

## MATERIALS LICENSE

Amendment No. 10

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 36, 39, 40, and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee		In accordance with application dated July 14, 1994	
1. Mid American Inspection Services, Inc.		3. License Number 21-26060-01 is renewed in its entirety to read as follows:	
2. 1206 Effie Road Gaylord, MI 49735		4. Expiration Date September 30, 2001	
		5. Docket or Reference No. 030-31160	
6. Byproduct, Source, and/or Special Nuclear Material	7. Chemical and/or Physical Form	8. Maximum Amount that Licensee May Possess at Any One Time Under This License	
A. See Condition 10.	A. Sealed Sources	A. See Condition 10.	
B. Iridium-192	B. Sealed Sources (Spec Mo.G-23)	B. Not to exceed 10 curies per source	
C. Uranium depleted uranium-238	C. Solid metal	C. Not to exceed 999 kilograms total possession limit	
9. Authorized Use:			
A. For use in industrial radiography.			
B. To be used in Gamma Industries Pipliner Model 1 for controlling the movement of Automatic X-ray Crawlers within pipelines during industrial radiographic operations. Source exchange shall be performed by the device manufacturer or other persons specifically authorized to perform such services.			
C. For shielding in exposure devices and source changers.			

CONDITIONS

10. Sealed Sources, Exposure Devices and Source Changers authorized for industrial radiography are as follows:

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9610220337 960920  
PDR ADOCK 03031160  
B PDR

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MATERIALS LICENSE  
SUPPLEMENTARY SHEET

License Number

21-26060-01

Docket or Reference Number

030-31160

Amendment No. 10

<u>Isotope</u>	<u>Maximum Activity Per Sealed Source</u>	<u>Manufacturer's Name and Model No. of Sealed Source</u>	<u>Manufacturer's Name and Model No. of Exposure Device</u>	<u>Manufacturer's Name and Model No. of Source Changer</u>
A. Iridium-192	100 curies	Amersham 89913	Tech/Ops 520	Amersham 650 Gamma Industries C-10 Spec C-1
B. Iridium-192	100 curies	Spec G-3F Spec G-1F Amersham 89911	Gamma Industries Century S	Gamma Industries C-10 Spec C-1 Amersham 650
C. Iridium-192	100 curies	Spec G-3F Amersham 89912	Gamma Industries Century SA	Gamma Industries C-10 Spec C-1 Amersham 650
D. Ir-192	120 curies	Amersham 87703	Industrial Nuclear IR-100	Amersham 650 or 650L
E. Ir-192	120 curies	Amersham 89916	Industrial Nuclear IR-100	Amersham 820
F. Ir-192	100 curies	SPEC G-40 F SPEC G-40T	Industrial Nuclear IR-100	SPEC C-1
G. Ir-192	100 Ci	AMSHM A-424-9	Amersham 660A Amersham 660B Amersham 660 System	AMSHM 650L
H. Ir-192	100 Ci	SPEC T-5 SPEC T-5F	Amersham 660A Amersham 660B Amersham 660 System	SPEC C-1
I. Ir-192	100 curies	Industrial Nuclear 32 or 33	Industrial Nuclear IR-100	Industrial Nuclear IR-50

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**MATERIALS LICENSE  
SUPPLEMENTARY SHEET**

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11. Licensed material may be stored at the licensee's facilities located at 1206 Effie Road, Gaylord, Michigan and may be used at temporary job sites of the licensee anywhere in the United States where the U.S. Nuclear Regulatory Commission maintains jurisdiction for regulating the use of licensed material.
12. The Radiation Safety Officer for this license is Terry Wilkins.
13. Licensed material shall only be used by, or under the supervision and in the physical presence of, individuals who have received the training described in application dated July 14, 1994 and letter dated September 6, 1996 and have been approved in writing by the Radiation Safety Officer.
14. A. Notwithstanding the periodic leak test required by 10 CFR 34.25(b), the requirement does not apply to radiography sources that are stored and not being used. The sources exempted from this test shall be tested for leakage before use or transfer to another person. No sealed source shall be stored for a period of more than 10 years without being tested for leakage and/or contamination.  
B. Sealed sources authorized for a use other than radiography shall be tested for leakage in accordance with 10 CFR 34.25.
15. The licensee is authorized to receive, possess, and use sealed sources of iridium-192 or cobalt-60 where the radioactivity exceeds the maximum amount of radioactivity specified in this license provided:
  - A. Such possession does not exceed the quantity per source specified in Item 8 by more than 20 percent for iridium-192 or 10 percent for cobalt-60; and
  - B. Records of the licensee show that no more than the maximum amount of radioactivity per source specified in this license was ordered from the supplier or transferor of the byproduct material; and
  - C. The levels of radiation for radiographic exposure devices and storage containers do not exceed those specified in 10 CFR 34.21.
16. Sealed sources containing licensed material shall not be opened.
17. The licensee is authorized to transport licensed material only in accordance with the provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."

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MATERIALS LICENSE  
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18. Notwithstanding the requirements of 10 CFR 34.20(a), and pursuant to 10 CFR 34.51, radiographic equipment authorized for use in radiographic operations under this license need not comply with the torque criteria of Section 8.9.2(c) of American National Standard N432-1980.
19. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The U.S. Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.
- A. Application dated July 14, 1994 (with attachments); and
- B. Letters dated November 15, 1994, June 6, 1996 and September 6, 1996.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Date SEP 20 1996

By

Deborah M. Pokura  
Nuclear Materials Licensing Branch, Region III

COPY

(FOR LFMS USE)  
INFORMATION FROM LTS

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: PROGRAM CODE: 03320
: STATUS CODE: 2
: FEE CATEGORY: 30
: EXP. DATE: 19940831
: FEE COMMENTS:
: DECOM FIN ASSUR REGDT N

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## A. REGION

2. FEE ATTACHED  
AMOUNT: \$2,900.00  
CHECK NO.: 4224

### 3. COMMENTS

SIGNED P. Roloff  
DATE 7-20-93

B. LICENSE FEE MANAGEMENT BRANCH (CHECK WHEN MILESTONE 03 IS ENTERED) ☒

1. FEE CATEGORY AND AMOUNT: 30 212 192960<sup>00</sup>
2. CORRECT FEE PAID. APPLICATION MAY BE PROCESSED FOR:  
AMENDMENT  
RENEWAL  
LICENSE

3. OTHER

SIGNED \_\_\_\_\_  
DATE 8/3/94

BY JUL 22 PM 2:18

RECEIVED  
AUG 08 1994  
REGION III

AUG 01 1994

Mid American Inspection Services  
ATTN: Terry F. Wilkins  
President  
650 Alpine Road  
Gaylord, Michigan 49735

Gentlemen:

This refers to your application dated July 15, 1994, for renewal of Materials License 21-26060-01.

We received your check for \$2,900. Your request is subject to renewal fees totalling \$2,960 as specified in fee Categories 30 (\$2,800) and 2B (\$160) of 10 CFR 170.31 of the enclosed July 20, 1993, Federal Register notice. Payment of the additional \$60 fee should be made to the U.S. Nuclear Regulatory Commission and mailed to the following address:

U.S. Nuclear Regulatory Commission  
ATTN: Shirley Crutchfield  
License Fee and Debt Collection Branch, OC/DAF  
Mailstop T-9 E10  
Washington, D.C. 20555

Your application will be processed by the Region III Licensing staff located at 801 Warrenville Road, Lisle, Illinois 60532-4351. The fee, however, is required prior to issuance of the renewal. When submitting the additional fee, please refer to CONTROL NUMBER 397275.

If we do not receive a reply from you within 30 calendar days from the date of this letter, we shall assume that you do not wish to pursue your application and will void this action.

Sincerely,

Signed by Shirley A. Crutchfield

Shirley Crutchfield  
License Fee and Debt Collection Branch  
Division of Accounting and Finance  
Office of the Controller

Enclosure:  
July 20, 1993, Federal Register notice

cc: Region III

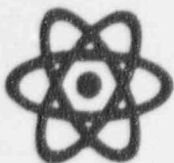
DISTRIBUTION  
Pending Fee File  
OC/DAF R/F  
LFDCB R/F (2)

OFFICE: OC/LFDCB  
NAME: S Crutchfield  
DATE: 7/12/94

OC/LFDCB

~~S Crutchfield~~  
7/12/94

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## MID AMERICAN INSPECTION SERVICES, INC.

NDE Division  
650 Alpine Road  
Gaylord, MI 49735  
(517) 732-8059 Fax (517) 732-0019

July 14, 1994

Nuclear Regulatory Commission  
Region III  
Nuclear Licensing Section  
801 Warrenville Road  
Lisle, IL 60532-4351

SUBJECT: MATERIALS LICENSE RENEWAL

Dear Sir:

Enclosed please find a three part submittal for our license renewal, License Number: 21-26060-01. Also enclosed please find an application and our check in the amount of \$2900.00 (Two Thousand Nine Hundred Dollars), for renewal fee.

If you have any questions regarding this submittal, please contact our office at your convenience.

Thank you for your attention in this matter.

Sincerely,

MID AMERICAN INSPECTION SVCS., INC.

Terry L. Wilkins  
President

TLW/sk

Enclosure

RECEIVED

JUL 18 1994

License Fee Information  
on Application

CONTROL NO.

REGION III  
397275



## APPLICATION FOR MATERIAL LICENSE

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 9 HOURS. SUBMITTAL OF THE APPLICATION IS NECESSARY TO DETERMINE THAT THE APPLICANT IS QUALIFIED AND THAT ADEQUATE PROCEDURES EXIST TO PROTECT THE PUBLIC HEALTH AND SAFETY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (MNBB 7714), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0120), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

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

## APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY  
OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS  
U.S. NUCLEAR REGULATORY COMMISSION  
WASHINGTON, DC 20555-0001

## ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

## IF YOU ARE LOCATED IN:

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

LICENSING ASSISTANT SECTION  
NUCLEAR MATERIALS SAFETY BRANCH  
U.S. NUCLEAR REGULATORY COMMISSION, REGION I  
475 ALLENDALE ROAD  
KING OF PRUSSIA, PA 19406-1410

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

NUCLEAR MATERIALS LICENSING SECTION  
U.S. NUCLEAR REGULATORY COMMISSION, REGION II  
101 MARIETTA STREET, NW, SUITE 2900  
ATLANTA, GA 30323-0199

## IF YOU ARE LOCATED IN:

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

MATERIALS LICENSING SECTION  
U.S. NUCLEAR REGULATORY COMMISSION, REGION III  
801 WARRENVILLE RD.  
LISLE, IL 60532-4351

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

NUCLEAR MATERIALS LICENSING SECTION  
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV  
611 RYAN PLAZA DRIVE, SUITE 400  
ARLINGTON, TX 76011-8064

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

RADIOACTIVE MATERIALS SAFETY BRANCH  
U.S. NUCLEAR REGULATORY COMMISSION, REGION V  
1450 MARIA LANE  
WALNUT CREEK, CA 94596-5368

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

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

- ☐ A. NEW LICENSE  
☐ B. AMENDMENT TO LICENSE NUMBER \_\_\_\_\_  
☒ C. RENEWAL OF LICENSE NUMBER 21-26060-01

## 2. NAME AND MAILING ADDRESS OF APPLICANT (Include Zip code)

Mid American Inspection Services  
650 Alpine Road  
Gaylord, Michigan 49735

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

650 Alpine Road  
Gaylord, Michigan 49735

"Temporary Job Site in States Subject to NRC Regulatory Authority"

## 4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Terry L. Wilkins

TELEPHONE NUMBER  
(517) 732-8059

SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

## 5. RADIOACTIVE MATERIAL

a. Element and mass number; b. chemical and/or physical form; and c. maximum amount which will be possessed at any one time

## 6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED

## 7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE

## 8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS

## 9. FACILITIES AND EQUIPMENT

## 10. RADIATION SAFETY PROGRAM

## 11. WASTE MANAGEMENT

## 12. LICENSEE FEES (See 10 CFR 170 and Section 170.31)

FEE CATEGORY 2-0

AMOUNT  
ENCLOSED \$ 2,900.00

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

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, 36, 39 AND 40, AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF

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

## CERTIFYING OFFICER - TYPED/PRINTED NAME AND TITLE

Terry L. Wilkins, President

## SIGNATURE

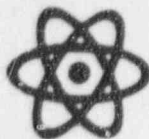
*Terry L. Wilkins*

## DATE

7/15/94

## FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED	CHECK NUMBER	COMMENTS
Renewal	Jul 17	302B	\$2900	4224	4234
APPROVED BY				DATE	
<i>SC</i>				8/3/94	



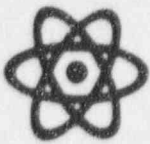
# MID AMERICAN INSPECTION SERVICES, INC.

