DL-122394_01

NORSHIPCO

NORFOLK SHIPBUILDING & DRYDOCK CORPORATION

P.O. BOX 2100 - 750 WEST 45TH STREET AVENUE
NORFOLK, VIRGINIA 23[illegible]
Cable: NORSHIPCO
Telephone: 804 494 4000

Serial #NSQA-94-1448
December 23, 1994

U.S. Nuclear Regulatory Commission
License Fee and Debt Collection Branch
Division of Accounting and Finance
Office of the Controller
Washington, DC 20555-0001

Attn: Rita Messler
License Fee Analyst

Ref: License No. 45-12042-01
Control No. 256237

Subj: Renewal for Byproduct Material License

Gentlemen:

In response to your request submitted on NRC Form 577, License Fee Requirements, enclosed is our check in the amount of $160.00 for payment of the additional fee for renewal of our Byproduct Material License.

If I can be of further assistance, please contact me at (804) 494-2951.

Very truly yours,

C A Cherry

C. A. Cherry
Quality Assurance Engineer

Enclosure

NRC FORM 577 (10-94)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSE FEE REQUIREMENTS

LICENSE FEE AND DEBT COLLECTION BRANCH
DIVISION OF ACCOUNTING AND FINANCE
OFFICE OF THE CONTROLLER
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001
Attn. RITA MESSIER

Norfolk Shipbuilding & Drydock
Attn: C.A. Cheng
Quality Assurance Engineer
P.O. Box 2100
Norfolk, VA 23501-2100

TYPE OF ACTION

- [ ] NEW LICENSE
- [X] RENEWAL OF LICENSE
- [ ] AMENDMENT TO LICENSE

REQUESTED DATE: 11/21/94

LICENSE NUMBER: 45-12042-01

CONTROL NUMBER: 256237

I. APPLICATION FEE DUE

Your request for a licensing action is subject to the fee(s) in the category(ies) noted below in accordance with Section 170.31 of the enclosed Federal Register notice. Payment of the fee is required prior to the issuance of the license, renewal, or amendment.

FEE CATEGORY	APPLICATION	RENEWAL	AMENDMENT
3O	$	$ 1700	$
	$	$	$
2B	$	$ 160	$
	$	$	$
	$	$	$
	$	$	$
	$	$	$
	$	$	$
	$	$	$
	$	$	$

FEE(s) DUE: $ 3,060
PAYMENT RECEIVED: $ 2,900
AMOUNT DUE: $ 160

- [ ] Your request was received without the prescribed application fee.
- [X] We received your Check No. 1012 in the amount of $ 2900. Payment of the additional fee noted above is required.
- [ ] Your request will increase the scope of your license program. Therefore, your request is subject to the application fee(s) noted above. Refer to Section 170.31 and Footnote 1(d)(2).
- [ ] Your license expired prior to the receipt of your application for renewal. Therefore, your request is subject to the application fee(s) noted above. Refer to Section 170.31 and Footnote 1(a).

MAKE PAYMENT OF THE FEE(S) TO THE U.S. NUCLEAR REGULATORY COMMISSION AND MAIL THE PAYMENT TO THE ADDRESS LISTED AT THE TOP OF THIS FORM. IF WE DO NOT RECEIVE A REPLY FROM YOU WITHIN 30 CALENDAR DAYS FROM THE DATE LISTED BELOW, WE SHALL ASSUME THAT YOU DO NOT WISH TO PURSUE YOUR APPLICATION AND WILL VOID THIS ACTION.

II. FEE NOT REQUIRED

- [ ] Enclosed is Check No. _____ which accompanied your request. The fee is not required because:
  - [ ] We received your Check No. _____ in payment of the fee.
  - [ ] The Licensing staff has informed us that your request is to be considered as a continuation of your request dated _____, Control No. _____
  - [ ] Your request was combined, prior to review, with your _____ request, Control No. _____.

III. CHECK RETURNED

- [ ] Enclosed is Check No. _____ which was returned to us by the bank for:
  - [ ] INSUFFICIENT FUNDS
  - [ ] ACCOUNT CLOSED
  - [ ] OTHER

MAIL THE REPLACEMENT CHECK TO THE ADDRESS LISTED AT THE TOP OF THIS FORM AND REFERENCE THE ABOVE CONTROL NUMBER.

IV. LICENSE ISSUED WITHOUT THE REQUIRED FEE

- [ ] License No. _____, Amendment No. ____, issued on _____ was issued without the required fee being collected. The fee required is noted in Section I of this form.
- [ ] The scope of your licensed program was increased. Therefore, your request is subject to the application fee(s) noted in Section 1 of this form. Refer to Section 170.31 and Footnote 1(d)(2).
- [ ] Because of the urgency of your request, the license was issued without remittance of the prescribed fee noted in Section 1 of this form.

SIGNATURE -- LICENSE FEE ANALYST	LFDCB	LFDCB		DATE
Rita Messier	[illegible]	[illegible]	[illegible]	12/13/94
	12/13/94	12/13/94		

NRC FORM 577 (10-94)

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE ONE

NORFOLK SHIPBUILDING & DRYDOCK CORPORATION
(NORSHIPCO)

INDUSTRIAL RADIOGRAPHY PROCEDURE

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

PREFACE

1 SCOPE

1.1 To establish the standard procedures and responsibilities for the use of Iridium 192 and Cobalt 60 sealed sources when used for Industrial Radiography and to provide stringent safety measures to be observed by the Personnel working with these sources.

1.2 This procedure applies to Industrial Radiography in all areas within the scope of NRC license No. 45-12042-01 issued to NORSHIPCO.

2. REFERENCE

2.1 Title 10 Parts 20, 21, 31, 34, Code of Federal Regulations

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE: ONE

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE ONE
SECTION 1

DUTIES AND RESPONSIBILITIES	LIST OF PERSONNEL
1. OVERALL RESPONSIBILITIES FOR RADIATION PROGRAM	
1.1 Quality Assurance Engineer	C. A. Cherry Phone: 494-2951 Home Phone: 479-0730
2. ADVISER OF INDUSTRIAL RADIOGRAPHY	
2.1 F. W. Duvall	Phone: 494-4343 Home Phone: 482-4016
2.2 C. A. Cherry	Phone: 494-2951 Home Phone: 479-0730
3. GENERAL SUPERVISOR OF WORK	
3.1 Supervisor	L. T. Eure, Jr. Phone: 494-4387 Home Phone: 919-441-9316
4. INTERNAL AUDIT OF SAFETY PHASES OF PROGRAM	
4.1 Quality Assurance Engineer	C. A. Cherry Phone: 494-2951 Home Phone: 479-0730
4.2 Resident Industrial Hygienist/Environmental Safety & Health Engineer	T. L. Beacham Phone: 494-4563 Home Phone: 420-8407
4.3 RADIOACTIVE MATERIAL CONTROL COMMITTEE:	
Resident Industrial Hygienist/Environmental Safety & Health Engineer	T. L. Beacham Phone: 494-4563 Home Phone: 420-8407
4.4 WORKER'S COMPENSATION COORDINATOR	
A. L. Walker	Phone: 494-4575 Home Phone: 482-5907
5. PERSONNEL RADIATION EXPOSURE EVALUATION	
5.1 RADIATION SAFETY OFFICER	McConnell Baker Phone: 494-4388 Home Phone: 545-8942

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE ONE
SECTION 2

Carl A. Cherry

Advisor of Industrial Radiography/Radiographer/Quality Assurance Engineer

Type of Training

1. Principles and Practices of Radiation Protection:

1.1 Where Trained: NORSHIPCO

1.2 Duration Of Training: 25 1/2 years

1.3 On-The-Job (Yes):

1.4 Formal Training (Yes) 390 hours

Experience with Radiation:

2. Isotopes: Iridium 192 & Cobalt 60

2.1 Maximum Amount: Iridium 192 - 100 Curies
Cobalt 60 - 50 Curies

2.2 Where Experience Was Gained: NORSHIPCO

2.3 Duration of Experience: 25 1/2 years

2.4 Type of Use: Industrial Radiography

3. Personnel Training:

3.1 Attended Radiographic Inspector Course conducted by Norfolk Naval Shipyard. A total course hours for Radiographic Inspector is 160 hours. Duration of experience fourteen (14) years.

3.2 Radiological Monitoring for Instructors Course conducted by the Virginia Civil Defense Administration. Total hours of course 40 hours.

3.3 Radiological Defense Officer Course conducted by the Virginia Civil Defense Administration. Total hours of course 40 hours.

3.4 Shelter Management for Instructors conducted by the Virginia Civil Defense Administration. Total hours of course 40 hours.

3.5 Attended seminars on the administration of isotope Radiography Safety Programs. Tech/ops; Time (24) hours.

3.6 Attended classroom and laboratory on leak testing of radioactive sources. Tech/ops time (32) hours.

Carl A. Cherry (cont)

3.7 A.S.N.T Level III Examiner duration of experience ten (10) years.

3.8 Attended seminars on the administration of isotope Radiography Safety Programs. Tech/ops; MAY 1986 (16 hours)

3.9 Attended seminars on the administration of isotope Radiography Safety Programs. RTS Technology, Inc. April 1988, (16 hours)

4. AFFILIATIONS

4.1 American Society for Non-Destructive Testing

4.2 Shipbuilding Council of American - Quality Assurance Subcommittee

4.3 American Society for Quality Control

4.4 South Tidewater Association of Ship Repairers, Inc.

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE ONE
SECTION 2

McConnell Baker
Radiation Safety Officer & Radiographer

Type of Training

1. Principles and Practices of Radiation Protection:

1.1 Where Trained: NORSHIPCO

1.2 Duration Of Training: 27 years

1.3 On-The-Job (Yes):

1.4 Formal Training (Yes) 390 hours

Experience with Radiation:

2. Isotopes: Iridium 192 & Cobalt 60

2.1 Maximum Amount: Iridium 192 - 100 Curies
Cobalt 60 - 50 Curies

2.2 Where Experience Was Gained: NORSHIPCO

2.3 Duration of Experience: 27 years

2.4 Type of Use: Industrial Radiography

3. Personnel Training:

3.1 Attended radiographic interpretation course conducted by Magnaflux Corporation, Chicago Illinois, Classroom and Laboratory Time (40) Hours Duration of Experience eleven (11) years and eleven (11) months. Date, Jan 1977.

3.2 Attended seminar in radiation safety for industrial radiographer. Sponsored by- United States Nuclear Regulator Commission, Atlanta, Georgia. Nov 1978.

3.3 Attended seminar on the administration of Isotopes Radiography safety programs. Technical operations incorporated time (92) hours.

3.4 Attended classroom and laboratory on leak testing of radioactive sources. Tech/ops time (8) hours.

3.5 A.S.N.T Level III Examiner and Radiation Safety Instructor duration of experience fifteen (15) years.

3.6 Radiation Safety Officer duration of experience fifteen (15) years.

3.7 Attended the continuing education course and has satisfactory completed program objectives on the subject of SNT-TC-1A: "Its use and abuse".

McConnell Baker (cont)

3.8 Attended seminars on the administration of isotope Radiography Safety Programs. AMERSHAM. Year and time: October 1993 (20 hours)

3.9 Attended seminar on the administration of Isotope Radiography Safety Programs, RTS Technology, Inc. Year and time: April 1988 (16 hours)

4. AFFILIATIONS

4.1 American Society for Non-Destructive Testing

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE ONE
SECTION 2

Thomas L. Beacham
Resident Marine Chemist

Advisor to Radiations Safety Officer

All sealed source leak testing performed by NORSHIPCO will be monitored by Mr. T. L. Beacham.

The following resume outlines Mr. Beacham's schooling, professional experience, and certification.

Schools

University of Georgia - B. S. Chemistry, 1973
Old Dominion University - M. S. Chemistry, 1975

Experience

Twenty (20) years in Chemistry and related disciplines. Completed graduate courses in radiation theory, applications, and measurements.
Chief analytical chemist for eighteen (18) years.
Member of Marine Chemist Association and American Chemical Society

Certification

Certified by National Fire Protection Association - Marine Chemist #635
Certified by American Board of Industrial Hygiene - CIH #3993

Present Position

Resident Marine Chemist
Chief Analytical Chemist
Resident Industrial Hygienist
Environmental Engineer
Advisor to Radiation Officer

ENCLOSURE ONE
SECTION 2

Frank W. Duvall

Radiographer and Advisor of Industrial Radiography Engineer

Type of Training

1. Principles and Practices of Radiation Protection:

1.1 Where Trained: NORSHIPCO

1.2 Duration Of Training: 26 1/2 years

1.3 On-The-Job (Yes):

1.4 Formal Training (Yes) 390 hours

Experience with Radiation:

2. Isotopes: Iridium 192 & Cobalt 60

2.1 Maximum Amount: Iridium 192 - 100 Curies
Cobalt 60 - 50 Curies

2.2 Where Experience Was Gained: NORSHIPCO

2.3 Duration of Experience: 26 1/2 years

2.4 Type of Use: Industrial Radiography

3. Personnel Training:

3.1 Attended seminar in radiation safety for industrial radiographer. Sponsored by United States Nuclear Regulator Commission, Atlanta, Georgia. Nov 1978.

3.2 A.S.N.T Level III Examiner (Instructor) 10 years Radiation safety Instruction.

3.3 Attended seminars on the administration of isotope Radiography Safety Programs. Tech/ops; Time (72) hours.

3.4 Attended seminars on the administration of isotope Radiography Safety Programs. RTS Technology; NOV 1987 (16 hours)

3.5 Attended seminars on the administration of isotope Radiography Safety Programs. RTS Technology;, JUNE 1989, (16 hours)

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE ONE
SECTION 2

L. T. Eure

Supervisor & Radiographer

Type of Training

1. Principles and Practices of Radiation Protection:

1.1	Where Trained:	NORSHIPCO
1.2	Duration Of Training:	12 years
1.3	On-The-Job (Yes):	
1.4	Formal Training (Yes)	330 hours

Experience with Radiation:

2.	Isotopes:	Iridium 192 & Cobalt 60
2.1	Maximum Amount:	Iridium 192 - 100 Curies Cobalt 60 - 50 Curies
2.2	Where Experience Was Gained:	NORSHIPCO
2.3	Duration of Experience:	12 years
2.4	Type of Use:	Industrial Radiography

3. Personnel Training:

3.1 Attended seminar on the administration of Isotope Radiography Safety Programs. RTS Technology, Inc; APRIL 1988, 16 hours.

