRINT – Last, first, and middle)	2. SOCIAL SECURITY NO.
3. DATE OF BIRTH (Month, day, year)	4. NAME OF LICENSEE Struthers Wells Corporation

5. DOSE RECORDED FOR (Specify: Whole body; skin of whole body; or hands and forearms, feet and ankles.) Whole Body	6. WHOLE BODY DOSE STATUS (rem)	7. METHOD OF MONITORING (e.g., Film Badge – FB; Pocket Chamber – PC; Calculations – Calc.) X OR GAMMA FB,PC BETA _____ NEUTRONS _____

8. PERIOD OF EXPOSURE (From – To)	DOSE FOR THE PERIOD (rem)				13. RUNNING TOTAL FOR CALENDAR QUARTER (rem)
	9. X OR GAMMA	10. BETA	11. NEUTRON	12. TOTAL	

LIFETIME ACCUMULATED DOSE

14. PREVIOUS TOTAL (rem)	15. TOTAL QUARTERLY DOSE date rem	16. TOTAL ACCUMULATED DOSE (rem)	17. PERM. ACC. DOSE 5(N-18) (rem)	18. UNUSED PART OF PERMISSIBLE ACCUMULATED DOSE (rem)

TECH/OPS, INC.
LEAK TEST KIT MODEL 518

INSTRUCTIONS FOR USE

This kit is designed for use on Tech/Ops Gamma Ray Projectors. It provides a convenient and safe method of performing leak tests of radiographic sources in accordance with NRC regulations, which require such tests at intervals of not more than 6 months.

CONTENTS

Flexible swab holder with swab
Vial of EDTA solution
Plastic Envelope
Mailing Box
Identification Sheet

PROCEED IN THIS MANNER:

1. Be sure source is fully retracted and secured in the projector. (Use a survey meter to be sure that radiation levels are normal.)
2. Remove source guide tube from front of projector or remove shipping plug.
3. Wet the swab with EDTA solution. Shake off excess and insert the swab into the hole in the shield. Wipe the interior of the hole thoroughly by rotating swab holder.
4. Withdraw swab and place in plastic envelope.
5. The swab should now be monitored by turning the survey meter to its most sensitive range. Place the meter in a low background area and move the swab in its plastic envelope to the meter, not the meter to the swab.
6. If there is no indication on the meter, or if the indication is no more than 0.2 mR per hour above background, put the plastic envelope with the swab in the mailing box and mail to Tech/Ops, Incorporated, 40 North Ave., Burlington, Massachusetts 01803. Be sure to fill out and return the identification sheet.
7. If the swab should show more than 0.2 mR per hour, do not mail. Contact Tech/Ops, Inc., for specific instructions.

   NOTE: If the survey meter available does not have the capability of detecting as little as 0.2 mR per hour, ship the wipe-test swab to Tech/Ops, Inc., via express. Do not ship if the radiation from the swab exceeds 2 mR per hour and contact Tech/Ops, Inc., for specific instructions. The wipe-test swab will be subjected to a precise radio-assay when received by Tech/Ops, and a leak-test certificate will be mailed promptly. The NRC requires that this certificate be kept with your records and that it be available for inspection (10 CFR 34.25(c)).

NOTICE

In order to use this Model 518 Leak Test Kit, the user must be specifically licensed to do so in accordance with Title 10, Code of Federal Regulations, Part 34, Paragraph 34.11 (f). If your license does not authorize the use of this leak test kit, an application for a license amendment should be filed on Form NRC-313R with the Materials Licensing Branch, Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards, U. S. Nuclear Regulatory Commission, Washington, DC 20555.

Use of this kit without specific authorization constitutes a violation of U. S. Nuclear Regulatory Commission regulations.

Tech/Ops, Inc.
Burlington, MA

TechOps
40 NORTH AVENUE
BURLINGTON, MA 01803
(617) 272-2000

8503031123

JUL 1984
RECEIVED
QC

40

518 LEAK TEST

Co. Name Struthers Wells Corporation P.O. No. J8406-014

Street 1111 Fourth Avenue NRC ~~or State License No~~ 37-11152-01

City, State Warren, Pennsylvania 16365

Projector Model No. 151 Serial No —

Source Model No. ~~XXXXX~~ 36907 Serial No. C-849 Curies 25

IR-192 ____ CO-60 X CS-137 ____ Other ____

Wipe Performed By C Rowles (C. Rowles) Date 7-10-84

The United States Nuclear Regulatory Commission requires that radiographic sources be tested for evidence of leaking at the time of manufacture and thereafter at not more than six-month intervals.
The amount of removable contamination must not exceed 0.005 microcuries. If the test shows more than 0.005 microcurie of removable contamination, the source and equipment must be immediately taken out of service and be repaired or be disposed of. Please note that this source must be tested again on or before

FOR TECH-OPS USE ONLY

PROCESSED AT TECH/OPS ON 7/26/84
RADIOASSAY <.001 MICROCURIE
TEST PERFORMED BY Alan C.
NEXT LEAK TEST DUE 1-10-85

ORIGINAL

Struthers

SECTION 11

WASTE MANAGEMENT

The disposal of licensed material shall be in accordance with Section 20.301 of 10 CFR Part 20. This licensed material will be disposed of by returning to the original supplier or to another specific licensee authorized to possess the licensed material. Certificates of these transactions shall be maintained on file by Struthers Wells Corporation.

WASTE MANAGEMENT
PAGE 2 OF 3

TO: STRUTHERS WELLS CORP.
P.C. BOX 8
WARREN, PA. 16365

NOV 1984
RECEIVED
Q.C.

SUBJECT: ISOTOPE RECEIPT

ATTACHED PLEASE FIND A COPY OF AN ISOTOPE RECEIPT FOR THE RETURN OF 1 MODEL 500 SU, SN 541 CONTAINING IR 192, SOURCE SN A1-66 RECEIVED AT TECH/OPS, INC ON 10-31-84.

THANK YOU,

DATE 11-1-84

TECH/OPS, INC.
40 NORTH AVENUE
BURLINGTON, MASS 01803
U.S.A.
TEL. 617-272-2000

RECEIVING DEPT.

SALES COPY

Tech/Ops, Inc.

RADIATION PRODUCTS DIVISION

Received From Struther Wells

Address WARREN Date 10/31 19 84

PA

PREPAID ☒

Via Pilot Freight COLLECT ☐

	MODEL 650 Cap. S.N.
1	MODEL 500 SU S/N 541
	CAP S/N AI-66 = 4.6 @ IR192
	SR 4 MR/HR @ 0.2
	SO # 30125

NOV 7 1984

EXPEDITING DEPT.

NOV 1984
RECEIVED
Q.C.

R 11177 E Garvey

RECEIVED BY - SIGNATURE

BETWEEN: William O. Miller, Chief
License Fee Management Branch
Office of Administration

John E. Glenn, Chief
Nuclear Materials Section B
Division of Engineering and
Technical Programs

LICENSE FEE TRANSMITTAL

A. REGION 1

1. APPLICATION ATTACHED

Applicant/Licensee: Struthers Wells Corporation

Application Dated: 9/20/85

Control No.: 104445

License No.: 37-11152-01

2. FEE ATTACHED

Amount: $700.00

Check No.: 9444

3. COMMENTS

$700.00 03310 11/85

Signed Brenda Platchek

Date 10/3/85

B. LICENSE FEE MANAGEMENT BRANCH

1. Fee Category and Amount: 3O ($700)

2. Correct Fee Paid. Application may be processed for:

Amendment _____

Renewal ✓

License _____

Signed [illegible]

Date 10/8/85

NRCM 1 FORM 213