NDE Division  
650 Alpine Road  
Gaylord, MI 49735  
(517) 732-8059 Fax (517) 732-0019

## INDEX

INTRODUCTION.....	Management Responsibilities
SECTION I.....	Material to be Possessed Reference Item #5
SECTION II.....	Purpose for which licensed Material will be used Reference Item #6
SECTION III.....	Individuals Responsible for Radiation Safety Program Reference Item #7
SECTION IV.....	Training for Individuals Working in or Frequenting Restricted Areas Reference Item #8
SECTION V.....	Facilities and Equipment Reference Item #9
SECTION VI.....	Radiation Safety Program Reference Item #10
SECTION VII.....	Waste Management Reference Item #11
SECTION VIII.....	Forms and Reports

CONTROL NO. 397275



# **MID AMERICAN INSPECTION SERVICES, INC.**

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## INTRODUCTION

## MANAGEMENT RESPONSIBILITIES



## MID AMERICAN INSPECTION SERVICES, INC.

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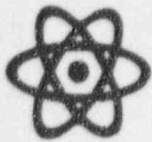
### MANAGEMENT RESPONSIBILITIES

#### PURPOSE:

To assure all individuals involved in the radiography program are properly informed of Company policies and NRC Regulations. And all equipment used is safe for radiography to ensure that all individuals will be protected from the hazards of radiation exposure.

#### SCOPE:

To procure all equipment involved with radiography, including exposure devices, all additional remote handling equipment (control cables, guide tubes, collimators), survey meters, dosimeters, film badges, rate alarms. To insure that maintenance and calibrations are completed and timely. To insure that all individuals are trained in accordance with NRC Regulations, Parts 19, 20, 34 and proper training in the use of radiography equipment and licensed material. To maintain all records pertaining to radiography, survey reports, material transportation reports, calibration records, leak testing, quarterly personnel audits, source shipping and receiving records, radiation incident reports, lost or damaged film badge reports, storage vault survey reports, NRC Form 4 and NRC Form 5. Complete information on training and examinations of each individual involved in program, and to continue training on a periodic basis. And that every individual have copies of Company's Operating and Emergency Procedures along with NRC materials license at any location where radiography is being performed. To guide and direct the day to day operations of the radiography program to assure the safety of all individuals.



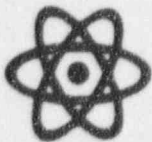
# **MID AMERICAN INSPECTION SERVICES, INC.**

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## **SECTION I**

**MATERIAL TO BE POSSESSED**



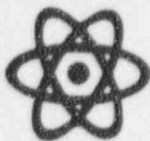


## **MID AMERICAN INSPECTION SERVICES, INC.**

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### ITEM 5 SCOPE

Covers the sources, exposure devices, and source changers. Also names of manufacturer and model numbers, and maximum activity of any source.

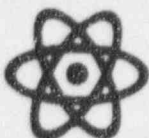


## MID AMERICAN INSPECTION SERVICES, INC.

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### A. Sealed IR-192 sources and exposure devices

MANUFACTURER AND MODEL NO. OF EXPOSURE DEVICES	MANUFACTURER AND MODEL NO. OF SOURCE ASSEMBLIES	MAXIMUM ACTIVITY PER SOURCE (CURIES)
1. Automation Industries Model 520	Tech/Ops Model 866 Gamma Industries B-8-A Gulf Nuclear RAG-17 SPEC Model B-16	100 100 100 100
2. SPEC Model 2-T	Tech/Ops Model 848 Gamma Industries A-2-A Gulf Nuclear RG-13 SPEC Model G-1	100 100 100 100
3. Gamma Industries Model Century S	Tech/Ops Model 848 Gamma Industries A-2-A Gulf Nuclear RG-13 SPEC Model G-1	100 100 100 100
4. Gamma Industries Model Century SA	Tech/Ops Model 848 Gamma Industries A-2-A Gulf Nuclear RGSA-13 SPEC Model G-3	100 100 100 100
5. Gulf Nuclear Model 20V	Tech/Ops Model 848 Gamma Industries A-2-A Gulf Nuclear RG-13 SPEC Model G-1	100 100 100 100



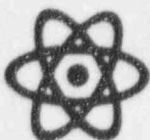
## MID AMERICAN INSPECTION SERVICES, INC.

NDE Division  
650 Alpine Road  
Gaylord, MI 49735  
(517) 732-8059 Fax (517) 732-0019

### ITEM #5

#### A. Sealed IR-192 sources and exposure devices

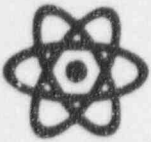
MANUFACTURER AND MODEL NO. OF EXPOSURE DEVICES	MANUFACTURER AND MODEL NO. OF SOURCE ASSEMBLIES	MAXIMUM ACTIVITY PER SOURCE (CURRIES)
1. Automation Industries Model 520	SPEC B-16F Tech/Ops 89913 INC 5 INC 6	100 100 120 100
2. Gamma Industries Model Century S	SPEC G-1F SPEC G-3F Tech/Ops 89911/12 INC 2 Inc 22	100 100 120 100 100
3. Gamma Industries Model Century SA	SPEC G-3F Tech-Ops 89912 INC 8 INC 88	100 120 100 100
4. SPEC Model 2-T	SPEC G-1F SPEC G-3F INC 88 Tech/Ops 89911/12	100 100 100 120
5. Tech/Ops Model 660/660A	SPEC T-5F Tech/Ops 424-9 INC 7	100 120 100



## MID AMERICAN INSPECTION SERVICES, INC.

NDE Division  
650 Alpine Road  
Gaylord, MI 49735  
(517) 732-8059 Fax (517) 732-0019

6.	Tech/Ops Model 660B	SPEC T-5F Tech/Ops 424-9 INC 7	100 140 100
7.	Industrial Nuclear Model IR-100	SPEC G-40F Tech/Ops 89916 INC 32 INC 33	100 120 120 120
8.	SPEC Model SPEC Check I	SPEC G-23	100
9.	Gamma Industries Model Pipeline I	SPEC G-23 Tech/Ops GP	100
10.	SPEC Model SPEC Check II	SPEC G-36	100



## MID AMERICAN INSPECTION SERVICES, INC.

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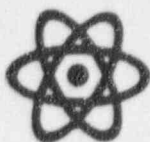
### B. Source Changers to be used with listed IR-192 Sources:

#### MANUFACTURER AND MODEL NO. OF SOURCE CHANGERS

#### MANUFACTURER AND MODEL NUMBER OF SOURCE ASSEMBLIES

- |  |  |
|--|--|
| 1. Tech/Ops<br>Model 650                 | Tech/Ops Models 424-9, 89913, 89911/12<br>89912, 89916<br>SPEC Models B-16F, G1F, G-3F, T-5F<br>G-40F<br>INC Models 2, 5, 6, 7, 8, 22, 32,<br>33, 88     |
| 2. Gamma Industries<br>Model C-10        | Tech/Ops Models 424-9, 89911/12,<br>89912, 89913, 89916<br>SPEC Models G-1F, G-3F, G-40F, B-16F,<br>T-5F<br>INC Models 5, 6, 7, 22, 88, 32, 33           |
| 3. Automation Industries<br>Model 500-SU | Tech/Ops Models 424-9, 89913, 89916<br>89911/12, 89912,<br>SPEC Models G-1F, G-3F, G-40F, B-16F,<br>T-5F<br>INC Models 2, 5, 6, 7, 8, 22, 32,<br>33, 38  |
| 4. Industrial Nuclear<br>Model IR-50     | Tech/Ops Models 424-9, 89911/12, 89912<br>89913, 89916<br>SPEC Models G-1F, G-3F, G-40F, T-5F,<br>B-16F  |
| 5. SPEC                                  | SPEC Models B-16F, G-1F, G-3F, T-5F,<br>G-40F,<br>Tech/Ops Models 424-9, 89911/12,<br>89912, 89913, 89916<br>INC Models 2, 5, 6, 7, 8, 22, 32,<br>33, 88 |





## MID AMERICAN INSPECTION SERVICES, INC.

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### B. Source changers to be used with listed IR-192 sources:

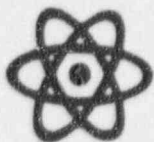
MANUFACTURER AND MODEL NO. OF SOURCE CHANAGERS	MANUFACTURER AND MODEL NUMBER OF SOURCE ASSEMBLIES
---	---

- |  |   |
|--|---|
| 1. Tech/Ops Model 650                    | Tech/Ops Models 848, 866<br>Gamma Industries A-2-A, B-8-A<br>Gulf Nuclear RG-13, RG5A-13,<br>RAG-17<br>SPEC Models G-1, G-3, B-16 |
| 2. Gamma Industries                      | Tech/Ops Models 848, 866<br>Gamma Industries A-2-A, B-8-A<br>Gulf Nuclear RG-13, RG5A-13,<br>RAG-17                               |
| 3. SPEC Model C-1                        | Tech/Ops Models 848, 866<br>Gamma Industries A-2-A, B-8-A<br>Gulf Nuclear RG-13, RG5A-13,<br>RAG-17<br>SPEC Models G-1, G-3, B-16 |
| 4. Automation Industries<br>Model 500 54 | Tech/Ops Models 848, 866<br>Gamma Industries A-2-A, B-8-A<br>Gulf Nuclear RG-13, RG5A-13,<br>RAG-17<br>SPEC Models G-1, G-3, B-16 |

### C. Sealed Cesium - 137 to be used in calibration of dosi- meter pencils.

#### DOSIMETER CALIBRATORS

MODEL NO. AND MANUFACTURER	MAXIMUM CAPACITY (MILLI-CURIES)
DCA Model 3060	10 Milli-Curries
Victoreen Model 06-201	10 Milli-Curries

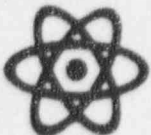


# **MID AMERICAN INSPECTION SERVICES, INC.**

NDE Division  
650 Alpine Road  
Gaylord, MI 49735  
(517) 732-8059 Fax (517) 732-0019

## **SECTION II**

**PURPOSE FOR WHICH LICENSED MATERIAL WILL BE USED**



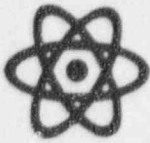
## MID AMERICAN INSPECTION SERVICES, INC.

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650 Alpine Road  
Gaylord, MI 49735  
(517) 732-8059 Fax (517) 732-0019

### ITEM 6

#### I Purpose for which licensed material will be used.

- A. The license has been based on industrial radiography. The use of IR-192 with compatible radiographic exposure devices will be used at temporary job sites throughout the United States.
- B. Source exchangers will be performed at temporary job sites by qualified radiographers after they have been through instructional source exchange practices in accordance with the Operation and Emergency Procedure Manual (Section V). The RSO will be responsible to assure that qualified personnel and the proper procedures are used during any source change activities. All source changers will be provided by manufacturer, and meet any and all specifications required by the NRC.
- C. In house calibration can be done in house or by an authorized outside agency. In house survey meter calibration, and pocket dosimeters shall be performed in accordance with the procedures detailed in the following pages of this section, using Cesium-137 Calibration equipment.



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### DESK TOP DOSIMETER CALIBRATOR

#### PURPOSE:

Pocket dosimeters require calibration at least annually. To assure accuracy of the instrument they must be tested with equipment that permits the evaluation of a dosimeter. All evaluations of dosimeter will be made by the Radiation Safety Officer.

#### SCOPE:

The equipment used for calibration will assist in meeting requirements in Title 10, Chapter 1, CFR Part 34, Section 34.33.

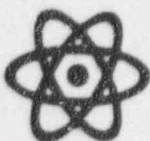
#### A. Operating Instruction - Desk Top Dosimeter Calibrators

1. With dosimeter charger, charge dosimeter with hair line at "0".
2. Place dosimeter in a hole in one of the two radiation levels.
  - a. The two radiation levels are inner holes 8.33 MR/HR, outer holes 2.08 MR/HR.
3. The dosimeter will be exposed in the calibrator as noted below:  
Inner Holes - 6 Hours 50 MR  
Outer Holes - 24 Hours 50 MR
4. Acceptable dosimeters shall read within plus or minus 30 percent of true radiation exposure.
5. Any dosimeter that does not meet the plus or minus 30 percent of radiation exposure will not be used by any individual.

There is a 24 hour DRIFT CHECK. Pencils must be removed from radiation area, sit for 24 hours, read and recorded. They must not drift more than 20% of scale.