3.2 Attended seminar on the administration of Isotope Radiography Safety Programs. RTS Technology, Inc; JUNE 1989, 16 hours.

3.3 Attended seminar on the administration of Isotope Radiography Safety Programs. AMERSHAM; OCT 1993, 20 hours.

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE ONE
SECTION 2

A. P. Nelson, SR.

Radiographer

Type of Training

1. Principles and Practices of Radiation Protection:

1.1	Where Trained:	NORSHIPCO
1.2	Duration Of Training:	14 years
1.3	On-The-Job (Yes):	
1.4	Formal Training (Yes)	390 hours

Experience with Radiation:

2.	Isotopes:	Iridium 192 & Cobalt 60
2.1	Maximum Amount:	Iridium 192 - 100 Curies Cobalt 60 - 50 Curies
2.2	Where Experience Was Gained:	NORSHIPCO
2.3	Duration of Experience:	14 years
2.4	Type of Use:	Industrial Radiography

3. Personnel Training:

3.1 Attended Level I and Level II Ultrasonic Ultrasonics Shear Wave Course Conducted by Krautkramer - Branson, Inc, 80 hours.

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE ONE
SECTION 2

D. E. Williams, Jr.

Radiographer

Type of Training

1.	**Principles and Practices of Radiation Protection:**	
1.1	**Where Trained:**	NORSHIPCO
1.2	**Duration Of Training:**	13 years
1.3	**On-The-Job (Yes):**	
1.4	**Formal Training (Yes)**	330 hours

Experience with Radiation:

2.	**Isotopes:**	Iridium 192 & Cobalt 60
2.1	**Maximum Amount:**	Iridium 192 - 100 Curies Cobalt 60 - 50 Curies
2.2	**Where Experience Was Gained:**	NORSHIPCO
2.3	**Duration of Experience:**	13 years
2.4	**Type of Use:**	Industrial Radiography

ENCLOSURE ONE
SECTION 2

John T. Sires

Radiographer

Type of Training

1.	**Principles and Practices of Radiation Protection:**	
1.1	**Where Trained:**	NORSHIPCO
1.2	**Duration Of Training:**	19 years
1.3	**On-The-Job (Yes):**	
1.4	**Formal Training (Yes)**	390 hours

Experience with Radiation:

2.	**Isotopes:**	Iridium 192 & Cobalt 60
2.1	**Maximum Amount:**	Iridium 192 - 100 Curies Cobalt 60 - 50 Curies
2.2	**Where Experience Was Gained:**	NORSHIPCO
2.3	**Duration of Experience:**	19 years
2.4	**Type of Use:**	Industrial Radiography

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE ONE
SECTION 2

L. Stewart

Radiographer

Type of Training

1.	**Principles and Practices of Radiation Protection:**	
1.1	**Where Trained:**	NORSHIPCO
1.2	**Duration Of Training:**	19 years
1.3	**On-The-Job (Yes):**	
1.4	**Formal Training (Yes)**	390 hours

Experience with Radiation:

2.	**Isotopes:**	Iridium 192 & Cobalt 60
2.1	**Maximum Amount:**	Iridium 192 - 100 Curies Cobalt 60 - 50 Curies
2.2	**Where Experience Was Gained:**	NORSHIPCO
2.3	**Duration of Experience:**	19 years
2.4	**Type of Use:**	Industrial Radiography

ENCLOSURE ONE
SECTION 2

R. Ferguson

Radiographer

Type of Training

1. Principles and Practices of Radiation Protection:

1.1	Where Trained:	NORSHIPCO
1.2	Duration Of Training:	25 years
1.3	On-The-Job (Yes):	
1.4	Formal Training (Yes)	330 hours

Experience with Radiation:

2.	Isotopes:	Iridium 192 & Cobalt 60
2.1	Maximum Amount:	Iridium 192 - 100 Curies Cobalt 60 - 50 Curies
2.2	Where Experience Was Gained:	NORSHIPCO & US NAVY
2.3	Duration of Experience:	25 years
2.4	Type of Use:	Industrial Radiography

3. PERSONNEL TRAINING

3.1 Attended Radiation Safety Course 120 hours US Navy School/SD, CA

3.2 Attended Radiographer Training Class 6904, SD,CA for NSTM 9922 and NAVSHIPS 250-1500-1 120 hours.

ENCLOSURE ONE
SECTION 2

Ronald Speight

Radiographer

Type of Training

1.	Principles and Practices of Radiation Protection:	
1.1	Where Trained:	NORSHIPCO
1.2	Duration Of Training:	16 years
1.3	On-The-Job (Yes):	
1.4	Formal Training (Yes)	390 hours

Experience with Radiation:

2.	Isotopes:	Iridium 192 & Cobalt 60
2.1	Maximum Amount:	Iridium 192 - 100 Curies Cobalt 60 - 50 Curies
2.2	Where Experience Was Gained:	NORSHIPCO
2.3	Duration of Experience:	16 years
2.4	Type of Use:	Industrial Radiography

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE ONE
SECTION 2

A. Lancaster

Radiographer Assistant

Type of Training

1.	**Principles and Practices of Radiation Protection:**	
1.1	**Where Trained:**	NORSHIPCO
1.2	**Duration Of Training:**	6 years
1.3	**On-The-Job (Yes):**	
1.4	**Formal Training (Yes)**	138 hours

Experience with Radiation:

2.	**Isotopes:**	Iridium 192 & Cobalt 60
2.1	**Maximum Amount:**	Iridium 192 - 100 Curies Cobalt 60 - 50 Curies
2.2	**Where Experience Was Gained:**	NORSHIPCO
2.3	**Duration of Experience:**	6 years
2.4	**Type of Use:**	Industrial Radiography

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE ONE
SECTION 3

Outline of Training for Radiographer's Assistants - as Revised

LECTURE AND TRAINING PROGRAM TO READ AS FOLLOWS:

3.1 Fundamentals of radiation safety-minimum (32) thirty-two hours.

3.1.1 Characteristics of gamma radiation.

3.1.2 Units of radiation dose (mrem) and quantity of radioactivity (curie)

3.1.3 Hazards of excessive exposure to radiation. How excessive exposure can occur internal and external exposure, effect on tissue.

3.1.4 Levels of radiation from licensed materials.

3.1.5 Methods of controlling radiation dose.

3.1.5.1 Working time.

3.1.5.2 Working distance.

3.1.5.3 Shielding.

3.2 Radiation detection instrumentation to be used minimum (10) ten hours.

3.2.1 Use of Eberline 130-A and 130-G gamma radiation survey meters.

3.2.2 Operation of radiation survey instruments.

3.2.3 Calibration of survey instruments.

3.2.4 Limitation of survey instruments.

3.2.5 Survey techniques.

3.2.6 Use of radiac instruments.

3.2.7 Establishment of high radiation areas and radiation areas before exposure, by source data survey and monitoring exposure of the source.

3.2.8 Detection of scatter or secondary radiation.

3.2.9 Personnel monitoring device.

3.2.10 Film badges-instruction for wearing, care and purpose.

3.2.11 Pocket dosimeter for wearing, care, reading excessive exposure and changing.

3.2.12 Alarm ratemeter for wearing, care [illegible]

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE ONE
SECTION 3

3.3 Radiographic equipment to be used minimum sixteen (16) hours.

3.3.1 The iridium 192 camera and radiation patterns.

3.3.2 The cobalt calibration kit and radiation patterns.

3.3.3 The radiographic equipment will be by demonstration to all radiographer's assistant by a qualified instructor for training of assistan radiographer's and radiographer.

3.3.4 Radiographer's assistant will be permitted to use radiographic equipment "only" under the "personnel supervision" of a radiographer, at the site where sealed source are being used and when the assistant uses radiographic exposure devices, sealed sources or related source handling tools, or radiation survey instruments in radiography.

3 3.5 Posting and establishing radiation areas.

3.3.6 Proper use of cameras, tubes, collimator and control cables when making exposures.

3.3.7 Monitoring the restricted area.

3.3.8 What constitutes an emergency.

3.3.9 Shielding radioactive source and building where source is stored.

3.4 Instruction and training for previous experience radiographer's assistants minimum (8) hours.

3.4.1 Written examination in the safe handling and use of radioisotopes.

3.4.2 The assistant will be issued and given instruction in NORSHIPCO operating and emergency procedure.

3.4.3 The assistant will be instructed in use of our radiographic equipment as stated in para. 3.3 of this section.

3.4.4 Review NRC standards for protection against radiation 10 CFR part 20 and 10 CFR part 34.

3.5 Refresher training program will be held once annually in radiation safety for all radiographer's assistants and radiographer, minimum 10 hours.

3.6 Re-Instruction on questions missed on all examination. Minimum (1) hour.

3.6.1 All radiographer's assistants and radiographers will be re-instructed and given the corrected answers to all questions missed on all examination, no later than (2) days after the examination.

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE ONE
SECTION 3

3.7 Transportation requirements in transporting radioactive sources. minimum (1) hour.

3.8 Review the requirements of Federal (NRC) regulations. Minimum (6) hours.

3.9 Review NORSHIPCO operating and emergency procedure. Minimum (2) hours.

3.10 Follow up records, keeping for completeness and accuracy of records of exposure, monitoring and dosimeter readings. Minimum (1) hour.

3.11 Training and testing for Radiographer's assistants with no previous experience.

3.11.1 Training period of radiation Safety and Industrial Radiography.

3.11.2 Training time for radiographer's assistants with no previous experience is a minimum of sixty eight hours required for class room lectures, demonstrations and discussions. On the job training shall consist of placing the trainee with a certified radiographer for a minimum of three months. A trainee shall not be designated an assistant to the radiographer on the job until he has shown skill and demonstrated competance and willingness to accept responsibility during the class room lectures, demonstrations and discussions and pass a written examination making a grade of seventy (70) or higher.

SECTION 3

QUESTIONS AND ANSWERS FOR EXAMINATION OF RADIOGRAPHER'S ASSISTANTS IN THE SAFE HANDLING AND THE USE OF RADIOSOTOPES

1. What are the building blocks of the atomic structure?

ANSWER: A. Protrons B. Neutrons C. Electrons

2. What is an isotope?

ANSWER: An element having same number of protons, but different number of neutrons.

3. Does all radiation come from isotopes?

ANSWER: No

4. How is the energy of a radioactive element expressed?

ANSWER: MEV Million Electron Volts

5. What is radioactivty?

ANSWER: Process of spontanious decentragration.

6. Define a Curie.

ANSWER: 37 Billion DPS

7. If you have a radioactive source producing 1000 Ci with a half life of 5.0 years, how many half-lives would pass before the source decayed to 25 Ci?

ANSWER: 5

8. How often should survey meters be calibrated?

ANSWER: Every 3 months.

9. What level of loose radioactivity on surfaces is considered to be contaminated?

ANSWER: .005 Microcurie

SECTION 3

10. What would be the total dose received if an individual were exposed to 10 Rads of gamma, 5 Rads of fast neutrons, and 100 Rads of x-radiation?

ANSWER: 160 Rems

10 Rads gamma	10 x 1 =	10 Rem
5 Rads fast neutron	5 x 10 =	50 Rem
100 Rads x-ray	100 x 1 =	100 Rem
		160

11. What do the letters REM stand for?

ANSWER: A. Roentgen B. Equivalent C. Man

12. Write the stay time formula and determine how long a man could stay in a 600 mr/hr area and not exceed 200 mrem.

ANSWER: $ST = \frac{MPE \times 60\ MIN}{Field\ Strength}$ $ST = \frac{200 \times 60}{600}$ $\frac{200}{60}$ $\frac{12000}{600}$ $600\overline{)12000}$ $\frac{20}{}$

ST = 20 Minutes

13. Write the inverse square law formula and determine the radiation output from a point source at 10 feet, if the source is emitting 250 mr/hr at 1 foot.

ANSWER: $I = Io\left(\frac{do}{d}\right)^2$ $I = 250\ mr/hr\left(\frac{1}{10}\right)^2$

$I = 2.5\ mr/hr$ $I = 250\ mr/hr\ \frac{1}{100}$ $100\overline{)250}$ $\frac{2.5}{}$

$I = \frac{250}{100}$

14. The HVL of lead for Cobalt 60 is ½ inch. How many HVL would be required to reduce the radiation level from a 5 R/hr to 20 mrem/hr?

ANSWER: 8 HVL 5000 mr/hr, (1) 2500, (2) 1250, (3) 625, (4) 312.5

(4) 312.5, (5) 156.25, (6) 78.125, (7) 39.0625, (8) 19.53

15. How many inches of lead would be required to reduce the radiation in example 14?

ANSWER: 4 inches

16. At 10 ft. away from a sealed source, a radiation detector measurers an intensity of radiation of 200 mr/hr. What will be the intensity of radiation 15 ft. away from the same sealed source?

ANSWER: $I_2 = 200 \times \frac{100}{225} = \frac{2000}{225}$ $I_2 = 88$ MR/HR

17. What would be your exposure if you were in a 20 MR/HR radiation area for 5 hours and 15 minutes and would this be a permissible whole body dosage? (E=IT).