Calibrators used will contain approximately 10 milli-curries Cesium 137. Shall be effectively labeled to ensure radiation source awareness.

CONTROL NO. 397275



## **MID AMERICAN INSPECTION SERVICES, INC.**

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### **CESIUM - 137 SURVEY METER CALIBRATION**

#### **PURPOSE:**

Survey meters require calibrations not to exceed 3 month intervals when in use. To assure accuracy of the instrument, they must be tested with equipment that permits the evaluation of the survey meter. All evaluations of survey meters will be made by the Radiation Safety Officer.

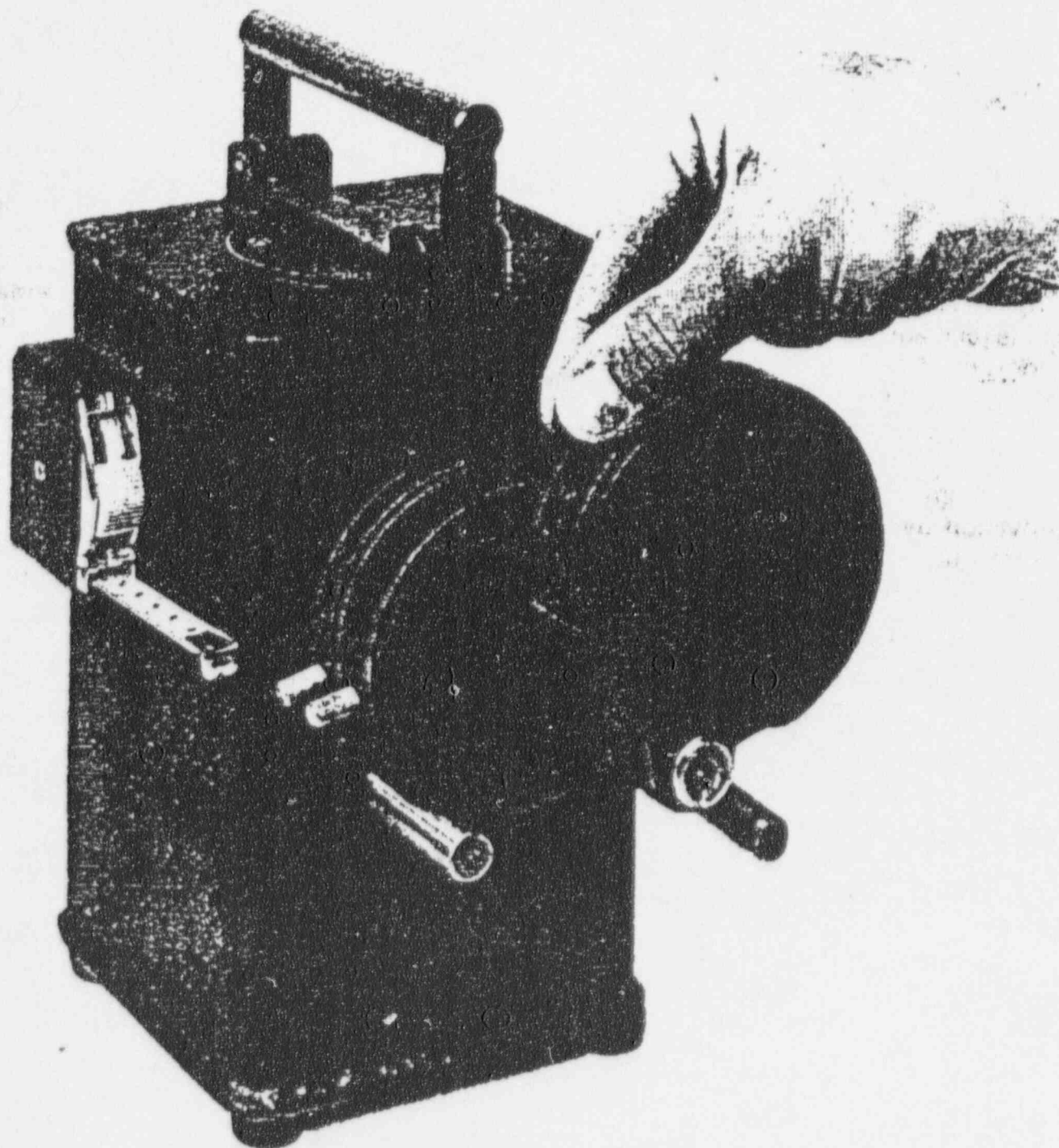
#### **SCOPE:**

The equipment used for calibration will assist in meeting requirements in Title 10, Chapter 1, CFR Part 34, Section 34.43.



# INSTRUMENT CALIBRATOR MODEL 773

## OPERATING MANUAL



**A**mersham

## NOTICE

Model 773 contains a Caesium-137 gamma radiation source.

It must be kept and used only by operators, qualified and licensed in compliance with local and national safety regulations and properly trained in the use of radiation sources for instrument calibration.

Such operators must first read and fully understand this manual BEFORE handling or using the device.

The unit is designed to emit a radiation beam when required for the calibration of radiation meters.

No person should be exposed to the radiation beam because irradiation at close range can cause serious injury.

Operators must wear approved personal dosimeters to monitor any dose received. Any person who has received an irradiation dose in excess of the ICRP recommended limits [currently 50mSv (5R) in any one year, or 30mSv (3R) in a period of 13 weeks] must report this to the local Radiation Protection Officer and seek qualified advice.

Amersham shall not be liable for any errors or omissions contained herein and the provision by Amersham of the information set out in this manual does not in itself constitute acceptance of any liability or responsibility on the part of Amersham.

This manual shows both international SI measurement units and traditional units.

Tech/Ops R P D was acquired by Amersham on 30th June 1986.

## **1. Description**

Model 773 is a portable calibrator intended for calibration of radiation survey instruments. It contains a sealed Caesium-137 gamma source attached to a moveable source rod which is installed in a lead shield. The source is exposed when required by raising the source rod, which positions the source at the apex of a 36 x 20 degree collimated beam port, giving an external radiation beam. This is illustrated in figures 1 and 2.

The unit is equipped with a beam flattening attenuator at the collimator port to produce a radiation field whose intensity is uniform in any plane perpendicular to the beam axis.

Three moveable attenuators with transmissions of 0.25, 0.10 and 0.10 permit a survey meter with three ranges to be calibrated at 20% and 80% of each range without changing the position of the survey instrument.

The unit has a carrying handle which also serves to lock the source in the OFF position to prevent unauthorised use of the calibrator.

A shipping cover disc secures the source during shipment.

## **2. Receiving**

Inspect the package on receipt for signs of external damage. If damage is evident, Amersham should be informed and the carrier should be present while unpacking.

Survey the device with a radiation survey meter and record dose-rates on the receiving report: Radiation levels should not exceed 2mSv/h (200mR/h) at the surface, or 100µSv/h (10mR/h) at a distance of 1 metre from the surface. If the levels exceed these limits, secure the device in a restricted area and notify the Radiation Safety Officer.

Check the source test report and record the isotope, activity, model and serial numbers of the device and then lock it in the Radioactive Material Store.

## **3. Safety precautions**

The Model 773 Calibrator contains a radioactive source which emits penetrating gamma radiation. This radiation can cause injury if the unit is improperly used.

Any service requiring disassembly of the device or removal of the source must only be performed by the manufacturer. Do not remove the safety wire from the 2 screws which secure the source retaining collar.

Although Model 773 (with the source stored) has radiation levels which are well below the maximum permitted for transportation, personnel should not stay close to the device any longer than necessary. For lengthy or repeated measurements, additional shielding should be placed between the Model 773 and the operator to minimize his exposure.

The unit must only be used in the upright position, since it depends upon gravity to return the source to the stored position. Check that the rod holding the source falls back freely each time it is used to ensure that no accidental exposure can occur. If the source fails to return freely, push the rod back down into place.

**Personnel should not enter the area of the radiation beam or expose any part of the body to the radiation beam. Failure to comply will expose them to the risk of radiation injury.**

#### 4. Location

Locate the calibrator in a restricted area in such a way that the radiation beam will be aimed horizontally towards an area from which all personnel can be excluded.

To minimise the effects of scattered radiation, the unit must be placed so that the primary beam does not strike a wall, floor, or ceiling for at least 5 metres.

Place an instrument support in front of the calibrator to locate meters undergoing test at the correct position in the beam (see figures 1 and 2).

The supports must be made of low 'Z' material (plastic or wood) to minimise scatter.

#### 5. Distance calculation

For proper calibration of a linear scaled survey instrument, its response must be determined for two intensities on each of its ranges.

These intensities should be separated by at least 50% of the full scale reading.

Instrument readings must agree with the actual radiation intensity within  $\pm 20\%$  to be in satisfactory calibration.

5.1 Determine the source strength from a decay chart or, use the formula:

$$A = A_0 e^{-kt}$$

where  $A$  = the present activity of the source,  $A_0$  = the activity at the original date when the source was calibrated,  $t$  = the number of months elapsed since source calibration and  $k$  = a decay constant with the value 0.0019186.

5.2 To establish the distance 'D' at which a given unattenuated intensity will occur, use the following formula for SI units:

$$D \text{ (cm)} = 0.929(\text{MBq/mSv/h})^{1/2}$$

where MBq = source strength decayed to the date of use.

mSv/h = desired unattenuated intensity (usually 80% of full scale).

Thus, if the decayed source strength is 5402 MBq (146mCi x 37) and the desired intensity is 8 mSv/h, the distance according to the formula would be:

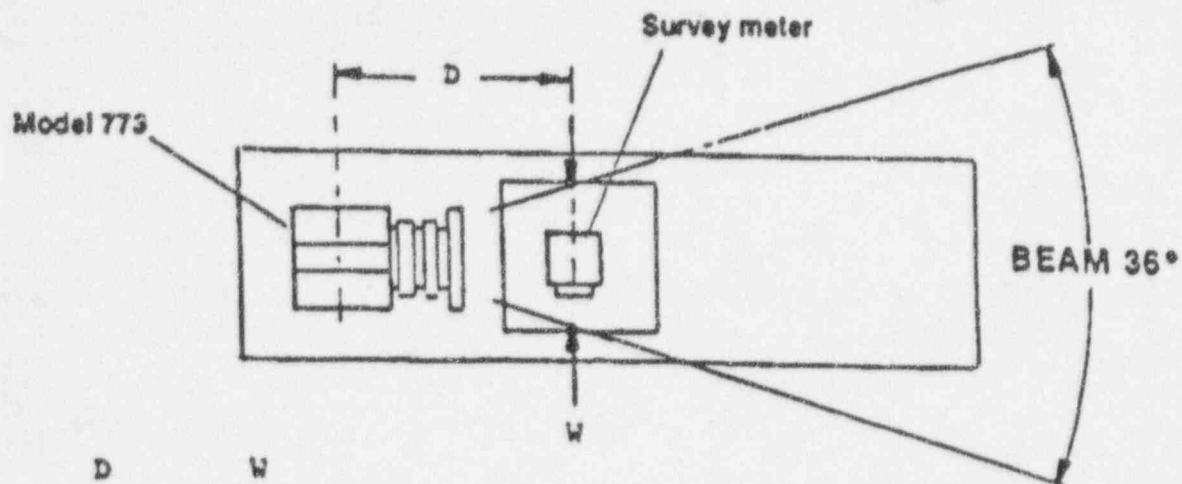
$$D = 0.929(5402/8)^{1/2} = 24.1 \text{ cm.}$$

5.3 For traditional units, use the formula:

$$D \text{ (cm)} = 56.5(\text{mCi/mR/h})^{1/2}$$

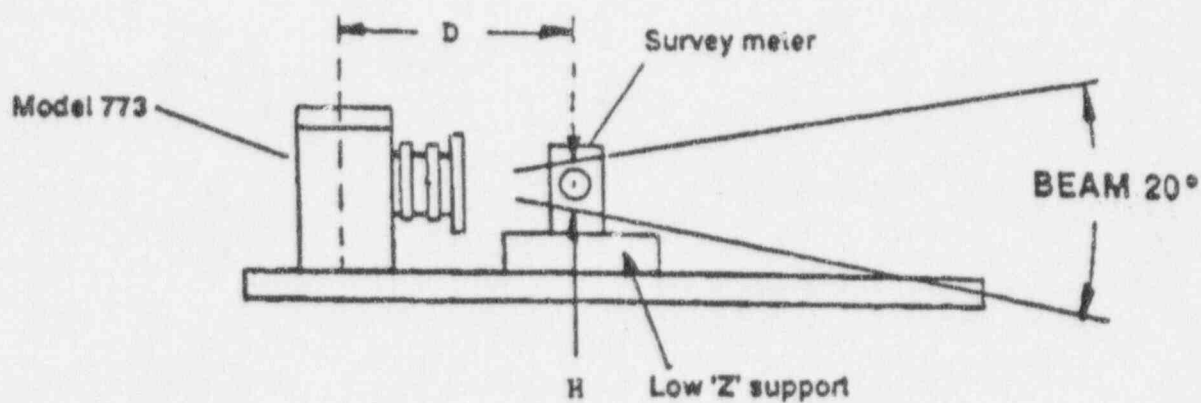
Thus, if the decayed source strength is 146 mCi and the desired intensity is 800 mRh, the distance would be:  $D = 56.5(146/800)^{1/2} = 24.1 \text{ cm.}$





D	W
10 cms	6 cms
20	13
30	19
40	26
50	32
60	39
70	45
80	52

Figure 1



D	H
10 cms	3 cms
20	7
30	10
40	14
50	17
60	21
70	24
80	28

Figure 2



## 6. Calibration

The typical procedure described below assumes that a survey meter with three linear ranges is to be calibrated. The ranges in this example are:

0 to 10 mSv/h (0 to 1000 mR/h)

0 to 1 mSv/h (0 to 100 mR/h)

0 to 0.1 mSv/h (0 to 10 mR/h).

- 6.1 Turn on the survey meter and allow it to "warm up" for 10 minutes.
- 6.2 Determine the activity of the source on the date of use as described in section 5.1.
- 6.3 Calculate the distance from the source at which the radiation intensity would be 80% of full scale deflection (fsd) on the high range from section 5.
- 6.4 Use fig.1 and fig.2 to check that the beam height and width at the calculated distance are sufficient to irradiate the survey meter's detector fully. If not, a lower intensity must be chosen, but the intensity must be at least 50% of fsd (if less than 50%, contact Amersham).
- 6.5 Using the tape measure attached to the Model 773, place the center of the survey meter's detector at the distance and height determined in sections 6.3 & 6.4. The center of the detector is often indicated by marks on the survey meter case.  
Note that the beam axis is centred at 135mm above the base of the 773.
- 6.6 Unlock the handle of the calibrator and remove the shipping plate. Rotate all attenuators out of the radiation beam path, taking care to avoid damaging your fingers.  
Set the survey meter on the high range.
- 6.7 Stand away from the radiation beam and expose the source by raising the source rod until it reaches its internal stop. Use a telescope or CCTV to observe the meter readings without entering the radiation beam.
  - (a) Note and record the survey meter reading.  
Release the source rod and ensure that it drops to the stored position.
  - (b) The meter reading should be 80% ( $\pm 20\%$ ) of full scale deflection (fsd). If not, release the source rod to store the source, adjust the meter sensitivity and repeat the calibration.
- 6.8 Shift the 0.25 attenuator into the beam and repeat step 6.7(a). The reading should be 20% ( $\pm 20\%$ ) of fsd (ie.  $0.25 \times 80\%$ ). Adjust the sensitivity if necessary, after releasing the source rod to store the source.
- 6.9 Set the meter on its middle range. Remove the 0.25 attenuator and place a 0.10 attenuator in the beam. Repeat step 6.7; the reading should be 80% ( $\pm 20\%$ ) of fsd.
- 6.10 Add the 0.25 attenuator to the 0.10 attenuator in the beam and repeat step 6.7(a). The reading should be 20% ( $\pm 20\%$ ) of fsd.
- 6.11 Set the meter on its low range. Remove the 0.25 and place both of the 0.10 attenuators in the beam. Repeat step 6.7; the reading should be 80% ( $\pm 20\%$ ) of fsd.
- 6.12 Place all three attenuators in the beam and repeat step 6.7(a). The reading should be 20% ( $\pm 20\%$ ) of fsd.

Should the desired readings not be attainable by adjustment of the sensitivity control, the survey meter should be repaired by a qualified technician and recalibrated before use.

After calibration is complete, close and lock the calibrator handle to prevent unauthorized use.

## 7. Leak testing

Model 773 Calibrator contains a sealed Caesium-137 source.

The source must be leak tested at intervals as required by local or national legislation.

The following procedure should be used:

- (a) Place the Model 773 calibrator in a restricted area.
  - (b) Unlock the calibrator and remove the shipping cover.
  - (c) Set a survey meter on its most sensitive range in a low background area away from the calibrator.
  - (d) Moisten a leak test swab with ethanol or water.
  - (e) Wipe around the knob of the source rod.
  - (f) Place the leak test swab in a plastic envelope.
  - (g) Take the swab, in its plastic envelope, to the meter and note the reading when the envelope is in contact with the meter.
  - (h) If the meter indication is less than  $2\mu\text{Sv/h}$  ( $0.2\text{ mR/h}$ ) above background, proceed with the next test.
  - (i) Standing away from the beam port, raise the source rod to the exposing position and wipe the exposed source rod thoroughly. Replace the source rod.
  - (j) Place the swab in a plastic envelope and take it to the meter. If the reading is less than  $2\mu\text{Sv/h}$  ( $0.2\text{ mR/h}$ ) above background, the swab may be taken to a sensitive radiation counter or sent by mail for assay.
- DO NOT MAIL** If the swab shows more than  $2\mu\text{Sv/h}$  ( $0.2\text{ mR/h}$ ), contact Amersham for specific instructions.

In the USA, Amersham provides a leak test service using the Model 518 leak test kit.

Outside the USA, please contact the local regulatory authorities for information about leak test requirements and testing services.

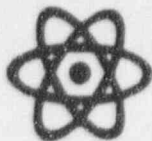
## 8. Disposal

When the unit is no longer required it must be disposed of as high level radioactive waste in accordance with local and national regulations.

## 9. Specifications

Size:	127mm (5in) wide; 127mm (5in) deep; 216mm (8½in) high
Weight:	24kg (52lb); or without attenuators 20kg (45lb)
Source:	Caesium-137, 6.1GBq (165mCi) nominal activity
Attenuators:	3 moveable absorbers, x 0.25, x 0.10, x 0.10
Accuracy:	Intensity at any point within the beam in any plane normal to the beam axis is within $\pm 5\%$ of calculated central axial value.
Shipping:	DOT specification 7A Type A package
Shield:	Lead metal 13kg (29lb)

and Adjustments: see Section 10  
Note: The following information is for  
the use of the Model 773 Calibrator  
only. It is not intended for use with  
other models of the Model 773 series.

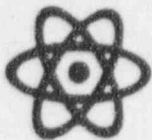


# **MID AMERICAN INSPECTION SERVICES, INC.**

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Gaylord, MI 49735  
(517) 732-8059 Fax (517) 732-0019

## SECTION III

### INDIVIDUALS RESPONSIBLE FOR RADIATION SAFETY PROGRAM



## MID AMERICAN INSPECTION SERVICES, INC.

NDE Division  
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Gaylord, MI 49735  
(517) 732-8059 Fax (517) 732-0019

### ITEM 7

#### 1. Individuals responsible for management/supervision of radiography program.

A. Terry L. Wilkins is the Radiation Safety Officer and shall be responsible for all activities regulated by this license. Those responsibilities shall include:

- I Procurement of licensed material
- II Implementation of training program
- III Internal inspection of radiographic personnel
- IV Procurement, distribution and maintenance of dosimetry
- V Procurement, distribution and maintenance of calibrated and operable survey instrumentation
- VI Disposal of sealed sources
- VII Maintenance of required records
- VIII Performance of quarterly maintenance of exposure devices and related handling of equipment
- IX Leak testing of sealed sources



## **MID AMERICAN INSPECTION SERVICES, INC.**

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### **RADIATION SAFETY MONITOR**

Shall be Radiographers appointed by the Radiation Safety Officer to assist in the Radiation Safety Program.

#### **Duties Performed:**

1. Quarterly Audits
2. Quarterly Inspections
3. Leak Testing
4. Source Recovery
5. Examination Monitoring
6. Source Shipment
7. Source Receiving

All duties performed by RSM Shall be under direction of the Radiation Safety Officer.

**CONTROL NO. 397275**



# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

660 ALPINE ROAD

GAYLORD, MICHIGAN 49735

517-732-8058

### RESUME

TERRY L. WILKINS

#### INDUSTRIAL SEMINARS:

SPONSOR	COURSE TITLE	HOURS
PIE, INC.	(Radiation Safety Officer)	8 (1989)
Teck-Check	Radiation Safety	40 (1989)
TEI Analytical Services	Radiation Safety	16 (3/88)
Trans-Eastern Inspection	Magnetic Particle	20 (12/86)
Trans-Eastern Inspection	Radiation Safety	16 (7/85)
Cleveland X-Ray	Radiation Safety	40 (1980)
Consolidated X-Ray	Radiation Safety	40 (1979)
Test Master	Radiation Safety	40 (1977)
AWS (Certified Welding Inspector)		(1988)

#### EMPLOYMENT EXPERIENCE:

Company and Address:	Mid American Inspection Services/ NDE Division Gaylord, Michigan
Date:	July 1990 to present
Job Title:	Radiation Safety Officer
Certifications Held:	RT, MT, PT, Level II (SNT-TC-1A) AWS-CWI
Job Description:	Performing RT, MT, PT, on piping and structures in accordance with various codes.
Company and Address:	PIE, INC. Gaylord, Michigan
Dates:	April, 1989 to July 1990
Job Title:	Radiation Safety Officer
Certifications Held:	RT, MT, PT, Level II (SNT-TC-1A) AWS-CWI
Job Description:	Performing RT, MT, PT, on piping and structures in accordance with various codes.

Company and Address: Metalogic Inspection  
Phoenix, Arizona

Date: August, 1984 to January, 1985

Job Title: Radiographer

Certifications Held: RT, PT Level II

Job Description: Radiographic work on piping and pressure  
vessels (contact, super imposition, elliptical)  
Liquid Penetrant examinations done on  
welds (socket, weldlet, butt welds).

Company and Address: Cleveland X-Ray  
Cleveland, Ohio

Date: October, 1979 to May, 1983

Job Title: Radiographer

Certifications Held: RT Level II

Job Description: Pipeline and pipeline related facilities  
using X and Gamma radiation.

Company and Address: Consolidated X-Ray  
Dallas, Texas

Date: October, 1978 to September, 1979

Job Title: Radiographer

Certifications held: RT Level II

Job Description: Pipeline work with gamma and crawler units.

Company and Address: Exam Company

Date: January, 1978 to October, 1978

Job Title: Radiographer

Certifications Held: RT Level II

Job Description: Pipeline and storage facilities using  
gamma radiation.

Company and Address: TEI Analytical Services, Inc.  
Kalkaska, Michigan

Date: August, 1987 to March, 1989

Job Title: NDE Technician

Certifications Held: RT, MT, PT, Level II (SNT-TC-1A)

Job Description: Performing RT, MT and PT at various jobs. Responsibilities include the radiography of various piping assemblies and components at field locations. Perform work using remote and external source handling device.

Company and Address: Trans-Eastern Inspection, Inc.  
Kalkaska, Michigan

Date: December, 1986 to August, 1987

Job Title: NDE Technician

Certifications Held: RT, MT, PT Level II (SNT-TC-1A)

Job Description: Performing RT, MT and PT at various jobs. Responsibilities include the radiography of various piping assemblies and components at field locations. Perform work using remote and external source handling device.

Company and Address: Trans-Eastern Inspection, Inc.  
Washington, Pennsylvania

Date: July, 1985 to December, 1986

Job Title: NDE Technician

Certifications Held: RT Level II (SNT-TC-1A)

Job Description: Responsibilities include the radiography of various piping assemblies and components at field locations. Perform work using remote and external source handling device.

# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

650 ALPINE ROAD

GAYLORD, MICHIGAN 49735

517-732-8059

### RESUME

ROBERT STORY

#### INDUSTRIAL SEMINARS:

SPONSOR	COURSE TITLE	HOURS
PIE, INC.	Radiation Safety	8 (1989)
Teck-Check	Radiation Safety	40 (1989)
TEI Analytical Services	Radiation Safety	16 (1987)
Trans-Eastern Inspection	Radiation Safety	16 (2/86)
Trans-Eastern Inspection	Radiation Safety	16 (7/85)
Metalogic	Radiation Safety	40 (1984)
Imperial Inspection	Radiation Safety	40 (1984)
Exam Company	Radiation Safety	40 (1978)
Testmaster Inspection	Radiation Safety	40 (1976)

#### EMPLOYMENT EXPERIENCE:

Company and Address: Mid American Inspection Services/  
NDE Division  
Gaylord, Michigan

Date: July, 1990 to present

Job Title: RT Level II Technician

Certification: RT Level II (ASNT-TC-1A)

Job Description: Perform X and gamma radiation on  
pipelines and related facilities.