ANSWER: E = IT
E = 20 MR/HR x 5 hours and 15 minutes
E = 105 MR and is not a permissible whole body dosage

18. What is a radiation area?

ANSWER: A radiation area is an area in which a body could receive in any one hour dosage in excess of 5 millirems or in 5 consecutive days a dose in excess of 100 millirems

19. What standards govern our protection against radiation?

ANSWER: Nuclear Regulatory Commission Rules and Regulations.

20. When is a person qualified to perform the duties of a Radiographer°s Assistant?

ANSWER: A person is qualified to perform the duties of a radiographer°s assistant when they have shown their knowledge and ability to comply with the rules and regulations of the Nuclear Regulatory Commission in regards to safe handling and use of radioactive materials and when they have demonstrated competence under supervision of certified radiographer in the use of the radiographic exposure devices and survey instruments.

21. What is the permissible whole body dosage of radiation in one week; quarter and one year?

ANSWER: A. One week - (100 Milirems, MR);
B. Quarter Year - (3 Rems, R);
C. One Year - (5 Rems, R)

SECTION 3

22. What is a radiation survey meter?

ANSWER: A radiation survey meter is a meter used only by qualified personnel to measure the existence of radiation levels at various locations while conducting radiography and to determine if any radioactive material is present.

23. What means of personnel monitoring is used to determine the amount of radiation dosage?

ANSWER: Film Badges and Pocket Dosimeters.

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE ONE
SECTION 3A

Outline of Training for Radiographers

LECTURE AND TRAINING PROGRAM TO READ AS FOLLOWS:

3.1 Fundamentals of Radiation Safety-minimum thirty-two (32).

3.1.1 Characteristics of gamma Radiation.

3.1.2 Units of Radiation does (mrem) and quantity of radioactivity (curie)

3.1.3 Hazards of excessive exposure to Radiation. How excessive exposure can occur internal externasl exposure, effect on tissue.

3.1.4 Levels of Radiation from licensed materials

3.1.5 Methods of controlling Radiation dose.

3.1.5.1 Working time.

3.1.5.2 Working Distance.

3.1.5.3 Shielding.

3.2 Radiation detection instrumentation to be used minimum ten (10) hours.

3.2.1 Use of Eberline 130-A and 130-G gamma Radiation survey meters.

3.2.2 Operation of Radiation survey instruments.

3.2.3 Calibration of survey instruments.

3.2.4 Limitation of survey instruments.

3.2.5 Survey Techniques.

3.2.6 Use of Radiac instruments.

3.2.7 Establishment of high Radiation areas and Radiation areas before exposure, by source, by source data survey and monitoring exposure of the source.

3.2.8 Detection of scatter or secondary Radiation.

3.2.9 Personal monitoring devices.

3.2.10 Film badges, instruction for wearing care and purpose.

3.2.11 Pocket dosimeter for wearing, care, readings excessive exposure and charging.

ENCLOSURE ONE
SECTION 3A

3.3 Radiographic equipment to be used minimum sixteen (16) hours.

3.3.1 The Iridium 192 camera and Radiation patterns.

3.3.2 The Cobalt-60 calibrator kit and Radiation patterns.

3.3.3 The Radiographic equipment will be by demonstration to all radiographer's assistant by a qualified instructor for training of assistant Radiographer's and Radiographers.

3.3.4 Radiographer's assistant will be permitted to use Radiographic equipment "only under the personal supervision" of a Radiographer, at the site where sealed sources are being used and when the assistant uses Radiographic exposure devices, sealed sources or related source handling tools, or Radiation survey instruments in Radiography.

3.3.5 Posting and establishing Radiation areas.

3.3.6 Proper use of cameras, tubes, collimators and control cables when making exposure.

3.3.7 Monitoring the restricted area.

3.3.8 What to do in case of an emergency and how and to whom you will report the emergency to.

3.4 Instruction and training for previous experience Radiographer's minimum eight (8) hours.

3.4.1 Written examination in the safe handling and the use of Radio-isotopes.

3.4.2 The Radiographers will be issued and given instruction in NORSHIPCO Operating and Emergency Procedure.

3.4.3 The Radiographer will instructed in use of our Radiographic equipment listed in para. 3.3 of this section.

3.4.4 The Radiographer's will be issued and given instruction in the applicable section of parts 34, 19, 20, and 21 of Federal regulations.

3.4.5 Transportation requirements in transporting Radioactive sources.

3.5 Refresher training program will be held once annually in Radiation safety for all Radiographer and Radiographers assistants minimum ten (10) hours.

3.6 Re-Instruction on questions missed on all examination minimum one (1) hour.

ENCLOSURE ONE
SECTION 3A

3.6.1 All radiographers and Assistant Radiographers will be re-instructed and given the correct answers to all questions missed on all examination, no later than two days after the examination.

3.7 Records, Reports and notification minimum one (1) hour.

3.7.1 Records of surveys and monitoring.

3.7.2 Reports of theft or loss.

3.7.3 Notification of incidents.

3.8 Fundamentals of Radiography minimum two (2) hours.

3.8.1 Sensitivity

3.8.2 Subject contrast.

3.8.3 Radiation Quality.

3.8.4 Type of material.

3.8.5 Thickness differences of specimen.

3.8.6 Scatter radiation.

3.8.7 Selection of film.

3.8.8 Selection of source to film distance.

3.8.9 Selection of Photographic density.

3.8.10 Selection of pentrameters.

3.8.11 Selection of shims.

3.8.12 Screens and cassettes.

3.8.13 Exposure Calculation.

3.9 Training and testing for Radiographer with no previous experience.

3.9.1 Training of Radiation safety and Industrial Radiograph.

3.9.2 Training time for a Radiographer is a minimum of seventy hours required for class room lectures, discussions and on the job training as an assistant for a period of three months.

ENCLOSURE ONE
SECTION 3A

3.10 Method of determining Competence.

3.10.1 A written examination is given to all Radiographer personnel. Those persons making a grade of 70 or higher on this examination, and who are willing to accept the responsibilities of the position, are selected for further training and demstration of competence for qualification as Radiographer.

3.10.2 A Radiographer who is found to be deficient in certain areas is retrained in classroom discussion by their supervisor from time to time on their knowledge and understanding of their method of operation. Alll Radiographers are spot checked on field operation for correct use of remote handling equipment, storage containers and survey meters and for compliance with safety regulations.

SECTION 3A

QUESTIONS AND ANSWERS FOR EXAMINATION OF RADIOGRAPHERS IN THE SAFE HANDLING AND USE OF RADIOISOTOPES

1. Why must we continue to refer to the Rules and Regulations of the Nucelar Regulatory Commission?

ANSWER: Because it is a standard that governs our protection against radiation.

2. Give the permissible exposure to radiation for whole body dose, for one quarter year and one year.

ANSWER: A. One quarter year Three Rems

B. One Year Five Rems

3. What are the three ways of controlling the intensity of radiation?

ANSWER: A. Shielding B. Distance C. Time

4. What by product material is listed on the NRC license of Norfolk Shipbuilding & Drydock Corporation, for the purpose of calibration? also what is the curie strength?

ANSWER: A. Cobalt 60; 15 Millicuries

5. Name three specific training requirements for radiographers prior to assuming the duties of a radiographer?

ANSWER: A. Having training by qualified instructor and radiographer

B. Must show willingness to accept the responsibilities in complying with NRC Safety Rules and Regulations

C. Must demonstrate competence and understanding of the principles in fundamental radiography

6. What unit of exposure is used in measuring the biological effect upon man?

ANSWER: A. Rem (R) B. Millirem (MR)

SECTION 3A

7. What records must a radiographer keep?

ANSWER: Utilization log, daily dosimeter readings, maintenance record, records of restricted areas at each job site, type of source used and serial number, strength of source at time used, records of radiation levels at external surface and three feet from the external surface upon receiving opening and shipping packages of radioactive material.

8. Name four things that would constitute an emergency situation?

ANSWER:
A. Lodging the source in guide tube
B. Malfunction of equipment
C. Misplacement of radioactive source
D. Vehicle accident

9. What are the permissible levels of radiation in an unrestricted area?

ANSWER: 0.5 rem in one calendar year, 2 Millirem in one hour, or 100 Millirem in seven consecutive days.

10. The process wherein radiation passing through a material transfers some or all of its energy to the material is:

ANSWER: Absorption

11. What part does lead foil screens, filtration, masks and diaphrams play in radiography?

ANSWER: The part they play is to reduce scatter radiation.

12. What is radiographic contrasts?

ANSWER: The density difference from one area to another area of the same radiograph.

13. Name four most likely things that would effect the radiographic sensitivity?

ANSWER:
A. Focal spot or physical source size.
B. Type of film
C. Scatter radiation
D. Specimen to film distance

14. What does the image of a lead letter "B" appearing in the radiograph mean?

ANSWER: Back scatter

SECTION 3 A

15. How would you identify a film side penetrament?

ANSWER: By the lead letter "F"

16. Where is the penetrameter normally placed in relation to the weld seam?

ANSWER: Adjacent to the weld

17. What size of penetrament would you use when making exposure, if the plate design thickness is 5/8 inch and specimen thickness is 1 and 1/8 inch?

ANSWER: 1.1 inch penetrament

18. The recording of an x-ray image pattern on a film is called:

ANSWER: Radiography

19. What is the purpose of agitating an x-ray film during development?

ANSWER: To renew the developer at the surface of the film

20. What are the three main steps in processing a radiograph?

ANSWER: A. Developing B. Fixation C. Washing

21. Name three things that would cause film artifacts during processing:

ANSWER: A. Static Electricity B. Pressure Marks C. Developer Scum

22. What should you do after returning an Iridium 192 source to its safe position between exposures?

ANSWER: You should always survey the exposure device and the entire length of the source guide tube with an approved survey meter.

23. Give the shim thickness of like material when making exposure, if design thickness is ½ inch and specimen thickness is 3/4 inch?

ANSWER: The shim thickness is ¼ inch

24. When do you use double wall exposure on a four inch diameter pipe?

ANSWER: Only when you are unable to place film on the inside of pipe.

SECTION 4

DEFINITIONS

RADIATION

Any or all of the following: Alpha rays, beta rays, gamma rays, x-rays, neutrons, high speed electrons, high speed protons, and other atomic particles.

BY-PRODUCT MATERIAL (RADIOISOTOPES)

Any material, except special nuclear materials, yielded in or made radioactive by exposure to the radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material (for example, Cobalt-60 and Iridium-192).

RADIOACTIVE MATERIAL

Any such material whether or not subject to licensing control by the NRC.

SEALED SOURCE

Any radioactive material that is encased in a capsule designed to prevent leakage or escape of the radioactive material.

RADIOGRAPHY

The examination of the structure of materials by non-destructive methods, using sealed sources of radioactive materials or electronic radiation sources.

STORAGE CONTAINER

A device in which sealed sources are transported or stored.

RADIOGRAPHIC EXPOSURE DEVICE

Any instrument containing a sealed source fastened or contained therein, in which the sealed source of shielding thereof may be moved or otherwise changed, from a shielded to unshielded position for purposes of making a radiographic exposure.

RADIOGRAPHER

Any individual who performs or who, in attendance at the site where the sealed source or sources are being used, personally supervises radiographic operations and who is responsible to the licensee for assuring compliance with the requirements of the Code of Federal Regulations, Title 10, Parts 20, 30, 31 and 34 and the conditions of the shipyard's NRC License.

RADIOGRAPHER'S ASSISTANT

Any individual who, under the personal supervision of a radiographer, uses radiographic exposure devices, sealed sources, related handling tools and survey instruments in radiography.

SECTION 4

DEFINITIONS

RESTRICTED AREA

Any area, access to which is controlled by the licensee.

UNRESTRICTED AREA

Any area, entry into which is not controlled by the licensee.

RADIATION AREA

Any area, accessible to personnel, in which there exists radiation originating in whole or in part within radioactive materials or electronic x-radiation devices at such levels that a major portion of the body could receive in any one hour a dose in excess of 5 millirem (5 mr/hr equivalent), or in any 5 consecutive days a dose in excess of 100 millirem (100 mr/hr equivalent).

HIGH RADIATION AREA

Any area accessible to personnel, in which there exists radiation originating in whole or in part within radioactive material or electronic x-radiation devices at such levels that a major portion of the body would receive in any one hour a dose in excess of 100 millirem.

SURVEY

An evaluation or radiation hazards incident to the production, use, release, disposal or presence of radioactive materials or other sources of radiation under a specific set of conditions. When appropriate, such evaluation includes a physical survey of the location of materials and equipment measurements of levels of radiation or concentrations of radioactive material present.

SURVEY METER

An instrument that measures the intensity of radiation (mr/hr or r/hr) at a given location, at an instant of time. Examples of this instrument are Geiger-Mueller Counters and Iron-Chambers.

PERSONNEL MONITORING EQUIPMENT

Devices designed to be worn or carried by an individual for the purpose of measuring the dose received (i.e. film badges, pocket chambers, pocket dosimeter, film rings, etc.)

CURIE

That amount of radioactive material which disintengrates at the rate of 37 billion atoms per second.

SECTION 4

DEFINITIONS

ROENIGEN (r)

That quantity of x or Gamma radiation such that the associated corpuscular emission per 0.001293 gram of air produces, in air, ions carrying 1 electrostatic unit of electricity of either sign. One milliroentgen (mr) is equivalent to 0.00.r.

ROENIGEN EQUIVALENT MAN (rem)

A measure of the dose to body tissue of any ionizing radiation, in terms of its estimated biological effect relative to a dose of 1r of x-rays. One millirem (mrem) is equivalent to 0.001 rem. For x-ray and gamma radiation, 1r = 1 rem = 1 rad.

RADIATION ABSORPTION DOSE (rad)

The dose corresponding to the absorption of 100 crgs per gram of tissue.

10 CER 31. Title 10 Code of Federal Regulations, Part 31.

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE ONE
SECTION 5

5. OPERATING PROCEDURE FOR USE OF POCKET DOSIMETER AND DOSIMETER CHARGE

5.1 PROCEDURE

5.1.1 DOSIMETERS

5.1.1.1 All radiographer and assistants shall wear a pocket dosimeter at all times while performing radiographic operations.