Company and Address: PIE, INC.  
Gaylord, Michigan

Date: April, 1989 to July 1990

Job Title: RT Level II Technician

Certification: RT Level II (ASNT-TC-1A)

Job Description: Perform X and gamma radiation on  
pipelines and related facilities.

Company and Address: Trans-Eastern Inspection, Inc.  
Washington, Pennsylvania

Date: February, 1986 to March, 1989

Job Title: RT Level II Technician

Certification Held: RT Level II (SNT-TC-1A)

Company and Address: Trans-Eastern Inspection, Inc.  
Washington, Pennsylvania

Date: July, 1985 to February, 1986

Job Title: NDE assistant

Certifications Held: RT Level I (SNT-TC-1A)

Job Description: Work as an NDE Assistant (Level I) includes performing the operational portions of RT examination. Primary duties include the testing of various components to API specifications. Responsible for conducting tests, processing film and assisting in report preparation.

Company and Address: Metalogic  
Phoenix, Arizona

Date: September, 1984 to February, 1985

Job Title: Level I Radiographer

Certifications Held: RT Level I

Job Description: Radiography of pipes, vessels, and plates in oil refinery using Gamma Century.

Company and Address: Imperial Inspection Company  
Lafayette, Louisiana

Date: July, 1984 to September, 1984

Job Title: Radiographer's Assistant

Certifications Held: RT Level I

Job Description: Radiography of pipeline and fabrication welds.



Company and Address:

Exam Company  
Perrysburg, Ohio

Date:

June, 1978 to December, 1978

Job Title:

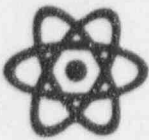
Radiographer

Certifications Held:

RT Level II

Job Description:

X-Ray of pipeline welds.



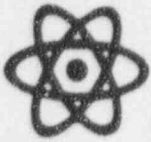
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Gaylord, MI 49735  
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## **SECTION IV**

### **TRAINING PROVIDED TO OTHER USERS**

See Attachment listed  
Training Program

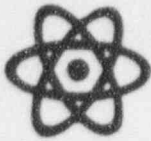


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## **SECTION V**

### **FACILITIES AND EQUIPMENT**



## **MID AMERICAN INSPECTION SERVICES, INC.**

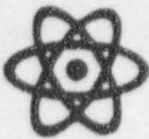
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### ITEM 9

#### 1. Facilities and Equipment

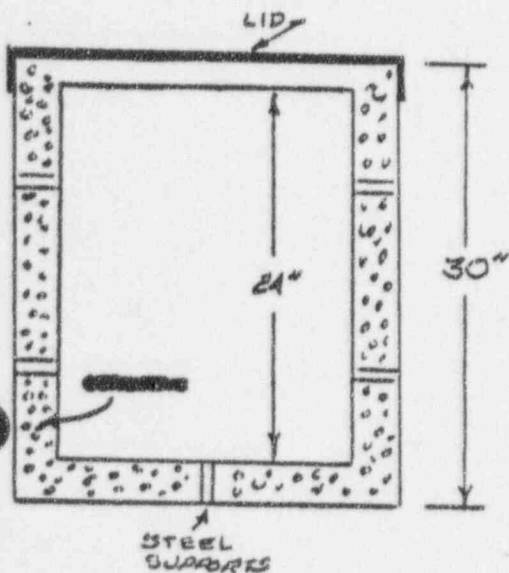
- A. The physical address is 650 Alpine Road, Gaylord, Michigan, 49735. These facilities will be used for the storage of exposure devices and source changers used by the Company. At no time will industrial radiography be performed within the facility. In addition to storage, this facility shall be used for maintenance and retention of all documents related to the radiography program.

The storage vault is constructed of 42" x 1/2" steel outer shell with a 30" x 1/2" thick inner liner. The top is welded 1/8" plate with hinges with hasp and lock. Radiation signs shall be posted on three sides of the vault to maintain awareness. Only authorized personnel will be permitted use of the vault, and only then under supervision of the RSO.

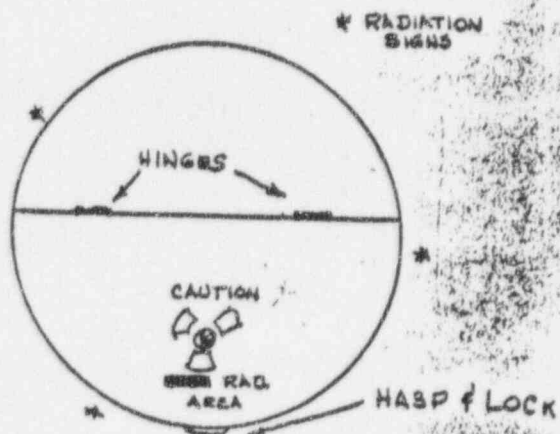
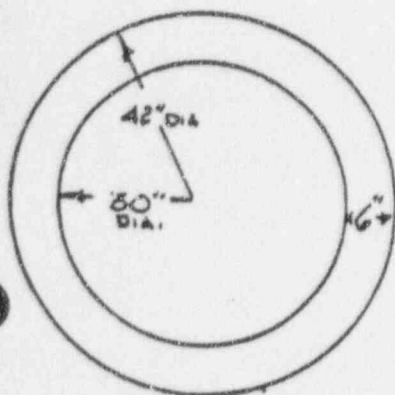


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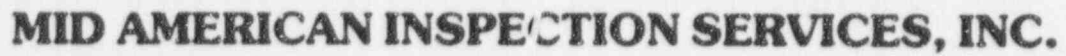
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STORAGE VAULT







## APPENDIX B

WFF 8

CONTROL NO. 397275



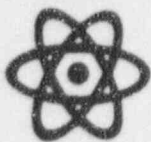
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## **SECTION VI**

### **RADIATION SAFETY PROGRAM**

- 10.1 Personnel Monitoring Equipment
- 10.2 Radiation Detection Instruments
- 10.3 Internal Inspection Program
- 10.4 Operating and Emergency Procedures
- 10.5 Leak-Testing of Sealed Sources
- 10.6 Source Retrieval or Recovery



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### RADIATION SAFETY PROGRAM

#### ITEM 10

##### A. 10.1 - Personnel Monitoring Equipment

All personnel involved in radiography will be required to wear an operable and calibrated pocket dosimeter that records from 0-200 MR. Film badges will be issued to all radiographic personnel. Film badges shall be exchanged at least monthly. Rate alarm meter that provides audible indication in radiation fields at or about 500 MR/HR calibrated and operable.

##### B. 10.2 - Radiation Detection Instruments

Operable and calibrated survey meters with a range from 2 MR/HR through 1 R/HR will be maintained. With calibration so that readings are plus or minus 20 percent of the actual values of the range of the instrument. Have calibration chart or graph showing results of calibration, date of last calibration, and due date of next calibration affixed to the survey meter. All survey meters will be calibrated at periods not to exceed 90 days or after each servicing. All calibration records of survey meters will be kept for a minimum two years after each calibration. Outside firms will be used to perform survey meter calibration. (Attachment "A")

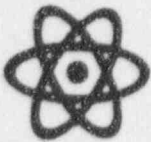
##### C. 10.3 - Internal Inspection Program

Quarterly audits will be performed on Radiographers and Radiographer's Assistants. To assure that NRC regulations license provisions, and operating and emergency procedures are being followed. Any Radiographers or Radiographers Assistants who are not operating in accordance with all the above provisions will be required to, in writing, explain why they did not meet provisions. An evaluation will be made by RSO whether re-instruction is required or possible termination from radiography program depending on the extent of deficiencies. Audits will be performed at intervals not to exceed 3 months. Any Radiographer or Radiographer's Assistant that has not performed radiography for a period exceeding 3 months shall have an audit performed the first time they are engaged in radiographic operations.

Individuals who will conduct quarterly audits.

Terry L. Wilkins     )  
Robert E. Story     ) Resumes attached (Attachment B)

Copy of quarterly audit with items to be covered attached.  
(Attachment "C")



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- D. 10.4 - Operating and Emergency Procedures  
(Attached) Operating and Emergency Procedures Manual  
Items 10.4.1 through 10.4.12 will be addressed in  
Operating and Emergency Procedures Manual in Sections  
and pages listed.

10.4.1 - Handling and use of sealed sources and Radiographic Exposure Devices.

### SECTION IV - PAGES 1-3

10.4.2 - Methods and Occasions for Conducting Radiation Surveys.

### SECTION I - PAGES 11-13

10.4.3 - Methods for Controlling Access to Radiographic Areas.

### SECTION I - PAGE 14

10.4.4 - Methods and Occasions for locking and securing radiographic exposure devices, storage containers and sealed sources.

### SECTION I - PAGES 15-16

10.4.5 - Personnel Monitoring and the use of Personnel Monitoring Equipment.

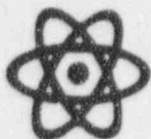
### SECTION I - PAGE 6-10A

10.4.6 - Transporting sealed sources to field locations, securing exposure devices and storage containers in vehicles, posting of vehicles and control of sealed sources during transportation.

### SECTION I - PAGES 16-19

10.4.7 - Minimizing exposure of persons in the event of an accident - emergency procedures.

### SECTION II - PAGES 1-7



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10.4.8 - Notification of proper persons in the event of an accident.

### SECTION II - PAGE 1

10.4.9 - Maintenance of Records.

#### APPENDIX A - REQUIRED DAILY REPORTS

SECTION I - PAGE 19 (Quarterly Inventory)

SECTION I - PAGES 17-18 (Transportation and Shipping)

10.4.10 - Daily inspection and maintenance of exposure devices and storage containers.

SECTION I - PAGES 23-27  
APPENDIX A (Survey Report)

10.4.11 - Off-scale Pocket Dosimeter Readings.

SECTION I - PAGE 9  
APPENDIX B (Lost or Overexposed Film Badge Report)

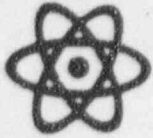
10.4.12 - Procedure for Identifying and Reporting Defects and Noncompliance as Required by Part 10 CFR Part 21.

### SECTION I PAGES 26-27

#### E. 10.5 - Leak Testing of Sealed Sources

Section 34.25 of Title 10, Chapter 1 CFR Part 34 contains the requirements for leak-testing of sealed sources. The leak test shall be capable of detecting the presence of .005 micro-curie of removable contamination on the sealed source. The procedures, and leak-test kits listed shall be used to perform this operation. The RSO shall retain complete responsibility for leak-testing program. He may also delegate responsibilities to other trained and qualified personnel, but will not relieve RSO for overall responsibility of the program requirements. Leak-test of sealed sources shall be at intervals not to exceed six months. In the absence of a certificate that a satisfactory test has been made in the previous six months the sealed source shall not be used.





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## Leak-test kits and suppliers:

Applied Health Physics, Inc.  
2986 Industrial Boulevard  
Box 197  
Bethel Park, PA 15102

MARK V LEAK TEST KIT

Source Productions and Equipment Company, Inc.  
113 Teal Street  
St. Rosa, LA. 70087

SPEC MODEL 1 LEAK TEST KIT

## Leak Testing Procedures

Qualified personnel performing leak test shall ensure all personnel in area are wearing properly assigned film badges and dosimeters. An operable survey meter with proper calibration shall be used during leak-test procedure.

### \*Procedure Mark V Leak Test Kit

See Operating Procedures Manual, Section I, Page 22, Item A.

### \*Procedure SPEC Model I Leak Test Kit

See Operating Procedures Manual, Section I, Page 22a, Item B.

Satisfactory test results shall include a leak test certificate containing the specifics on the isotope, equipment and the six month validation period. The leak test label shall be affixed to the exterior of the device. A copy of the leak test certificate shall be attached to the existing decay curve and accompany the exposure device at all times. The original leak test document shall be incorporated into the exposure device files for review by authorized agencies.

### F. 10.6 - Source Retrieval or Recovery

Source retrieval or recovery shall be the total responsibility of the RSO. Other qualified personnel may assist in source retrieval. The procedures and tool to be used for recovery operations are attached. There are two common types of retrieval (1) source disconnected in guide tube outside of exposure device (2) source disconnected outside of exposure device.



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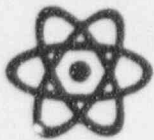
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There are different retrieval methods for each of the two occurrences listed. The RSO must also evaluate variables in environment, physical locations, and circumstances in any unusual incident prior to initiating corrective actions.

Tools used:

1. 6 foot retrieval tongs
2. 5 ten pound bags lead shot
3. 12" pliers (or) channel locks
4. Small tarpoleum
5. High range dosimeter pencil(s)

- (1) Source disconnected in guide tube outside of exposure device.
1. With survey meter check to assure 2 MR/HR levels are posted and under constant surveillance. Read record and zero all dosimeter pencils. Calculate dose rates and working times for each entry.
2. With tongs, straighten guide tube on flat surface, as quickly as possible. Leave area. Read, record and zero pencils and note time.
3. Cover area of guide tube containing source with lead tunnel or bags of lead shot as quickly as possible. Leave area. Read, record and note time.
4. Conduct survey to assure you have maximum shielding.
5. Disconnect guide tube from exposure device.
6. Spread tarp on ground close to exposure device.
7. With tongs, remove bags of lead shot from guide tube.
8. With tongs, pick up enclosed end of guide tube and gently shake source assembly onto tarp. Leave area. Read, record and zero dosimeter pencils and note time.
9. With tongs, grasp the source assembly and return it to the exposure device. Do this as quickly as possible to reduce amount of radiation received.
10. Replace front plug to exposure device with pliers to push source into shielded position, survey camera and lock. Leave area. Read, record and zero dosimetry. Note elapsed time.



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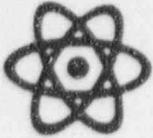
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11. Investigate cause, take statements from personnel, file reports.

All steps listed should be done as quickly as possible to reduce amount of radiation received. Stand as far away as possible when working with tongs or pliers.

Between entries, it is extremely important to check dosimeters and recharge to maintain it on scale. When operation is complete send in film badge to be processed to assure no overexposure has taken place.

- (2) Source disconnect outside of exposure device and related equipment.
  1. With survey meter check to assure 2 MR/HR levels are posted and under constant surveillance.
  2. RSO shall zero all pencils and calculate working times and exposure rates.
  3. The RSO shall enter the ones to visually check the area and condition of source, exposure device and related equipment. Leave area, read, record and zero dosimeter. Note elapsed time.
  4. Enter the area, place lead tunnel over source capsule being careful to leave connector side visible. Leave area, read, record and zero dosimeter. Note elapsed time.
  5. Enter area, position exposure device in close proximity to the sealed source. Leave area. Read, record and zero dosimeter. Note elapsed time.
  6. Enter area taking handling tongs, grasp source assembly with tongs and insert into exposure device. Push the source assembly into the exposure device as far as possible. Leave area. Read, record and zero dosimeter. Note elapsed time.
  7. Enter area taking 12" pliers, position body behind shielded side of exposure device, grasp source tube side safety cap with pliers and push the source assembly to its fully shielded position in the exposure device. Lock exposure device and survey to confirm proper position. Leave area. Read, record and zero dosimeter pencil. Note elapsed time.



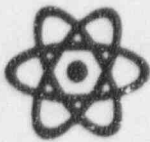
## **MID AMERICAN INSPECTION SERVICES, INC.**

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(517) 732-8059 Fax (517) 732-0019

8. Take statements from Radiographic team. Investigate cause and file required reports.

This should be done as quickly as possible to reduce amount of radiation received. Stand as far away as possible when working with tongs or pliers.

Send in film badge to be processed to assure no overexposure has taken place.



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Gaylord, MI 49735  
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### ITEM 10 - ATTACHMENT A

#### SURVEY METER REPAIR AND CALIBRATION

- A. Applied Health Physics, Inc.  
2986 Industrial Boulevard  
Bethal Park, PA 15102  
Phone: (412) 563-2242
- B. Source Production and Equipment Company, Inc.  
113 Teal Street  
St. Rosa, LA 70087  
Phone: (504) 464-9471
- C. Tech-Check, Inc.  
219 North Main Street  
Yale, OK 74085  
Phone: (918) 387-2491
- D. Venture Technical Sales and Service  
106th South 109th East Place  
Tulsa, OK 74128  
Phone: (918) 234-7440

The Radiation Safety Officer may use other vendors for the repair and/or calibration of survey instruments. Alternate vendors or manufacturers will be approved by the RSO provided the facility is properly licensed to perform this function.



# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

650 ALPINE ROAD

GAYLORD, MICHIGAN 49735

517-732-8059

### RESUME

TERRY L. WILKINS

#### INDUSTRIAL SEMINARS:

SPONSOR	COURSE TITLE	HOURS
PIE, INC.	(Radiation Safety Officer)	8 (1989)
Teck-Check	Radiation Safety	40 (1989)
TEI Analytical Services	Radiation Safety	16 (3/88)
Trans-Eastern Inspection	Magnetic Particle	20 (12/86)
Trans-Eastern Inspection	Radiation Safety	16 (7/85)
Cleveland X-Ray	Radiation Safety	40 (1980)
Consolidated X-Ray	Radiation Safety	40 (1979)
Test Master	Radiation Safety	40 (1977)
AWS (Certified Welding Inspector)		(1988)

#### EMPLOYMENT EXPERIENCE:

Company and Address:	Mid American Inspection Services/ NDE Division Gaylord, Michigan
Date:	July 1990 to present
Job Title:	Radiation Safety Officer
Certifications Held:	RT, MT, PT, Level II (SNT-TC-1A) AWS-CWI
Job Description:	Performing RT, MT, PT, or. piping and structures in accordance with various codes.
Company and Address:	PIE, INC. Gaylord, Michigan
Dates:	April, 1989 to July 1990
Job Title:	Radiation Safety Officer
Certifications Held:	RT, MT, PT, Level II (SNT-TC-1A) AWS-CWI
Job Description:	Performing RT, MT, PT, on piping and structures in accordance with various codes.

Company and Address: TEI Analytical Services, Inc.  
Kalkaska, Michigan

Date: August, 1987 to March, 1989

Job Title: NDE Technician

Certifications Held: RT, MT, PT, Level II (SNT-TC-1A)

Job Description: Performing RT, MT and PT at various jobs. Responsibilities include the radiography of various piping assemblies and components at field locations. Perform work using remote and external source handling device.

Company and Address: Trans-Eastern Inspection, Inc.  
Kalkaska, Michigan

Date: December, 1986 to August, 1987

Job Title: NDE Technician

Certifications Held: RT, MT, PT Level II (SNT-TC-1A)

Job Description: Performing RT, MT and PT at various jobs. Responsibilities include the radiography of various piping assemblies and components at field locations. Perform work using remote and external source handling device.

Company and Address: Trans-Eastern Inspection, Inc.  
Washington, Pennsylvania

Date: July, 1985 to December, 1986

Job Title: NDE Technician

Certifications Held: RT Level II (SNT-TC-1A)

Job Description: Responsibilities include the radiography of various piping assemblies and components at field locations. Perform work using remote and external source handling device.

Company and Address: Metalogic Inspection  
Phoenix, Arizona

Date: August, 1984 to January, 1985

Job Title: Radiographer

Certifications Held: RT, PT Level II

Job Description: Radiographic work on piping and pressure vessels (contact, super imposition, elliptical) Liquid Penetrant examinations done on welds (socket, weldlet, butt welds).

Company and Address: Cleveland X-Ray  
Cleveland, Ohio

Date: October, 1979 to May, 1983

Job Title: Radiographer

Certifications Held: RT Level II

Job Description: Pipeline and pipeline related facilities using X and Gamma radiation.

Company and Address: Consolidated X-Ray  
Dallas, Texas

Date: October, 1978 to September, 1979

Job Title: Radiographer

Certifications held: RT Level II

Job Description: Pipeline work with gamma and crawler units.

Company and Address: Exam Company

Date: January, 1978 to October, 1978

Job Title: Radiographer

Certifications Held: RT Level II

Job Description: Pipeline and storage facilities using gamma radiation.

# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

660 ALPINE ROAD

GAYLORD, MICHIGAN 49735

517-732-8069

### RESUME

ROBERT STORY

#### INDUSTRIAL SEMINARS:

SPONSOR	COURSE TITLE	HOURS
PIE, INC.	Radiation Safety	8 (1989)
Teck-Check	Radiation Safety	40 (1989)
TEI Analytical Services	Radiation Safety	16 (1987)
Trans-Eastern Inspection	Radiation Safety	16 (2/86)
Trans-Eastern Inspection	Radiation Safety	16 (7/85)
Metalogic	Radiation Safety	40 (1984)
Imperial Inspection	Radiation Safety	40 (1984)
Exam Company	Radiation Safety	40 (1978)
Testmaster Inspection	Radiation Safety	40 (1976)

#### EMPLOYMENT EXPERIENCE:

Company and Address: Mid American Inspection Services/  
NDE Division  
Gaylord, Michigan

Date: July, 1990 to present

Job Title: RT Level II Technician

Certification: RT Level II (ASNT-TC-1A)

Job Description: Perform X and gamma radiation on  
pipelines and related facilities.

Company and Address: PIE, INC.  
Gaylord, Michigan

Date: April, 1989 to July 1990

Job Title: RT Level II Technician

Certification: RT Level II (ASNT-TC-1A)

Job Description: Perform X and gamma radiation on  
pipelines and related facilities.

Company and Address: Trans-Eastern Inspection, Inc.  
Washington, Pennsylvania

Date: February, 1986 to March, 1989

Job Title: RT Level II Technician

Certification Held: RT Level II (SNT-TC-1A)

Company and Address: Trans-Eastern Inspection, Inc.  
Washington, Pennsylvania

Date: July, 1985 to February, 1986

Job Title: NDE assistant

Certifications Held: RT Level I (SNT-TC-1A)

Job Description: Work as an NDE Assistant (Level I) includes performing the operational portions of RT examination. Primary duties include the testing of various components to API specifications. Responsible for conducting tests, processing film and assisting in report preparation.

Company and Address: Metalogic  
Phoenix, Arizona

Date: September, 1984 to February, 1985

Job Title: Level I Radiographer

Certifications Held: RT Level I

Job Description: Radiography of pipes, vessels, and plates in oil refinery using Gamma Century.

Company and Address: Imperial Inspection Company  
Lafayette, Louisiana

Date: July, 1984 to September, 1984

Job Title: Radiographer's Assistant

Certifications Held: RT Level I

Job Description: Radiography of pipeline and fabrication welds.



Company and Address:

Exam Company  
Perrysburg, Ohio

Date:

June, 1978 to December, 1978

Job Title:

Radiographer

Certifications Held:

RT Level II

Job Description:

X-Ray of pipeline welds.

# CONTINUING EDUCATION UNITS

Awarded By

## AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING



ROBERT E. STORY



Attended the Continuing Education Course and has  
satisfactorily completed program objectives  
on the subject of

FUNDAMENTALS OF RADIATION SAFETY

JANUARY 28,29 & FEBRUARY 4,5, 1989

Presented by TECH CHEK, INC.

Given this 20th day of JUNE 1989

Ronald H. Selner  
ASNT HEADQUARTERS STAFF

4.0  
CEU's AWARDED

THOMAS D. REEDER  
COURSE DIRECTOR

# TECH LHEK INC.

Presents this Certificate to

ROBERT E. STORY

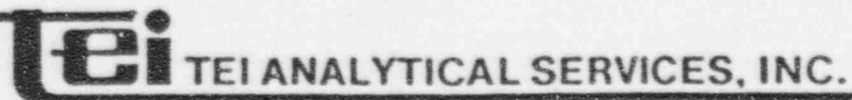
This individual has satisfactorily completed  
INTERNATIONAL UNION OF OPERATING ENGINEERS  
LOCAL 2-B

Forty Hour Initial Radiation Safety Training  
and Demonstrated Competency in the Subjects  
Identified in Appendix A to 10 CFR, Part  
34, by Successfully Passing A Written Exam.

Given this 5th day of February 1989



*J. Muder*  
INSTRUCTOR



THIS DOCUMENT SHALL CERTIFY THAT

ROBERT E. STORY

HAS MET THE TRAINING AND EXAMINATION CRITERIA SPECIFIED IN NRC RADIOACTIVE MATERIALS  
LICENSE NUMBER 37-28004-01, AND IS QUALIFIED TO ACT IN THE CAPACITY OF:

RADIOGRAPHER

TEST SCORES: 94.64% GENERAL

96.00% SPECIFIC

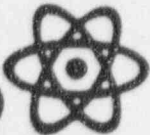
100.00% PRACTICAL

EXAM DATE: July 11, 1987

Gary E. Lewis

RADIATION SAFETY OFFICER

TEI ANALYTICAL SERVICES, INC.



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650 Alpine Road  
Gaylord, MI 49735  
(517) 732-8059 Fax (517) 732-0019

On \_\_\_\_\_ an Unannounced Radiation Safety Inspection was conducted at \_\_\_\_\_.