5.1.1.2 Pocket dosimeter, Victoreen 541/A or equivalent, with range of (0) zero to (200) two hundred Milliroentgen will be furnished.

5.1.1.3 Dosimeter are delicate instruments, and should be treated as such. Jarring or dropping the instrument may cause an incorrect reading. If damage to your dosimeter is suspected, notify your supervisor. Should dosimeter be found off scale, you shall consider it to be an emergency situation and the corresponding film badge shall be immediately returned to the supplier for processing.

5.1.1.4 If a dosimeter becomes full discharges, immediately discontinue operation, return the source to its shielded position in exposure device, lock the device and survey the exposure device and the area. Notify your supervisor and he will immediately have your film badge processed to determine if any over exposure has taken place.

5.2 DOSIMETER CHARGES

5.2.1 Insert dosimeter into charging socket.

5.2.2 Hold dosimeter in contact with bottom of socket (Pressure required against spring). Look through dosimeter at hairline and seal.

5.2.3 Turn large knob to adjust dosimeter to zero.

5.2.4 Remove dosimeter from charger and check hairline position by looking through dosimeter at a light source.

5.3 PROCEDURE FOR ISSUANCE AND PROCESSING OF BADGES

5.3.1 Film Badge Issuance

5.3.1.1 Film badges shall be worn by all Radiographer while performing radiographic operations.

5.3.1.2 Each film badge shall be placed in a film badge rack at end of each shift.

5.3.1.3 Radiographic personnel shall not report to a job without their film badge.

5.3.1.4 The film badge is to be worn only by the person to whom it is assigned.

5.3.1.5 A record of each individual's name and the dates he worked in radiography shall be maintained by the Supervisor.

5.3.2 FILM BADGE PROCESSING

5.3.2.1 Film badges shall be returned to NORSHIPCO's Medical Department by the Supervisor the first of each month and the Medical Dept. will sent them to Laddauer Film Badge Service for processing as soon as possible thereafter.

5.4 ALARM RATEMETERS

5.4.1 All Radiographer and assistants shall wear an alarm ratemeter at all times while performing radiographic operations.

5.4.2 The alarm ratemeter will be calibrated at periods not to exceed one year for correct response to radiation.

5.4.3 The alarm ratemeter will be sent back to the manufacturer or some qualified company or person for calibration.

ENCLOSURE ONE
SECTION 6

Conclusion: The sample swipe does not exhibit leak characteristics.

A radionuclide decays at a predicable rate. This can be important as the reference dpm does change with time and new dpm must be calculated. The new rate can be calculated from the following equation:

$\log Ao/At = .3t/T$ where Ao = original activity
At = activity at time t
t = days past since day zero
T = Half life in days

example: How many microcuri.e are left of 50 μci of 35, after 60 days? The T for 35, is 87 days. therefore:

$\log 50/At = (.3)(60)/87 = .206$; since the antilog of .206 = 1.607

$50/At = 1.607$ therefore: At = 31 μci

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ENCLOSURE ONE
SECTION 6

6. PROCEDURE FOR LEAK TESTING RADIOACTIVE SOURCES

6.1 This procedure outlines NORSHIPCO's method of verifying the integrity of sealed radioactive sources. This is required by the United States Nuclear Regulatory Commission under Title 10, Chapter 1, Part 34.11. A list of radioactive exposure devices, sources, and shipping container used by NORSHIPCO is provided:

Manufacturer - Model No-S/N	Sealed Source/Model#
AMERSHAM CORP - 660B-B1265	Irid - 192 (424-9)
Technical Operations - 571-60	Co-60-571 source rod

6.2 Equipment Required

6.2.1 Eblerline count rate meter model E-140N

6.2.2 Hand probe model Hp-210T, thin window pancake type detector.

6.2.3 Sample holder Eberline model SH-4A

6.2.4 Wharman filter paper #1, 4.25 cm disameter

6.2.5 Filter paper holder

6.2.6 Check source

6.3 Leak Test Procedure

6.3.1 Individuals performing a leak test wipe hall wear a film badge and a pocket dosimeter and shall use a calibrated and operable survey meter.

6.3.2 Insure that the source is in its proper storage position by surveying the exterior of the projector.

6.3.3 Remove the storage plug from the projector. (Note: Model 571 is without a storage plug).

6.3.4 Insert the swab into the projector tube by wiping as close to the source as possible. Wipe the end of the storage plug.

6.3.5 Withdraw the swab, check with survey meter and insert into a plastic envelope. Install the storage plug in the projector.

6.3.6 Take a background count, check source count, and swipe test count using the E-140N. record data on NORSHIPCO's CERTIFICATE OF SEALED SOURCE LEAK TEST.

6.3.7 Maintain above reports as required by USNRC.

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE ONE
SECTION 6

6.4 Action

6.4.1 Any test which reveals the presence of 0.005 micro-Curies or more of removable radioactive material shall be considered evidence of leakage. A report shall be filed, within five days of the test, with the below, describing the equipment involved, test results, and corrective action taken.

6.4.1.1 Director of Nuclear Material Safety & Safeguards
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

6.4.1.2 Director of Region II, USNRC
Office of Inspection and Enforcement
101 Marietta Street
Suite 3100
Atlanta, GA 30303

6.4.2 Any contaminated swipe will be stored in the designated leaded cabinet located in the NORSHIPCO Source Storage Building. Amersham-tech/ops notified for final deposition at:

AMERSHAM - CORP
Radiation Products Division
40 South Avenue
Burlington, MA 01803
(617) 272-2000

6.5 Sample Calculation

The following is a description of a sample situation along with the calculation showing conversion of measurements to the required microcurie units:

The source swipe was counted and had a net count rate of 45 cpm. For comparison a reference containing .082 microcurie of CO-60 was counted yielding a new count rate of 14,504 cpm. What is the activity of the source swipe?

By definition one curie will yield 2.22×10^{12} dpm therefore 1 μci = 2.22×10^{6} dpm and .082 μc = 182,040 dpm

Efficiency of meter = cpm/dpm = 14,504/182,040 = .080

In this case the meter counts 8% of the radiation emitted by the reference. It is assumed that the meter will also count 8% of the sample swipe. The count of the sample swipe was 45 cpm. However, if the meter counted 100% of the radiation it would be 45 cpm/.08 or 563 dpm.

Therefore activity of sample swipe = 563/2.22×10^{6} = .000253 μci

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE ONE
SECTION 7

7. Quarterly Internal Inspection System for controlling the receipt, possession and use of Radioactive Material.

7.1 Qualifications and duties of personnel responsible for maintaining control.

7.1.1 Carl A. Cherry, Quality Assurance Engineer and Advisor of Industrial Radiography has the responsibility of seeing that this procedure is adhered to and the following:

7.1.1.1 Inspect survey meters for calibration and condition.

7.1.1.2 Review daily production card and utilization log to insure records are complete.

7.1.1.3 Review daily reports on inspections and maintenance or radiographic exposure devices and storage containers.

7.1.1.4 Review radiation dosimetry report form r.S. Landau, Jr. and Co. to insure permissible accumulated dose has not been exceeded.

7.1.1.5 Review daily dosimeter reading chart and compare with report in 7.1.1.4.

7.1.1.6 Review quarterly inventory report to account for all sealed sources received and possessed.

7.1.1.7 See Table #1 for Qualifications.

7.1.2 Alan Walker - Worker's Compensation Coordinator has the following responsibilities:

7.1.2.1 Inspect shipping containers for proper tagging and any visible defects.

7.1.2.2 Review records of receipts for proper identification from the supplier.

7.1.2.3 Review records of disposal of licensed materials.

7.1.2.4 Inspect storage area for exposure devices as designated in section 1.3.2.5.

7.1.2.5 See Table #2 for qualifications.

7.1.3 Thomas L. Beacham - Environmental Engineer Industrial Hygienist.ha following responsibilities.

7.1.3.1 Inspect locking mechanism to insure proper working order.

7.1.3.2 Inspect source label.

7.1.3.3 Inspect drive cables and housing wear and defects.

7.1.3.4 Inspect cable connector for wear and defects.

7.1.3.5 Inspect crank mechanism, housing wall and drive cable for wear and defects.

7.1.3.6 Inspect source tube for signs of wear and damage.

7.1.3.7 Inspect the on-off indicator for weakness or damage.

7.1.3.8 Inspect source exposure switch for wear and defects.

7.1.3.9 Inspect collimator for damage.

7.1.3.10 See Table #3 for qualifications.

7.2 Control of Use of Radioactive Material.

7.2.1 The Quality Assurance Engineer will monitor the use of radioactive material to ensure that the Commission regulations and Norshipco"s operating and emergency procedures are being adhered to by the radiographer and radiographer's assistants.

7.3 Procedure for recording and reporting deficiencies to appropriate management personnel.

7.3.1 After the audit team has conducted its internal audit, they will compile all deficiencies found.

7.3.2 The inspections shall be recorded on the internal inspection form (See Table #4).

7.3.3 The deficiencies shall be recorded on the internal inspection form (See Table #5).

7.3.4 All deficiencies shall be reported to Mr. J. L. Roper, IV Executive Vice President, Operations and Mr. R. D. Twine, Sr. Vice President of Production along with the recommendations from the audit team on corrective action.

7.4 Education and follow-up program to be used in correcting deficiencies.

7.4.1 Education

7.4.1.1 Individuals who are found to be deficient in certain areas will be retrained and retested in the areas of those deficiencies.

7.4.1.2 Individuals will not be allowed on field operations until they have been retrained and have full knowledge and understanding of method of operation.

7.4.2 Follow-up program.

7.4.2.1 The audit team will follow-up the retraining and retesting of individuals to see that paragraph 7.4.1 is being adhered to.

7.4.2.2 Individuals will be spot checked on field operations for use of equipment and/or record keeping when they are found to be deficient.

TABLE 1

Carl A. Cherry
Quality Assurance Engineer
Advisor of Industrial Radiography

1977-Present Quality Assurance Engineer - NORSHIPCO

1974 Promoted to Assistant to the Foreman of NDT

1972 Passed all tests for Level III Examiner, including RT, MT and PT. Promoted to NDT Supervisor the same year.

1967 Transferred to the Non-Destructive testing Dept.

1961-65 Four year apprenticeship with NORSHIPCO.

TRAINING AND EXPERIENCE WITH RADIATION

1. Principles and Practices of Radiation Protection:

1.1 Where Trained:	NORSHIPCO
1.2 Duration Of Training:	25 1/2 years
1.3 On-The-Job (Yes):	
1.4 Formal Training (Yes)	390 hours

Experience with Radiation:

2. Isotopes:	Iridium 192 & Cobalt 60
2.1 Maximum Amount:	Iridium 192 - 100 Curies Cobalt 60 - 50 Curies
2.2 Where Experience Was Gained:	NORSHIPCO
2.3 Duration of Experience:	25 1/2 years
2.4 Type of Use:	Industrial Radiography

3. Personnel Training:

3.1 Attended Radiographic Inspector Course conducted by Norfolk Naval Shipyard. A total course hours for Radiographic Inspector is 160 hours. Duration of experience fourteen (14) years.

3.2 Radiological Monitoring for Instructors Course conducted by the Virginia Civil Defense Administration. Total hours of course 40 hours.

TABLE 1

Carl A. Cherry

3.3 Radiological Defense Officer Course conducted by the Virginia Civil Defense Administration. Total hours of course 40 hours.

3.4 Shelter Management for Instructors conducted by the Virginia Civil Defense Administration. Total hours of course 40 hours.

3.5 Attended seminars on the administration of isotope Radiography Safety Programs. Tech/ops; Time (24) hours.

3.6 Attended classroom and laboratory on leak testing of radioactive sources. Tech/ops time (32) hours.

3.7 A.S.N.T Level III Examiner duration of experience ten (10) years.

3.8 Attended seminars on the administration of isotope Radiography Safety Programs. Tech/ops; MAY 1986 (16 hours)

3.9 Attended seminars on the administration of isotope Radiography Safety Programs. RTS Technology, Inc. April 1988, (16 hours)

4. AFFILIATIONS

4.1 American Society for Non-Destructive Testing

4.2 Shipbuilding Council of American - Quality Assurance Subcommittee

4.3 American Society for Quality Control

4.4 South Tidewater Association of Ship Repairers, Inc.

TABLE 2

ALAN L. WALKER
WORKER'S COMPENSATION COORDINATOR

SUMMARY OF PROFESSIONAL EXPERIENCE:

1994-Present Workers Compensation Coordinator.

1985 Assistant Director of Material Handling - NORSHIPCO. Responsible for the Storeroom and Toolroom organization including authority for material management which encompasses the handling of all Government property for fixed price and phase maintenance contracts.

1981 Corporate Pilot - NORSHIPCO

1981 Ground and flight training wing aircraft. Obtained commercial and instrument flight ratings.

1980 First Class Machinist - NORSHIPCO

1977 Apprentice Outside Machinist - NORSHIPCO

EDUCATION:

1974 Graduate - Great Bridge High School
1974-77 Old Dominion University
1977-80 NORSHIPCO Apprentice School Graduate
1982 Tidewater Community College - Naval Architecture Course

PROFESSIONAL ACTIVITIES:

American Production and Inventory Control Society (APICS)

TABLE 3

THOMAS L. BEACHAM
Environmental Engineer/Industrial Hygienist

PROFESSIONAL SKILLS:

ENVIRONMENTAL ENGINEER
To ensure that the company is in compliance with all environmental regulations. Developed and presented the NORSHIPCO Environmental Seminar to more than 600 employees.

INDUSTRIAL HYGIENIST
To implement the company Industrial Hygiene Program. Developed and had approved the NORSHIPCO Three Day Asbestos Worker Class and Annual Update Class.

MARINE CHEMIST
To ascertain spaces aboard marine vessels are safe for entry. Responsible for confined space training in shipyard.

SUMMARY OF PROFESSIONAL EXPERIENCE:

11/79- Present — Environmental Engineer/Industrial Hygienist/Marine Chemist NORSHIPCO. Responsible for ensuring company compliance with all environmental regulations pertaining to the operation of the shipyard. Knowledgeable of OSHA, RCRA, CAA, CWA, SARA, and AHERA regulations. Extensive teaching and training responsibilities.

11/75- 11/79 — Chief Analytical Chemist - Union Camp Corporation, Franklin, VA Technical Center. Responsible for developing analytical methodologies to support various engineering groups within the plant. Responsible for maintaining quality control of all incoming raw products.

EDUCATION:

9/73 — University of Georgia, Athens, GA
Major: Chemistry and Zoology

12/75 — Old Dominion University, Norfolk, VA
Major: Chemistry

3/90 — University of Southern California, Los Angeles, CA
Major: Specialist (Industrial Hygiene)

AFFILIATIONS:

12/91- Present — Shipbuilders of America - Active member of the Environment Committee (SP-1) since December 1991

9/81- Present — Marine Chemist Association - Participates in the development of annual training programs for the National Fire Protection Association.

[redacted]

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE TWO

NORFOLK SHIPBUILDING & DRYDOCK CORPORATION
(NORSHIPCO)

OPERATING AND EMERGENCY PROCEDURE

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

OPERATING AND EMERGENCY PROCEDURES FOR RADIOGRAPHER AND RADIOGRAPHER ASSISTANT

ENCLOSURE TWO

Section 1 Operating Procedure for Radiographic

Section 2 Method for Conducting Radiation Survey, Including Transportation Radiation Source

Section 3 Instruction for Posting and Restricting Radiographic Area.

Section 4 Procedure for Transfer of Sealed Radioactive Source from Shipping Container to Exposure Devices

Section 5 Operating Procedure for use of Pocket Dosimeter, Dosimeter Chargers, Film Badges and Alarm Ratemeters

Section 6 Emergency Procedures for Radiographic Personnel

Section 7 Procedure for Inspection and Maintenance of Exposure Devices, Storage Containers and Quarterly Inventory for Seal Sources

Section 8 Record Keeping Maintained by Radiography Personnel

Section 9 Procedure for Shipping Radioactive Source

Sketch Of Storage Building

Table 6 Material Thickness of Half-Valve Shielding

Table 7 Time & Distance for 2 mr/hr Dosage Rate

Table 8 Production Card

Table 9 Daily Report Exposure Devices

Table 10 Dosimeter Reading Chart

Table 11 Production Cards (Example)

Table 12 Example of Half Valve Layers

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE TWO
SECTION 1

OPERATING PROCEDURE FOR RADIOGRAPHIC DEVICE

1.1 General Instructions

1.1.1 Each Radiographic device shall be checked with a Radiation Survey meter before it is put into operation or moved. This is to insure the radiographer that the source is in the device and is in its shielded position.

1.1.2 The radiographic device shall not be moved unless it is locked and its safety plug is inserted.

1.1.3 Lock and put the safety plug in the device immediately after making the last exposure at a given location.

1.1.4 After each exposure, check the device with a survey meter to insure that the device is back in its safe position.

1.1.5 Should the source fail to return to its shielded position within the device, or if any other emergency arises, immediately follow the emergency procedure outlined in Section 6, Sub-section 6.1.1.2 and 6.1.2.2.

1.1.6 All restricted areas shall be established in accordance with the requirements of Section 3, Sub-section 3.1.1.2.

1.1.7 When making radiation survey of Iridium 192, before leaving it in a locked storage area, the radiation should not exceed 50 mr/hr at six (6") inch distance from its surface, when radiographic exposure devices measuring less than four (4") inches from the sealed source storage position to any exterior surface of the device.

1.2 Instructions for use of AMERSHAM Corporation Iridium 192 model 660B

1.2.1 PROCEDURE

1.2.1.1 Establish and post a restricted area as specified in Section 3, Sub-section 3.1.1.2. do this by estimating the radius of the area prior to actual survey; data for making this estimate are given in Section 2, Sub-section 2.1.1 and 2.1.2.

1.2.1.2 Position and secure film.

1.2.1.3 Mark film and marker number locations on part to be inspected.

1.2.1.4 Position free end of source tube or collimator at exposure angle and source to film distance.

1.2.1.5 Straighten our the source guide tube; avoid bends if at all possible, but if bend is required, give it a large radius.

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SECTION 1

1.2.1.6 Position the exposure device at the end of the source tube that it is opposite to that of the exposure or closed end. This position should be as far away from the exposure end as possible.

1.2.1.7 Position and straighten out the control cable. This should be done so that the control end of the cable is as far away from the source tube as possible and behind any on-site shielding.

1.2.1.8 Expose the disconnect on the end of the control cable by running the cable out of its shielding tube about two inches. This can be done by turning the hand crank.

1.2.1.9 Unlock the plug from the exposure device and pull out the disconnect on the end of the pigtail on the source and connect its disconnect to the disconnect on the end of the control cable. If these connectors do not work freely, or if there is any evidence of malfunction, do not use the control cable or source, but lock the exposure device, and report the condition to your supervisor.

1.2.1.10 Connect the control cable into position in the exposure device.

1.2.1.11 Remove the plug from the source tube side of the exposure device and screw the source tube into place. Care will be taken to avoid contamination to the source guide plug.

1.2.1.12 Run the source out to the far end of the source tube. the source is run out the far end of the tube by turning the control crank until it stops and the position indicator light on the hand crank reel shows the source has reached the end of the tube. If for any reason the source cannot be moved to the end of the source tube, do not force it, but return it to its shielded position within the exposure device. Determine and correct the trouble before running the source tube again.

1.2.1.13 In running the source out to its exposure position within the exposure tube, the hand crank should be turned with a rapid steady cranking movement. Rapid cranking is desired because it moves the source from its safe position to its exposed position in the minimum possible time, thereby reducing the in-tube exposure time to the operator and surrounding area.

1.2.1.14 Immediately after the source reaches its exposure position at the end of the Source tube, make a survey of the perimeter of the restricted area with a survey meter, as required by Section 2, Sub-section 2.1.2 and make such adjustments in the perimeter as are required for compliance with the requirements of Section 3, Sub-section 3.1.1.1. The perimeter should be such that no person outside of it will receive a radiation dose of over 2 mr in any one hour period.

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1.2.1.15 Continuous surveillance of the restricted area shall be maintained during each exposure. This surveillance shall be made by the Radiographer and/or his Radiographer's Assistant, and shall be for the purpose of preventing, non-monitored personnel from entering the restricted area. Should an individual disregard their verbal and visual warnings, the Radiographer shall immediately return the source to its safe position in the exposure device, and take the action that is required by Section 6, Sub-section 6.1.3.

1.2.1.16 After the exposure is complete, return the source to its safe position in the exposure device. this is done by turning the control cable crank until it stops.

1.2.1.17 Check the source tube and exposure device with a survey meter to insure that the source has returned to its safe position. Care must be exercised in making this survey because there is the possibility of the source being lodged in the source tube.

1.2.1.18 Lock the exposure device.

1.2.1.19 Remove the film.

1.2.2 Securing Exposure Device After La - Exposure

1.2.2.1 Unthread source tube from front of exposure device.

1.2.2.2 Replace plug in opening that is left on removal od source tube.

1.2.2.3 Remove control cable by unlocking and rotating selector lever on source shield to connect position.

1.2.2.4 Disconnect control cable form pigtail on the source.

1.2.2.5 Replace plug in opening that is left on removal of control cable.

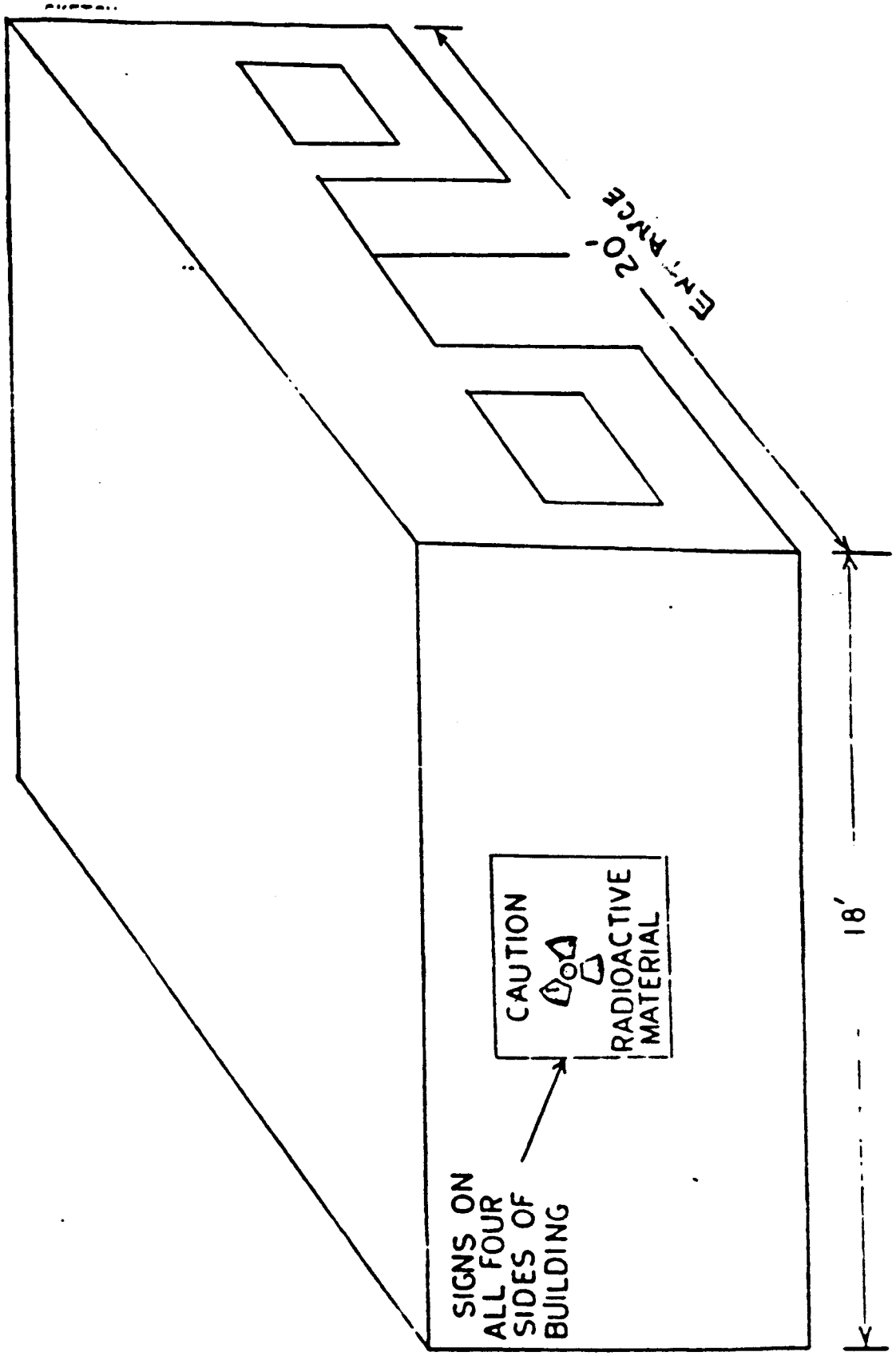
1.2.2.6 Lock the exposure device and remove the key from the lock.

1.2.2.7 Make a radiation survey of the exposure device to insure that the source is in its safe position within the device. The radiation from the device shall be as given in 1.1.7 herein.

1.2.2.8 Return exposure device to safe storage area in the radioactive source storage building located at the far south east end of NORSHIPCO's Berkley plant. Place exposure devices in designated places as shown in Sketch 2. At temporary job site, store exposure device on truck and fasten down to bed of truck. Survey area around storage building and truck so to assure that the radiation does not exceed 2 mr/hr. A record of this survey should be made on the production card.