The purpose of this inspection was to observe all safety requirements of NRC Regulations, and Mid American Inspection Svcs., Operating and Emergency Procedures.

## PERSONNEL

Radiographer \_\_\_\_\_ Film Badge # \_\_\_\_\_  
Dosimeter Pencil # \_\_\_\_\_ Unit# \_\_\_\_\_  
Asst. Radiographer \_\_\_\_\_ Film Badge # \_\_\_\_\_  
Dosimeter Pencil # \_\_\_\_\_  
Additional Personnel \_\_\_\_\_

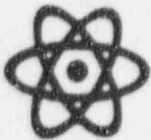
Are the Personnel Monitoring Devices worn? \_\_\_\_\_ Dosimeter Rdg. \_\_\_\_\_ mr.

## RADIOGRAPHIC EQUIPMENT

X-ray Machine: Make \_\_\_\_\_ Model \_\_\_\_\_ Ser. # \_\_\_\_\_  
Exposure Device: Make \_\_\_\_\_ Model \_\_\_\_\_ Ser. # \_\_\_\_\_  
Source Ser. # \_\_\_\_\_ Strength \_\_\_\_\_ Ci Leak Test Due \_\_\_\_\_  
Survey Meter: Make \_\_\_\_\_ Model \_\_\_\_\_ Ser. # \_\_\_\_\_  
Calibration Due Date: \_\_\_\_\_ Meter operating correctly (YES \_\_\_\_\_ NO \_\_\_\_\_)  
Dosimeter Charger: Make \_\_\_\_\_ Model \_\_\_\_\_ Ser. # \_\_\_\_\_  
Operable (YES \_\_\_\_\_ NO \_\_\_\_\_)

ARE THE FOLLOWING ITEMS ON THE UNIT: "Caution Radiation Area" signs (YES \_\_\_\_\_ NO \_\_\_\_\_)  
"Caution High Radiation Area" signs (YES \_\_\_\_\_ NO \_\_\_\_\_) Radiation Rope (YES \_\_\_\_\_ NO \_\_\_\_\_)  
Collimator (YES \_\_\_\_\_ NO \_\_\_\_\_) NRC-3 poster (YES \_\_\_\_\_ NO \_\_\_\_\_) Decay chart & Leak Test  
Certificate (YES \_\_\_\_\_ NO \_\_\_\_\_) Radiographic Personnel Operating and Emergency Manual,  
and other required documents available (YES \_\_\_\_\_ NO \_\_\_\_\_).





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## UNANNOUNCED RADIATION SAFETY INSPECTION REPORT (cont.)

### SAFETY REQUIREMENTS

ARE THE PROPER SIGNS POSTED AT OR ON THE FOLLOWING:

High Radiation Area (YES ☐ NO ☐) , Radiation Area (YES ☐ NO ☐) , Exposure Device (YES ☐ NO ☐) , Storage Box (YES ☐ NO ☐) , Entry to Dark Room (YES ☐ NO ☐) , All four (4) sides of Mobile Unit (YES ☐ NO ☐) .

RADIATION LEVEL AT THE FOLLOWING:

"Caution Radiation Area" signs \_\_\_\_\_ mR/hr. , Top Surface of Exposure Device \_\_\_\_\_ mR/hr. , Outside surface of the Unit \_\_\_\_\_ mR/hr. , Driver compartment of Unit \_\_\_\_\_ mR/hr. .

ARE LOCKS PRESENT AND OPERABLE ON THE FOLLOWING:

Exposure Device (YES ☐ NO ☐) , Storage Box (YES ☐ NO ☐) , Darkroom (YES ☐ NO ☐) , Cab of Truck (YES ☐ NO ☐) .

PRACTICAL APPLICATION OF SAFETY REQUIREMENTS:

Physical survey performed after each exposure (YES ☐ NO ☐) , Exposure Device surveyed after each exposure (YES ☐ NO ☐) , Entire length of Source Tube surveyed after each exposure (YES ☐ NO ☐) , Was survey meter used properly during each exposure (YES ☐ NO ☐) , Was Exposure Device locked after each exposure (YES ☐ NO ☐) .

WAS CONSTANT SURVEILLANCE MAINTAINED ON FOLLOWING:

Exposure Device when out of shipping container? (YES ☐ NO ☐) , All accessible entrances to the Restricted Area (YES ☐ NO ☐) .

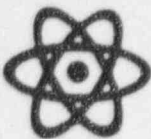
Other items checked concerning radiation safety: \_\_\_\_\_

If a negative answer is obtained to any of the above questions, list the corrective action on the reverse side of this form.

AUTHORIZATION: I certify that the above mentioned Unannounced Inspection was conducted by me on \_\_\_\_\_ (date).

SIGNATURE OF RADIATION SAFETY OFFICER \_\_\_\_\_

Technician: \_\_\_\_\_ Date: \_\_\_\_\_



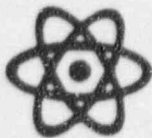
# **MID AMERICAN INSPECTION SERVICES, INC.**

NDE Division  
650 Alpine Road  
Gaylord, MI 49735  
(517) 732-8059 Fax (517) 732-0019

## **SECTION VII**

### **WASTE MANAGEMENT SEALED SOURCE DISPOSAL**

**CONTROL NO. 397275**



## MID AMERICAN INSPECTION SERVICES, INC.

NDE Division  
650 Alpine Road  
Gaylord, MI 49735  
(517) 732-8059 Fax (517) 732-0019

### ITEM 11

#### I SEALED SOURCE DISPOSAL

- A. Sealed sources used under this license shall be returned to the manufacturer for disposal. Shipments of material for disposal shall be in approved source changers and/or exposure devices. The RSO shall ensure all shipments meet the transportation requirements of the D.O.T. for land and air shipments.

The sealed source must have evidence of receipt and disposal by the receiving party. Copies of disposal records shall be maintained in the exposure device records for review by authorized parties.



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## SECTION VIII

### FORMS AND REPORTS

#### FORM NUMBER

#### TITLE

RSF-1	Notice To Employers
RSF-2	Radiation Surveys Report
RSF-3	Material Transportation Record
RSF-4	Receipt Inspection Record
RSF-5	Exposure Device Utilization Log
RSF-6	Radiographic Equipment Quarterly Inspection Record
RSF-7	Unannounced Radiation Safety Inspection Report
RSF-8	Exposure Device/Storage Vault Survey Log
RSF-9	Dosimeter Pencil Accuracy Record
RSF-10	Dosimeter Pencil Accuracy Verification Tag
RSF-11	Film Badge Overexposure or Loss
RSF-12	Radiation Incident Report
RSF-13	Periodic Training Record
RSF-14	Record of Radiation Safety Training

CONTROL NO. 397275

# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

### NOTICE TO EMPLOYEES

In accordance with 19.11 the documents listed below are available to any person who is working at (a) MAIS, INC. and (b) within the conditions of MAIS, INC. held NRC license. They may be examined during normal working hours at:

MID AMERICAN INSPECTION SERVICES, INC.

650 Alpine Road  
Gaylord, MI 49735

- I 10 CRF 19 Notices, Instructions and Reports to Workers; Inspections.
- II 10 CFR 20 Standards for Protection Against Radiation.
- III 10 CFR 34 License for Radiography and Radiation Safety Requirements for Radiographic Operations.
- IV MAIS, INC. Procedures Manual -- Radiographic Personnel Operations and Emergency Procedures Manual.
- V Any notice of Violation of Regulations and associated response from licensee.



Record an Area Survey each time you have a location or source change which will be indicated in the Radiation Device utilization Log.

DAILY MAINTENANCE (MSR) OF  
EXPENDITURE DEVICE IN  
ACCORDANCE WITH OPERATING  
PROCEDURES.  
NOTE REFER TO YOUR  
COMPANY OPERATING &  
EMERGENCY PROCEDURES  
MANUAL IN THE SECTION PER-  
TAINING TO OPERATING  
PROCEDURES FOR INSTRUCTION

DAY	INITIALS
SAT	
SUN	
MON	
TUE	
WED	
THUR	
FRI	

SURVEY METER	
Make	_____
Model	_____
Serial Number	_____
Calibration due date	_____
Dosimeter S/N	_____
Film Badge No.	_____

VEHICLE SURVEY	
DAY	WINE
SATURDAY	10:00-11:00 AM
SUNDAY	
MONDAY	
TUESDAY	
WEDNESDAY	
THURSDAY	
FRIDAY	

- 1 Were radiation signs posted? Yes \_\_\_\_\_ No \_\_\_\_\_
- 2 Was survey of sample made to insure source had returned safely to storage area after each exposure and prior to returning device to storage area?  
Yes \_\_\_\_\_ No \_\_\_\_\_ If No, explain \_\_\_\_\_

### EXCESSIVE EXPOSURE INFORMATION

A. Date of Exposure \_\_\_\_\_ Amount of exposure \_\_\_\_\_

B. Was area isolated? Yes \_\_\_\_\_ No \_\_\_\_\_ If no, explain \_\_\_\_\_

C. Date of last survey previous to excessive exposure \_\_\_\_\_

D. Was camera and dosimetry equipment in adequate condition? Yes \_\_\_\_\_ No \_\_\_\_\_

E. Describe how excessive exposure occurred. (Use Supplement sheet for additional space) \_\_\_\_\_

EMPLOYEE SIGN \_\_\_\_\_  
 (Signature to appear only in the event of excessive exposure)

DOSIMETER READINGS				THURSDAY		FRIDAY	
DATE	STARTING OF SHIFT	AFTER 1 DAY	END OF SHIFT	TOTAL MR'S TODAY	UTILIZED		
SAT.					GAMMA		
SUN.					2-RAY		
					GAMMA		
MON.					2-RAY		
					GAMMA		
TUE.					2-RAY		
					GAMMA		
WED.					2-RAY		
					GAMMA		
THUR.					2-RAY		
					GAMMA		
FRI.					2-RAY		
					GAMMA		
					2-RAY		
			TOTAL MR'S THIS WEEK				

## RADIATION DEVICE UTILIZATION LOG

[illegible]

When utilizing Gamma Ray complete the Radiation Device Utilization Log in its entirety if X-Ray is the source of radiation complete all columns except the Source S/N and Camera Model column.

I certify that I have completed all the requirements as outlined above. SIGNATURE \_\_\_\_\_

# MID AMERICAN

INSPECTION SERVICES • NDE DIVISION

PROPER SHIPPING NAME: UN - 2974, RADIOACTIVE MATERIAL  
Special Form, n.s.s.

TYPE OF CONTAINER: Type B  
PHYSICAL DESCRIPTION: Special Form  
TRANSPORT GROUP: Special Form

## RADIOACTIVE MATERIAL TRANSPORTATION RECORD

### CONTAINER INFORMATION

HAZARD CLASS: Radioactive Material  
Volume: 0.0002 cubic inches  
Nuclide: \_\_\_\_\_  
Label: Radioactive: \_\_\_\_\_

Weight: \_\_\_\_\_

Quantity: \_\_\_\_\_



# MID AMERICAN

Shipper: INSPECTION SERVICES • NDE DIVISION

650 ALPINE ROAD  
GAYLORD, MICHIGAN 49735  
(517) 732-8059

Ship VIA: \_\_\_\_\_

### SHIPPING INFORMATION

### Shipper's Certification

This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

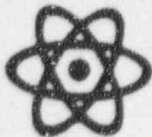
Signed for Shipper: \_\_\_\_\_ Date: \_\_\_\_\_

[illegible]

Labeling Criteria:  
Maximum Survey Limit(s)

White I	Yellow II	*Yellow III
.5 mR/Hr Surface	50 mR/Hr Surface	200 mR/Hr Surface
0 mR/Hr @ 1 Meter	1.0 mR/Hr @ 1 Meter	10 mR/Hr @ 1 Meter

\*PLACARDING REQUIRED



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NDE Division  
650 Alpine Road  
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(517) 732-8059 Fax (517) 732-0019

Isotope S/N \_\_\_\_\_

Isotope Curies \_\_\_\_\_

Isotope Placed In \_\_\_\_\_  
(Device #)

## RECEIPT INSPECTION RECORD RADIOACTIVE MATERIALS

DATE RECEIVED \_\_\_\_\_ TIME \_\_\_\_\_

SHIPPER \_\_\_\_\_

TYPE OF MATERIAL \_\_\_\_\_

SURFACE READING \_\_\_\_\_

ONE METER \_\_\_\_\_

TYPE OF METER \_\_\_\_\_

MODEL \_\_\_\_\_

SERIAL # \_\_\_\_\_

SURVEYED BY \_\_\_\_\_

REVIEWED BY \_\_\_\_\_

### COMMENTS:

- ☐ Shipment meets regulatory requirements and accepted.
- ☐ \* Shipment does not meet regulatory requirements  
\_\_\_\_\_ labeled incorrectly  
\_\_\_\_\_ transport papers incomplete/incorrect  
\_\_\_\_\_ survey limits exceeded

\*Material conditionally accepted pending notification and investigation by appropriate authorities.