ENCLOSURE TWO

SECTION 1

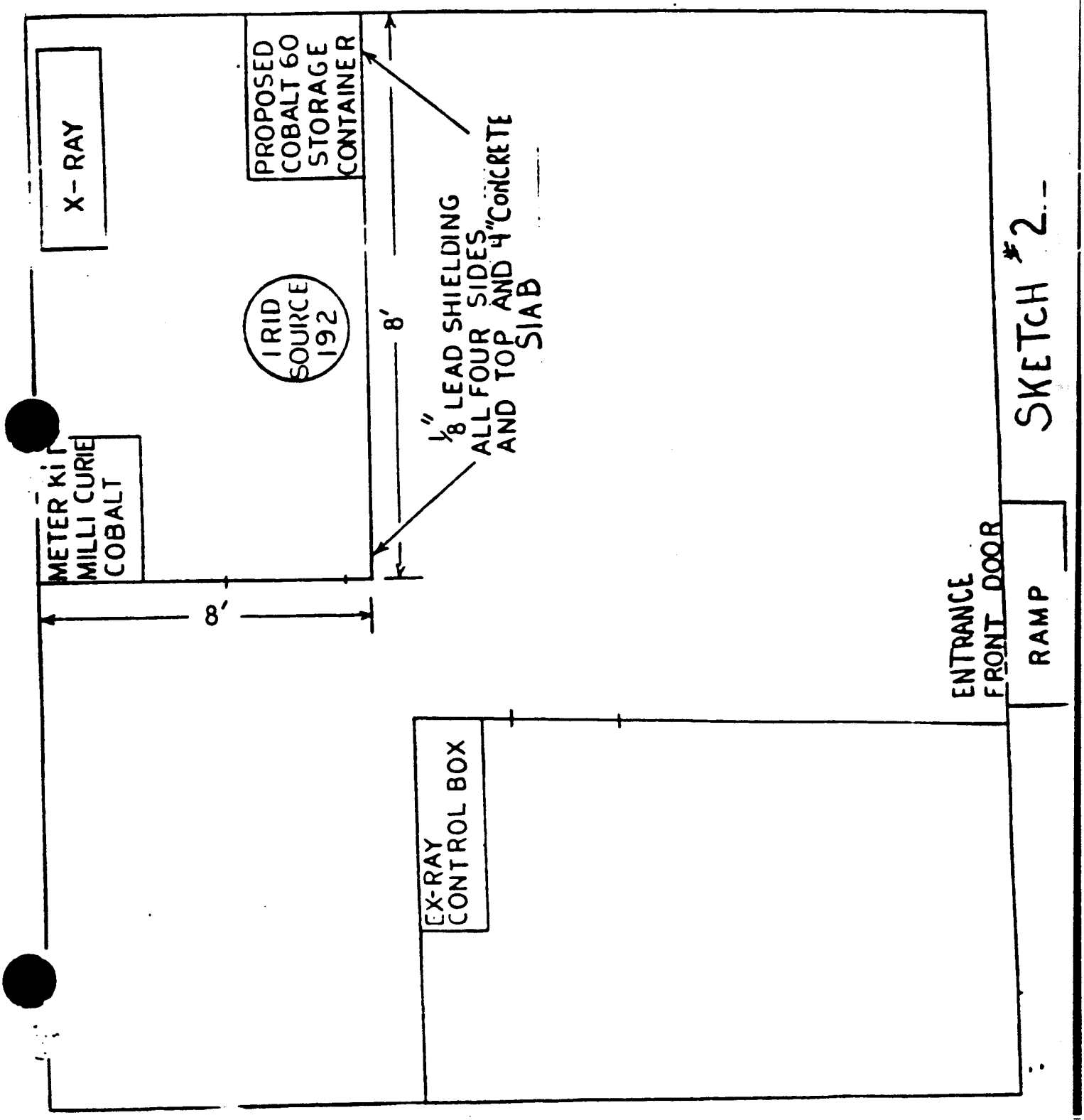


SOURCE STORAGE BUILDING
SKETCH #2

ENCLOSURE TWO

SECTION 1

FLOOR PLAN OF PRESENT RADIOACTIVE SOURCE
STORAGE BUILDING



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ENCLOSURE TWO
SECTION 2

2. METHOD FOR CONDUCTING RADIATION SURVEY

2.1 Restricted Areas shall be established by radiographer and/or radiographer Assistants

Whenever non-monitored personnel could receive a radiation dose of over 2 mr in any one hour period. These areas shall be of two types, one of which is a temporary area that is established without survey meters, and the other is a working or semi-permanent area that is established with survey meters. The only use that shall be made of the temporary area is to establish restricted area perimeters prior to exposure of the source, and in case of an accident in which no operable survey meter is available.

2.1.1 Procedure for Establishing a Temporary Restricted Area

2.1.1.1 Determine the radius of a perimeter around the source at which the rate of radiation will be such that if an individual were continuously present in the area, could result in his receiving a dose in excess of 2 mr/hr calculations of source type, source strength, time and distance.

2.1.1.2 Consider the effects on this radius of time, distance and any on site shielding. Data for the evaluation of these effects are given in Tables 6 and 7 of this enclosure. Table 6 gives the half-value shielding effect of the listed materials. Table 7 gives limiting times and distances that an individual can be exposed to a given source in any one hour and not exceed the permitted 2 mr/hr dosage rate.

2.1.1.3 Rope and post the area in accordance with the requirements of Section 3, Sub-section 3.1.1.2.

2.1.1.4 It shall be the responsibility of the radiographer to control the restricted area when established for short duration exposures by use of distance, on site shielding and survey meter.

2.1.1.5 Instructions to radiographer to insure that this control is maintained will be as follows:

2.1.1.5.1 Establish a temporary restricted area using procedure given in Section 1.1 of this enclosure.

2.1.1.5.2 Expose the source as outlined in Section 1, Sub-section 1.2.

2.1.1.5.3 Survey the perimeter of the temporary restricted area using a survey meter as per Table 7 Section 2.

2.1.1.5.4 Make such adjustments to the perimeter as are necessary to maintain that if an individual were continuously present in the area, could result in his receiving a dose in excess of 2 mr/hr.

Cont On-sight shielding may be used to maintain perimeters using Table 6 of this enclosure for a guide.

2.1.1.5.5 Records of exposure and all survey shall be recorded on Production card provided by this activity. Table 8. A shooting sketch of the location of temporary job sight shall be drawn giving the 2 mr/hr perimeter, source location, and structural objects contained within the radiation area.

2.1.1.5.6 Record all information on Radiation Production card provided (Table 8) including number of exposures, time of each exposures and survey instrument readings.

2.1.1.5.7 Examples: see Tables 11 and 12.

2.1.2 Procedure for Establishing a Working Restricted Area

2.1.2.1 Establish a temporary restricted area using the procedure given in Section 1.1 of this enclosure.

2.1.2.2 Expose the source as outlined in Section 1, Sub-section 1.2.

2.1.2.3 Survey the perimeter of the temporary restricted area using a survey meter.

2.1.2.4 Make such adjustments to the perimeter as are necessary to maintain readings at 2 mr/hr or less, or if this is not practical under the given circumstances, adjust the perimeter for application of short duration exposures. In the latter case refer to table 7 of this enclosure for information on duration exposure times, distance and sources.

2.1.2.5 Record the results of the instrument survey on the Production Card provided, if the perimeter of the restricted area is held at the 2 mr/hr isodose line. If it is held at other than this line, draw a sketch showing the location of the perimeter with respect to the source and recognizable structural objects in or near the restricted area. Record on the sketch the radiation level in mr/hr at personnel passageways, and other areas accessible to personnel where short duration exposure times are employed.

2.1.2.6 If more than one exposure is to be taken connectively in the same area and the material conditions are identical to the first exposure, re-survey of the area between exposure are not necessary. Record the number of exposures made and the total exposure time of each on the production card provided.

2.2 Physical Radiation Survey of Device after Completion of Individual Exposure

2.2.1 Return the source to its safe position within the exposure device.

2.2.2 Approach the device using a survey meter to check the device and the source cable for excessive radiation levels.

2.2.3 After determining that the source is in its safe position within the device, lock the device and remove the key.

2.3 Physical Radiation Survey Prior to Storage of Device After the Last Exposure

2.3.1 Use a survey meter to determine that the source is in its safe position with the exposure device.

2.3.2 Lock the device.

2.3.3 Disconnect source tube and control cable.

2.3.4 Replace its safety plugs.

2.3.5 Return the device to its storage area.

2.3.6 Re-Survey to determine that the Iridium 192 source is in its safe position. The readings on this survey should not exceed 50 mr/hr at six inches from the device if the distance from the sealed source storage position to the exterior of the device is less than four inches, and not over 200 mr/hr at the surface of devices measuring four inches and over from the source storage position to the exterior surface. Should a reading be obtained that is higher than this, the situation should be treated as an emergency.

2.3.7 Record the results of this survey on the Production card provided.

2.4 Vehicle for Transportation Radioactive Sources

2.4.1 Motorized vehicle or hand push cart shall be used in transporting radioactive source within the boundary of NORSHIPCO.

2.4.2 Requirements for transporting sources.

2.4.2.1 Exposure devices and storage container shall be checked with a radiation survey meter by a Radiographer prior to removal from any storage area. The purpose of this check is to insure that the source is in its safe position within the device/container.

2.4.2.2 A Radiographer or Radiographer's Assistant shall be in constant attendance during movement of the device or container.

2.4.2.3 No radioactive device or container shall be moved unless it is locked. All safety plugs shall be inserted before movement.

2.4.2.4 Do not hand carry portable devices and containers long distance because relatively high radiation levels may exist at their surfaces.

2.4.2.5 When transporting a sealed radioactive source, it must be firmly secured inside the vehicle. The securing must be such that the source does not bounce or move around.

2.4.2.6 In compliance with Section 20.1301 of 10 CFR 20 of Part 20 Standards for Protection against Radiation of Rules and Regulations of Nuclear Regulatory Commission, the outer surfaces of the vehicle that is used for transporting radioactive source must be surveyed with a survey meter to assure that the radiation level does not exceed 2 mr/hr. A physical radiation survey must be made after the exposure device is secured in the truck to assure that radiation level inside the passage compartment do not exceed 2 mr/hr.

2.4.2.7 Radioactive source must never be transported outside the shipyard unless accompanied by a Radiographer and a Radiographer's Assistant riding in the vehicle with the source or the Radiographer may accompany the shipment in separate vehicles.

2.4.2.8 The radioactive source must never be transported outside the shipyard unless ascertained that the following equipment is in the transporting vehicle prior to departing for out-of-yard work sites.

2.4.2.8.1 At least two (2) appropriate radiation survey meters which had been calibrated within ninety (90) days from the last day of the series of exposure you are about to make.

2.4.2.8.2 At least 600 foot of rope.

2.4.2.8.3 At least four (4) battery operated red blinker lights and a box of spare batteries.

2.4.2.8.4 At least eight (8) caution radiation area signs.

2.4.2.8.5 At least three (3) "Caution-High Radiation Area Signs."

2.4.2.8.6 Eight (8) stands to use in stringing rope.

2.4.2.8.7 At least two (2) Production cards for each day in the field.

2.4.2.8.8 The exposure device and all related cables.

2.4.2.8.9 Road Flares.

2.4.3 In case of an accident involving a vehicle that is transporting a radioactive source, the emergency procedures specified in Section 6, Sub-section 6.1.5, shall be followed to the fullest extent possible.

STANDARD PROCEDURES NORSHIPCO/RT (REV 7)

ENCLOSURE TWO
SECTION 2

2.5 Instrument

2.5.1 Eberline 130-A & 130-G Gamma Radiographic Survey Meter.

2.6 Calibration of Survey Meter

2.6.1 Each survey meter shall be calibrated at intervals not to exceed three months, and after each meter servicing.

2.6.2 These calibrations shall be made by radiographer of NORSHIPCO and by Eberline Instrument Company after meter servicing.

2.6.3 A record of the last date of each calibration must be maintained by Radiation Safety Officer.

2.6.3.1 Preparation for Use

A. Place the Cobalt 60 Source in a restricted area so that the directional part is aimed horizontally to minimize the effects of scattered radiation, the unit should be at least 16 feet from any wall, in the direction of the primary beam.

B. Position a support 10 feet long horizontally from the T/O 571 Directional Shield.

C. Restrict access to area 10 feet from the container.

2.6.3.2 Survey Meter Calibration

A. On the bottom of the identification label is a dose distance computer. The source size and date of calibration is stamped on the identification label. Follow these steps:

1. Set the age of the source shown on Scale B.

2. Tighten the screws holding the bottom scale. Desired dose rates are shown on Scale C, and you may read the correct distance directly below the dose rate desired.

B. Turn on your survey instrument, let it warm up for about 10 minutes and zero the meter.

C. Turn the range switch to the low range X1 and place the meter at the appropriate distance for a 2.5 mr/hr reading. The survey meter should be located so that the center of the ion chamber is at the correct distance and centered on the center line of the radiation beam. The longest dimension of the ion chamber should be at right angles to the radiation beam. Depending on the physical size and configuration of your survey meter, it may be necessary to mount the 571 source. When the proper geometry for your meter has been established, use the same physical set-up consistently in future calibration operations.

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SECTION 2

D. A maximum dose rate of 1000 mr/hr can be obtained with certain survey meters in contact with the radiation part; however, the physical geometry of some survey meters may lead to incorrect readings at such a close distance. Do not use less distance than the minimum distance which provides the correct maximum dose in accordance with the dose/distance computer. The meter should be placed so that you can read it from a distance without exposing yourself to the primary beam.

E. Stand away from the primary beam and open the source shutter. This may be done by lifting the source rod manually or remotely with a string attached to the source rod. Check the reading on the instrument and then close stored position. If the reading does not agree with ±10% an adjustment is required.

F. Turn the range switch to the next range x10 and place the meter at the appropriate distance for a 25 mr/hr reading, after calculating on this range plus or minus 10%, turn the range switch to the x100 range and place the meter at the appropriate distance for a 250 mr/hr reading, adjust if the reading does not agree with ±10%.

G. On completion of the calibration, the source rod is to be dropped to the closed position, the locking bar insert to prevent source movement and the lock is to be locked.

H. Survey meters which cannot be calibrated should be returned to the manufacturer for repair.

I. Fasten a label to your survey meter indicating the last date of calibration.

SECTION 2

TABLE 6

MATERIAL THICKNESS OF HALF-VALUE LAYER SHIELDING

MATERIAL	APPROX. THICKNESS OF HALF - VALUE LAYER, INCHES		
	IRIDIUM-192	COBALT-60	RADIUM-226
Lead	0.19	0.49	0.56
Brass	0.69	0.79	----
Steel	0.76	0.87	0.91
Concrete	1.90	2.70	2.90
Aluminum	2.18	2.50	2.60

SECTION 2

TABLE 7

REPRESENTATIVE TIMES AND DISTANCES FOR 2 mr/hr DOSAGE RATE

Distance from Source Feet	Exposure Time in Minutes Per Hour for Dose of 2 mr or less Per Hour											
	Iridium 192-Curies						Cobalt 60-Curies					Radium, gm
	10	20	30	60	80	100	15	20	25	30	50	300
10	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	3.8
20	0.8	0.4	0.3	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.1	15.3
30	1.8	0.9	0.6	0.3	0.2	0.1	0.5	0.4	0.3	0.2	0.2	34.4
40	3.2	1.6	1.1	0.5	0.4	0.3	0.9	0.7	0.5	0.4	0.3	60.0
50	5.1	2.5	1.7	0.8	0.6	0.5	1.4	1.1	0.8	0.7	0.4	60.0
60	7.3	3.6	2.4	1.2	0.9	0.7	2.1	1.5	1.2	1.0	0.6	60.0
70	9.9	5.0	3.3	1.6	1.2	1.0	2.8	2.1	1.7	1.4	0.9	60.0
80	12.9	6.4	4.3	2.2	1.6	1.3	3.6	2.7	2.2	1.8	1.1	60.0
90	16.4	8.2	5.5	2.7	2.0	1.6	4.6	3.5	2.8	2.3	1.4	60.0
100	20.2	10.1	6.7	3.4	2.5	2.0	5.7	4.3	3.4	2.9	1.7	60.0
150	45.5	22.7	15.1	7.6	5.7	4.5	12.9	9.1	7.7	6.5	3.9	60.0
200	60.0	60.0	26.9	13.5	10.1	8.1	22.8	17.1	13.7	11.5	6.9	60.0
300	60.0	60.0	60.0	30.3	22.7	18.2	51.4	38.6	30.9	25.9	15.5	60.0

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ENCLOSURE TWO
SECTION 3

3. INSTRUCTIONS FOR POSTING AND RESTRICTING RADIOGRAPHIC AREAS

3.1 Procedures

3.1.1 Restricted Area

3.1.1.1 A restricted area is that area into which a Radiographer and/or his Radiographer's Assistant must control access for purpose of radiation Safety. It shall include those areas that have radiation levels in excess of 2 mr/hr unless short duration exposure times are to be permitted in an area accessible to personnel.

3.1.1.2 The entire restricted area shall be marked with rope and posted with signs bearing the radiation caution sign and the words "Caution, Radiation Area."

3.1.2 Radiation Area

3.1.2.1 Radiation areas are those areas which contain radiation levels that could cause a person to receive over 5 millirem (5 mr equiv.) in any one hour if continuously present in the area. Such areas must be posted with signs bearing the radiation warning sign and the words, "Caution, Radiation Area."

3.1.3 High Radiation Areas

3.1.3.1 High Radiation Areas are those areas that contain radiation levels such that a person continuously preset in the area could receive an exposure of over 100 millirem (100 mr equiv.) in only one hour. The perimeter of this areas must be posted with signs bearing the radiation caution symbol and the words, "Caution, High Radiation Area." These high radiation signs must be posted at the 100 mr/hr isodose line.

3.1.4 Radiation and High Radiation Areas must be posted in the restricted area.

SECTION 4

4. PROCEDURE FOR TRANSFER OF SEALED SOURCES FROM SHIPPING CONTAINERS TO EXPOSURE DEVICES

4.1 This instruction applies to the source changer type of shipping containers.

4.1.1 Locate the source changer near the shielded head of the exposure device.

4.1.2 Position and lay out the control cable of the exposure device.

4.1.3 Run out the disconnect on the end of the control cable about two inches, by turning the control crank at the opposite end of the cable.

4.1.4 Remove the safety plug on the control cable side of the exposure device, and pull out the disconnect on the pigtail of the source.

4.1.5 Connect the disconnect on the end of the control cable with the disconnect on the end of the pigtail of the source.

4.1.6 Attach the control cable adapter to the exposure device.

4.1.7 Remove the plug from the empty chamber in the source changer.

4.1.8 Attach the short source tube that is supplied with the source changer to the inlet to the empty chamber of the source changer.

4.1.9 Remove the safety plug from the source side of the exposure device and connect the free end of the short source tube in its place.

4.1.10 Unlock the exposure device and run the source into the empty chamber of the source changer by turning the hand crank until it stops and the source position indicator shows the source is out of the exposure device.

4.1.11 Check the exposure device and source tube with a survey meter to insure that the source has gone into the source changer.

4.1.12 Detach the source tube from the source changer and disconnect the source from the control cable. Exercise care in this operation and do not pull the disconnect out of the source changer any further than is required to join the disconnects.

4.1.13 Replace the safety plug in the source changer.

4.1.14 Remove the plug from the loaded chamber of the source changer.

4.1.15 Pull out the disconnect on the pigtail of the source in the source changer and connect it to the control cable. Exercise care in this operation and do not pull the disconnect out of the source changer any further than is required to joint the disconnects.

4.1.16 Attach the source cable to the source changer.

4.1.17 Withdraw the source from the source changer and put it in the safe position in the exposure device, by turning the hand crank on the control cable until it stops, and the source position indicator light shows the source is in its stored position.

4.1.18 Check the exposure device and the source tube with a survey meter to insure that the source is in its safe position within the exposure device.

4.1.19 Lock the exposure device.

4.1.20 Remove the source tube from the exposure device and source changer, and insert their safety plugs.

4.1.21 Remove the control cable from the exposure device.

4.1.22 Disconnect the source from the control cable, and insert the safety plug.

4.1.23 Reseal outlets on source changer with lead seal provided.

4.1.24 The replacement of any sealed source fastened to or contained in a radiographic exposure device, leak testing, repair, tagging, opening, or any other modification of any sealed source, shall be performed only by persons specifically authorized to do so.

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ENCLOSURE TWO
SECTION 5

5. OPERATING PROCEDURE FOR USE OF POCKET DOSIMETER AND DOSIMETER CHARGE

5.1 PROCEDURE

5.1.1 DOSIMETERS

5.1.1.1 All radiographer and assistants shall wear a pocket dosimeter at all times while performing radiographic operations.

5.1.1.2 Pocket dosimeter, Victoreen 541/A or equivalent, with range of (0) zero to (200) two hundred Milliroentgen will be furnished.

5.1.1.3 Dosimeter are delicate instruments, and should be treated as such. Jarring or dropping the instrument may cause an incorrect reading. If damage to your dosimeter is suspected, notify your supervisor. Should dosimeter be found off scale, you shall consider it to be an emergency situation and the corresponding film badge shall be immediately returned to the supplier for processing.

5.1.1.4 If a dosimeter becomes full discharges, immediately discontinue operation, return the source to its shielded position in exposure device, lock the device and survey the exposure device and the area. Notify your supervisor and he will immediately have your film badge processed to determine if any over exposure has taken place.

5.2 DOSIMETER CHARGES

5.2.1 Insert dosimeter into charging socket.

5.2.2 Hold dosimeter in contact with bottom of socket (?ressure required against spring). Look through dosimeter at hairline and seal.

5.2.3 Turn large knob to adjust dosimeter to zero.

5.2.4 Remove dosimeter from charger and check hair[illegible]ne position by looking through dosimeter at a light source.

5.3 PROCEDURE FOR ISSUANCE AND [illegible]

5.3.1 Film Badge Issuance

5.3.1.1 Film badges shall be worn by all radiographer while performing radiographic operations.

5.3.1.2 Each film badge shall be [illegible] at end of each shift.

5.3.1.3 Radiographic personnel [illegible] to work without their film badge.

ENCLOSURE TWO
SECTION 5

5.3.1.4 The film badge is to be worn only by the person to whom it is assigned.

5.3.1.5 A record of each individual's name and the dates he worked in radiography shall be maintained by the Supervisor.

5.3.2 FILM BADGE PROCESSING

5.3.2.1 Film badges shall be returned to NORSHIPCO's Medical Department by the Supervisor the first of each month and the Medical Dept. will sent them to Laddauer Film Badge Service for processing as soon as possible thereafter.

5.4 ALARM RATEMETERS

5.4.1 All Radiographer and assistants shall wear an alarm ratemeter at all times while performing radiographic operations.

5.4.2 The alarm ratemeter will be calibrated at periods not to exceed one year for correct response to radiation.

5.4.3 The alarm ratemeter will be sent back to the manufacturer or some qualified company or person for calibration.

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ENCLOSURE TWO
SECTION 6

6. EMERGENCY PROCEDURES FOR RADIOGRAPHIC PERSONNEL

6.1 Procedure

6.1.1 In the event of a shop or ship emergency in an area adjacent to a radiographic device, such as fire or an accident involving personnel, immediately take the following action:

6.1.1.1 Exposure Device can be Operated and Removed from the Danger Area

6.1.1.1.1 Return the source to its shielded position in the exposure device, and lock the device.

6.1.1.1.2 Perform a physical radiation survey of the exposure device to assure that the source is in its shielded position.

6.1.1.1.3 Remove the source tube and control cable, and insert safety plugs.

6.1.1.1.4 Remove device from danger area and if possible, return to its locked storage area.

6.1.1.1.5 Remove all perimeter markings of the restricted radiation area.

6.1.1.1.6 Notify your supervisor.

6.1.1.2 Exposure Device cannot be Operated and Removed from the Danger Area

6.1.1.2.1 Set up a restricted area as specified in Section 3, Sub-section 3.1.1.2 around the device using a survey instrument to determine the area.

6.1.1.2.2 Notify your supervisor.

6.1.1.2.3 Maintain surveillance of the [illegible] relieved by your supervisor.

6.1.1.2.4 Action following this notification will be determined on a case basis by the supervisor.

6.1.2 In the event of an accident to the source or exposure device, such as being hit with fal[illegible] or jolting of the source in the source tube, immediately [illegible]

6.1.2.1 Source can be Returned to its [illegible]

6.1.2.1.1 Return source to its safe [illegible]

6.1.2.1.2 Lock the device.

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6.1.2.1.3 Establish a restricted area around the exposure device as specified in Section 3, Sub-section 3.1.1.2 using a survey meter.

6.1.2.1.4 Maintain surveillance of the restricted area until relieved by your supervisor.

6.1.2.1.5 The supervisor will check the operation and monitor the exposure device to see that it is safe and in proper working order before authorizing its continued use.

6.1.2.1.6 If the exposure device is determined unsuitable for use by your supervisor, return it to the locked storage area, and tag it as being unsuitable for use.

6.1.2.1.7 Do not use the tagged device until it is repaired and released for use by your supervisor.

6.1.2.2 Source cannot be Returned to its Safe Position

6.1.2.2.1 Establish a restricted area around the exposure device as specified in Section 3, Sub-section 3.1.1.2 using a survey meter.

6.1.2.2.2 Notify your supervisor.

6.1.2.2.3 Maintain surveillance of the restricted area until relieved by your supervisor.

6.1.2.2.4 The supervisor shall also personally inspect the exposure site and determine the most practical and safest way to get the source back into its safe position within the exposure device.

6.1.2.2.5 The supervisor shall prepare a record of the incident for files.

6.1.2.2.6 If an individual should receive a radiation dose of 100 mr during the week of the incident, he shall not work with ionizing radiation source until his dosimeter reading is equal to or less than 100 mr per week.

6.1.2.2.7 After source is returned to its safe position in the exposure device, return the device to the safe storage area for a check of its operation and radiation level by your supervisor.

6.1.2.2.8 Do not use the exposure device or tag it until released for use by your supervisor.

ENCLOSURE TWO
SECTION 6

6.1.3 In the Event of an Accident Involving the Exposure of Non-Monitored Personnel to Radiation Immediately take the following Action

6.1.3.1 Return the source to its safe position in the exposure device.

6.1.3.2 Establish a restricted area around the exposure device as specified in Section 3, Sub-section 3.1.1.2 using a survey meter.

6.1.3.3 Maintain surveillance of the restricted area until relieved by your supervisor.

6.1.3.4 Obtain name, badge number, serial number, indicated exposure time and distance from the source of each non-monitored individual involved in the incident.

6.1.3.5 Notify your supervisor.

6.1.3.6 Action following this notification shall be on a case basis and as determined by the supervisor.

6.1.3.7 The supervisor shall prepare a report of the incident for files.

6.1.4 In the Event of Loss of the Source take the Following Action

6.1.4.1 Survey the general area in which the source was being used with a survey meter.

6.1.4.2 If located, establish a restricted area around the source as specified in Section 3, Sub-section 3.1.1.2.

6.1.4.3 Notify your Supervisor.

6.1.4.4 Maintain surveillance over the restricted area until relieved by your supervisor.

6.1.4.5 The supervisor shall also go to the restricted area and determine the most practical and safe way of getting the source back into its shielded position. After making this determination, he shall discuss it with the Radiological Safety Officer.

6.1.4.6 The Supervisor shall prepare a report of the incident for files.

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SECTION 6

6.1.5 <u>In the Event of a Major vehicular Accident Involving a Radioactive Sources, Immediately take the Following Action</u>

6.1.5.1 A restricted area must be established as specified in Section 3, Sub-section 3.1.1.2.

6.1.5.2 If the survey meter is operable, use it to establish the perimeter of the restricted area.

6.1.5.3 If no operable radiation meter is available, and based on the assumption that the source material is an exposed position, and inside the vehicle, the restricted area shall be established through the use of Mathematical Formula Calculations or in the chart shown in Section 3 of this procedure.

6.1.5.4 In the event the driver of the vehicle is seriously injured, the Radiographer or the Assistant shall assist in every possible safe way to remove the driver from the vehicle to the safe established radiation level. The Radiographer or Assistant shall notify civil authorities and upon their arrival assist them of further aid to the injured driver.

6.1.5.5 Maintain complete surveillance of the restricted area until you are sure that the sealed radioactive source is safe in its shielded position. In the case of a minor accident where it can be visually determined that the source is safety stored in its container, no restriction of area is required.

6.1.5.6 If the survey meter is operable and no radiation hazard exists and the vehicle is movable, continue on your way.

6.1.5.7 In any case, immediately after establishing the restricted area, you must notify your supervisor and the local civil authorities.

6.1.6 <u>Notification and Reports of Incidents to N.R.C.</u>

6.1.6.1 After you notify your supervisor about an incident, give him the details about the incident so that the Radiation Protection Officer can notify NRC by telephone or telegraph in accordance with Section 20.2201 and 20.2202 of Part 20 of rules and Regulations of Nuclear Regulatory Commission.

6.1.6.2 Notify your supervisor of over-exposure and excessive levels so that your Radiation Protection Officer can notify NRC in writing within 30 days in accordance with Section 20.2203 of Part 20 od rules and Regulations of Nuclear Regulatory Commission.

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SECTION 6

NAMES AND NUMBERS OF INDIVIDUALS TO CONTACT IN THE EVENT OF AN EMERGENCY.

DUTIES AND RESPONSIBILITIES	**LIST OF PERSONNEL**
1. OVERALL RESPONSIBILITIES FOR RADIATION PROTECTION PROGRAM	
1.1 Quality Assurance Engineer	C. A. Cherry Phone: 494-2951 Home Phone: 479-0730
2. ADVISER OF INDUSTRIAL RADIOGRAPHY	
2.1 F. W. Duvall	Phone: 494-4343 Home Phone: 482-4016
2.2 C. A. Cherry	Phone: 494-2951 Home Phone: 479-0730
3. GENERAL SUPERVISOR OF WORK	
3.1 Supervisor	L. T. Eure, Jr. Phone: 494-4383 Home Phone: 919-441-9316
4. INTERNAL AUDIT OF SAFETY PHASES OF PROGRAM	
4.1 Resident Industrial Hygienist/Environmental Safety & Health Engineer	T. L. Beacham Phone: 494-4563 Home Phone: 420-8407
4.2 Radiation Safety Officer	McConnell Baker Phone: 494-4383 Home Phone: 545-8942

SECTION 7

7. PROCEDURE FOR INSPECTION AND MAINTENANCE OF EXPOSURE DEVICES, STORAGE CONTAINERS AND QUARTERLY INVENTORY FOR SEAL SOURCES

7.1 Procedure for Daily Inspection of exposure devices before using.

7.1.1 Inspect radiographic exposure devices and storage containers before using to assure that all components are there, clean and properly functioning safely.

7.1.2 Inspect control cable before using for signs of damage. Avoid twisting or bending excessively. Recoil control carefully for storage. Avoid all contact with dirty surfaces and do not drag around. Recover control cable plug when not in use.

7.1.3 Inspect source tube before using for signs of damage. Avoid twisting or bending excessively. Recoil source tube carefully for storage.

7.1.4 Inspect batteries and lamps on signal circuit before using for damage or weakness.

7.1.5 Keep records of all daily maintenance inspection on the enclosed form Table 9 for a minimum of two (2) years.

7.2 Procedure for Quarterly Inventory for Sealed Sources

7.2.1 All sealed sources received are documented in the radiostopes security book, records of inventories located in the radiography office of Norfolk Shipbuilding & Drydock Corporation.

7.2.2 All sealed sources are inventoried at time of receiving.

7.2.3 All sealed sources are inventoried every three (3) months thereafter.

7.2.4 All dates of inventory, test, etc. at time of inventory are documented in the radiosotopes security record book.

7.2.5 All sealed sources are located in the radioactive source storage building. See enclosure sketch #2.

7.2.6 The radiation safety officer shall insure that the inventory and documents are made each quarter.

SECTION 8

8. RECORD KEEPING REQUIREMENTS MAINTAINED BY RADIOGRAPHY PERSONNEL

8.1 Procedures

8.1.1 Record both yours and your assistant's daily dosimeter readings at the end of each shift on the daily production card, and daily dosimeter reading chart on the enclosed forms Tables 9 and 10.

8.1.2 Record the survey readings of radioactive sources prior to storage and prior to removing from storage.

8.1.3 Record the restricted areas at each job site.

8.1.4 Record type and strength of source used and the serial number of the source.

8.1.5 Record all radiographs taken on the job.

8.1.6 Record surveys on the enclosed production card, Table 8.

8.1.7 All surveys including those made after each exposure must be recorded, labeled and maintained in the files for inspection upon request of governing bodies of the Nuclear Regulatory Commission.

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SECTION 9

9. PROCEDURE FOR SHIPPING RADIOACTIVE SOURCES

9.1 These Instructions Apply to the Source Changer and Shipping Containers

9.1.1 Shipments will not be made until all test. Certifications, acceptances, and final inspections have been completed.

9.1.2 These test will be accomplished prior to shipping.

9.1.2.1 Leak test of radiographic sources.

9.1.2.2 Leak test of source changer or shipping container.

9.1.3 Attach the identification plate of the old source to the source changer chamber in which the source has been installed.

9.1.4 Survey to insure that the old source is secured in the source changer, the selector ring is in the lock position and the key operated plunger lock is engaged.

9.1.5 Bolt the source changer cover plates in place and seal wire.

9.1.6 Survey all exterior surfaces of the source chamber or shipping container to ensure that the radiation level does not exceed 200 milliroentgen per hour at surface.

9.1.7 Measure the radiation level three feet from all exterior surfaces of the source changer or shipping container and ensure that the radiation level is less than 10 milliroentgen per hour. The maximum radiation level measured three feet from any exterior surface is the transport index. (Example: With a maximum radiation level of 2.2 milliroentgen per hour the transport index ...).

9.1.8 Complete the appropriate "Fill ..." shipping labels. For contents, list the radioisotope ... or Iridium 192. Indicate the activity as the number ... Record the transport index a determined above.

9.1.9 Apply the "Radioactive; shipping ... completed, to two opposite sides of the container.

9.1.10 Make records and retained ... source being shipped are within safe radiation ...

9.1.11 Return the container to the ... (Truck or cargo plane).

SECTION 9

TABLE 8

DATE	SHIFT	SHIP OR PROJECT	CONTRACT NO.	PROD.CARD REF NO.

SOURCE AND SHIELDING

SOURCE		EXPOSURE DEVICE		STORAGE CONTAINER		STRENGTH IN CURIES (AT TIME OF USE)
TYPE	SERIAL NO.	MAKE	MODEL	MAKE	MODEL	

RADIATION SURVEY

EXPOSURE DEVICE		STORAGE CONTAINER		LOCATION OF STORAGE AREA
BEFORE USE	BEFORE SHOT	BEFORE USE	BEFORE SHOT	

NAMES OF RADIOGRAPHER'S ASSISTANT	DOSIMETER READING (mr)	NAMES OF RADIOGRAPHER'S ASSISTANTS	DOSIMETER READING (mr)
1.			
2.			

Notes:

Signature of Radiographer

Dosimeter Reading (mr)

Utilization Log
Radioactive Material

LOW RADIATION AREA	PERIMETER LOCATION #	1	2	3	4	5	6	HIGH RADIATION AREA SHORT DURATION EXPOSURE TIMES	CASSETTE NO.	DISTANCE (ft)	EXPLANATORY NOTES
	Time										
	If OVER 2 MR/HR, REPORT REASON AND JUSTIFICATION, OR SHOW ON SKETCH ON REVERSE										

TOTAL TIME (in Min.) EXPOSED EACH HOUR

EXPOSURE DEVICE SURVEY

EXPOSURE DATA AT VARIOUS TEST LOCATIONS	NO.	TEST LOCATION AREA-SITE-OBJECT	NO. OF [illegible]
	1		
	2		
	3		
	4		
	5		
	6		

[illegible]

[illegible]

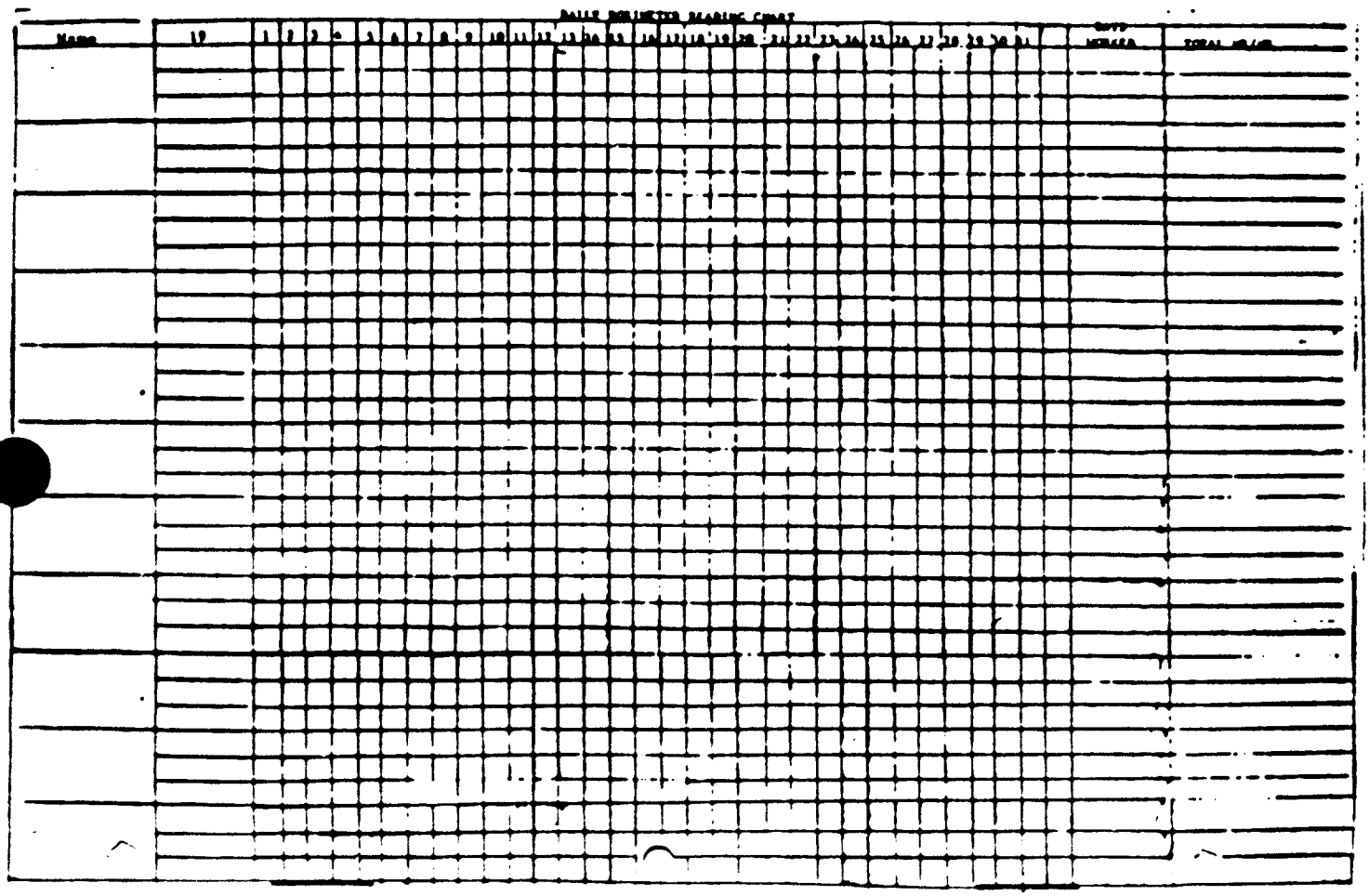
TABLE 8

INSPECTION AND MAINTENANCE OF RADIOGRAPHIC EXPOSURE DEVICES AND STORAGE CONTAINERS

PART	DATE	CONDITION		ACTION TAKEN		REMARKS
SHIELDED STORAGE CONTAINER						
LOCKING MECHANISM						
SOURCE LABEL						
DRIVE CABLES						
DRIVE CABLE HOUSING						
CABLE CONNECTORS						
CRANK MECHANISM						
SOURCE TUBES						
ON-OFF INDICATOR						
SOURCE EXPOSURE SWITCH						
COLLINATOR						
		IRIDIUM 192 MODEL (AMERTEST) 660B	COBALT 60 T/O 571	IRIDIUM 192 MODEL (AMERTEST) 660B	COBALT 60 MODEL T/0571	

SECTION 9

TABLE 10



SECTION 9

TABLE 11

DATE	SHIFT	SHIP OR PROJECT	CONTRACT NO.	PROD CARD REF NO.
9/28/78	1st	USS Hermitage	1100	NSDD 78 2130

SOURCE AND SHIELDING

SOURCE		EXPOSURE DEVICE		STORAGE CONTAINER		STRENGTH IN CURIES (AT TIME OF USE)
TYPE	SERIAL NO.	MAKE	MODEL	MAKE	MODEL	
IRID 192	S 2077	NSDD	Col	Tec/Op	683	42

RADIATION SURVEY

EXPOSURE DEVICE		STORAGE CONTAINER		LOCATION OF STORAGE AREA
BEFORE USE	BEFORE STORING	BEFORE USE	BEFORE STOR.	
0	0	25	25	Yellow House

NAMES OF RADIOGRAPHER'S ASSISTANT	DOSIMETER READING (mr)	NAMES OF RADIOGRAPHER'S ASSISTANTS	DOSIMETER READING (
1. L. A. Stewart	0		
2. W. L. Dorton	0		

Notes:

Signature of Radiographer D E Williams Dosimeter Reading 0 mr)

Utilization Log
Radioactive Material

LOW RADIATION AREA — PERIMETER LOCATION # | 1 | 2 | 3 | 4 | 5 | 6 |
Time/Dose | 2 | 2 | 2 | 2 | 2 | 2 |
IF OVER 2 MR/HR. REPORT REASON AND JUSTIFICATION, OR SHOW ON SKETCH ON REVERSE.

HIGH RADIATION AREA SHORT DURATION EXPOSURE TIMES

CASE NO.	TIME (Sec/Min/Hr)	DISTANCE (FEET)	EXPLANATORY NOTES

TOTAL TIME (in Min.) EXPOSED EACH HOUR 400

EXPOSURE DEVICE SURVEY

1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16

EXPOSURE DATA AT VARIOUS TEST LOCATIONS

NO.	TEST LOCATION AREA-SITE-OBJECT	NO. OF EXPOS
1	Weld Deck Insert Repairs	2
2		
3		
4		
5		
6		

SIGNATURE OF RADIOGRAPHER D E Williams

PRODUCTION CARD FOR RADIOACTIVE MATERIAL

SECTION 9

TABLE 12

EXAMPLE OF HALF VALUE LAYERS