(10 CFR 20.205)

# MID AMERICAN

INSPECTION SERVICES • NDE DIVISION

# EXPOSURE DEVICE UTILIZATION LOG

WEEK OF: / /

[illegible]

CONTROL NO.	397275
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# MID AMERICAN INSPECTION SERVICES, INC.

NDE Division

## RADIOGRAPHIC EQUIPMENT QUARTERLY INSPECTION RECORD

Date of Inspection/Qtr. \_\_\_\_\_

Signature of R.S.O. \_\_\_\_\_

### REM-DTE RADIOGRAPHIC EXPOSURE DEVICE

Radiographic Unit

Manufacturer \_\_\_\_\_

Model \_\_\_\_\_

Serial Number \_\_\_\_\_

Legend: S - Satisfactory  
U - Unsatisfactory  
M - Missing

Condition of Unit:

S

U

Condition of Pigtail Connector  
Condition of Lock & Lock Housing  
Radioactive Material Labels  
Radioactive Material Assay Labels  
Safety Plugs in Position  
Condition of Handle  
Identification of Unit  
Trans-Eastern Identification Plate  
List any unusual conditions \_\_\_\_\_

List corrective measures \_\_\_\_\_

### SOURCE TUBE

Length of Source Tube \_\_\_\_\_ Feet

Material of Source Tube \_\_\_\_\_

List any unusual conditions \_\_\_\_\_

List corrective measures \_\_\_\_\_

### CONTROL CABLES

Length of Control Cables \_\_\_\_\_ Feet

Type of Lock Box Adapter \_\_\_\_\_

List any unusual conditions \_\_\_\_\_

List corrective measures \_\_\_\_\_

### SURVEY OF EXPOSURE DEVICE

Maximum Survey Readings

Surface \_\_\_\_\_ rR/hr

6" \_\_\_\_\_ rR/hr

1 Meter \_\_\_\_\_ rR/hr



# MID AMERICAN INSPECTION SERVICES, INC.

NDE Division

## UNANNOUNCED RADIATION SAFETY INSPECTION REPORT

On \_\_\_\_\_ an Unannounced Radiation Safety Inspection was conducted at \_\_\_\_\_.

The purpose of this inspection was to observe all safety requirements of NRC Regulations; and Trans-Eastern Inspection, Inc. Operating and Emergency Procedures.

### PERSONNEL

Radiographer \_\_\_\_\_ Film Badge # \_\_\_\_\_  
Dosimeter Pencil # \_\_\_\_\_ Unit# \_\_\_\_\_  
Asst. Radiographer \_\_\_\_\_ Film Badge # \_\_\_\_\_  
Dosimeter Pencil # \_\_\_\_\_  
Additional Personnel \_\_\_\_\_

Are the Personnel Monitoring Devices worn? \_\_\_\_\_ Dosimeter Rdg. \_\_\_\_\_ mR.

### RADIOGRAPHIC EQUIPMENT

X-ray Machine: Make \_\_\_\_\_ Model \_\_\_\_\_ Ser. # \_\_\_\_\_  
Exposure Device: Make \_\_\_\_\_ Model \_\_\_\_\_ Ser. # \_\_\_\_\_  
Source Ser. # \_\_\_\_\_ Strength \_\_\_\_\_ Ci Leak Test Due \_\_\_\_\_  
Survey Meter: Make \_\_\_\_\_ Model \_\_\_\_\_ Ser. # \_\_\_\_\_  
Calibration Due Date: \_\_\_\_\_ Meter operating correctly (YES \_\_\_\_\_ NO \_\_\_\_\_)  
Dosimeter Charger: Make \_\_\_\_\_ Model \_\_\_\_\_ Ser. # \_\_\_\_\_  
Operable (YES \_\_\_\_\_ NO \_\_\_\_\_)

ARE THE FOLLOWING ITEMS ON THE UNIT: "Caution Radiation Area" signs (YES \_\_\_\_\_ NO \_\_\_\_\_)  
"Caution High Radiation Area" signs (YES \_\_\_\_\_ NO \_\_\_\_\_) Radiation Rope (YES \_\_\_\_\_ NO \_\_\_\_\_)  
Collimator (YES \_\_\_\_\_ NO \_\_\_\_\_) NRC-3 poster (YES \_\_\_\_\_ NO \_\_\_\_\_) Decay chart & Leak Test  
Certificate (YES \_\_\_\_\_ NO \_\_\_\_\_) Radiographic Personnel Operating and Emergency Manual,  
and other required documents available (YES \_\_\_\_\_ NO \_\_\_\_\_).

Date:

# MID AMERICAN INSPECTION SERVICES, INC.

NDE Division

## UNANNOUNCED RADIATION SAFETY INSPECTION REPORT (cont.)

### SAFETY REQUIREMENTS

ARE THE PROPER SIGNS POSTED AT OR ON THE FOLLOWING:

High Radiation Area (YES ☐ NO ☐) , Radiation Area (YES ☐ NO ☐) , Exposure Device (YES ☐ NO ☐) , Storage Box (YES ☐ NO ☐) , Entry to Dark Room (YES ☐ NO ☐) , All Four (4) sides of Mobile Unit (YES ☐ NO ☐) .

RADIATION LEVEL AT THE FOLLOWING:

"Caution Radiation Area" signs \_\_\_\_\_ mR/hr. , Top Surface of Exposure Device \_\_\_\_\_ mR/hr. , Outside surface of the Unit \_\_\_\_\_ mR/hr. , Driver compartment of Unit \_\_\_\_\_ mR/hr. .

ARE LOCKS PRESENT AND OPERABLE ON THE FOLLOWING:

Exposure Device (YES ☐ NO ☐) , Storage Box (YES ☐ NO ☐) , Darkroom (YES ☐ NO ☐) , Cab of Truck (YES ☐ NO ☐) .

PRACTICAL APPLICATION OF SAFETY REQUIREMENTS:

Physical survey performed after each exposure (YES ☐ NO ☐) , Exposure Device surveyed after each exposure (YES ☐ NO ☐) , Entire Length of Source Tube surveyed after each exposure (YES ☐ NO ☐) , Was survey meter used properly during each exposure (YES ☐ NO ☐) , Was Exposure Device locked after each exposure (YES ☐ NO ☐) .

WAS CONSTANT SURVEILLANCE MAINTAINED ON FOLLOWING:

Exposure Device when out of shipping container? (YES ☐ NO ☐) , All accessible entrances to the Restricted Area (YES ☐ NO ☐) .

Other items checked concerning radiation safety: \_\_\_\_\_

If a negative answer is obtained to any of the above questions, list the corrective action on the reverse side of this form.

AUTHORIZATION: I certify that the above mentioned Unannounced Inspection was conducted by me on \_\_\_\_\_ (date).

SIGNATURE OF RADIATION SAFETY OFFICER \_\_\_\_\_

Technician: \_\_\_\_\_ Date: \_\_\_\_\_

## NDE Division

**Week ending:**

[illegible]

# MID AMERICAN

INSPECTION SERVICES • NDE DIVISION

DOSIMETER PENCIL ACCURACY VERIFICATION TAG

CALIBRATION	
date	_____
by SAMPLE	_____
due	_____

# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

if you have reason to believe that your film badge has been overexposed or lost, complete this form immediately.

Name \_\_\_\_\_

Social Security Number \_\_\_\_\_

### POSSIBLE OVEREXPOSURE

1. When did the possible overexposure occur? Time: \_\_\_\_\_ Date: \_\_\_\_\_
2. Location: \_\_\_\_\_ Customer: \_\_\_\_\_ Address: \_\_\_\_\_
3. When did you notify your R.S.O.? Time: \_\_\_\_\_ Date: \_\_\_\_\_
4. Did you stop work immediately? \_\_\_\_\_ Yes \_\_\_\_\_ No Is your badge on its way to the R.S.O. \_\_\_\_\_ Yes \_\_\_\_\_ No
5. Did your dosimeter go off scale? \_\_\_\_\_ Yes \_\_\_\_\_ No If no, what did it read? \_\_\_\_\_
6. Was there anyone else involved? \_\_\_\_\_ Yes \_\_\_\_\_ No If Yes, who? \_\_\_\_\_
7. Approximately how far were you from the source? \_\_\_\_\_ For how long? \_\_\_\_\_
8. Do you believe you have overexposed? \_\_\_\_\_ Yes \_\_\_\_\_ No

Give specific details of exactly everything that happened: \_\_\_\_\_  
(over)

### LOST FILM BADGE

1. Did you lose your film badge? \_\_\_\_\_ Yes \_\_\_\_\_ No Was it stolen? \_\_\_\_\_ Yes \_\_\_\_\_ No
2. Was your film badge destroyed? \_\_\_\_\_ Yes \_\_\_\_\_ No If yes, how? \_\_\_\_\_
3. Were you working at the time you discovered it missing? \_\_\_\_\_ Yes \_\_\_\_\_ No
4. When did you notice your badge missing? Time: \_\_\_\_\_ Date: \_\_\_\_\_
5. Did you continue working or report to work without a film badge? \_\_\_\_\_ Yes \_\_\_\_\_ No
6. If your answer is yes to Question #5-EXPLAIN WHY!!! (Use Reverse Side)
7. When did you notify the R.S.O.? Time: \_\_\_\_\_ Date: \_\_\_\_\_

I \_\_\_\_\_ certify that the above information is correct.

Signature \_\_\_\_\_ Date: \_\_\_\_\_



# MIL AMERICAN

## INSPECTION SERVICES • NDE DIVISION

### RADIATION INCIDENT REPORT

NAME: \_\_\_\_\_ SOCIAL SECURITY #: \_\_\_\_\_

DATE: \_\_\_\_\_ TIME: \_\_\_\_\_

☐ POSSIBLE OVEREXPOSURE:

1. When did the incident occur? Time: \_\_\_\_\_ Date: \_\_\_\_\_

2. LOCATION: Customer Name: \_\_\_\_\_

Address: \_\_\_\_\_

3. When did you notify the RSO? Time: \_\_\_\_\_ Date: \_\_\_\_\_

4. Did you stop work immediately? \_\_\_\_\_ Yes \_\_\_\_\_ No

5. Is the film badge submitted for processing? \_\_\_\_\_ Yes \_\_\_\_\_ No

6. Did your dosimeter pencil(s) go off-scale? \_\_\_\_\_ Yes \_\_\_\_\_ No

7. Was anyone else involved in the exposure? \_\_\_\_\_ Yes \_\_\_\_\_ No

Name(s): \_\_\_\_\_

Telephone Number(s): \_\_\_\_\_

8. On the reverse side, give a complete written account of all events of the incident. Be specific and provide details of the cause and/or sketches of the actual worksite.

9. Could this incident have been prevented? \_\_\_\_\_ Yes \_\_\_\_\_ No

How? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

Name: \_\_\_\_\_ Social Security #: \_\_\_\_\_

Classification: \_\_\_\_\_ Year: \_\_\_\_\_

### Written Material(s)

Quiz/Exam Number	Date Completed	Results

### PRACTICAL APPLICATION/FIELD DEMONSTRATION AND TRAINING

Date	Location	Subject(s) or Topic(s) of Discussion	Instructor

# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

### RECORD OF RADIATION SAFETY TRAINING

Name \_\_\_\_\_ S. S. \_\_\_\_\_

SUBJECT	DATE	HOURS	INSTRUCTOR	COMMENTS BY INSTRUCTOR
I. FUNDAMENTALS of RADIATION SAFETY				
A. Why radiation safety is important				
B. What is radiation/radioactivity				
C. Harmful effects of radiation				
D. Levels of radiation from licensed material				
E. Methods of controlling radiation dose				
1. Working time				
2. Working distance				
3. Shielding				
II. RADIATION DETECTION				
Instruments to be used				
A. Use of radiation survey instruction				
1. Operation				
2. Calibration				
3. Limitations				
B. Survey techniques				
C. Use of personnel monitoring equip.				
1. Film badges				
2. Dosimeters				
III. RADIOGRAPHIC EQUIPMENT TO BE USED				
A. Remote handling equipment				
B. Radiographic exposure devices				
C. Storage containers				
IV. INSPECTION AND MAINTENANCE PERFORMED BY THE RADIOGRAPHER				
A. Exposure devices/changers				
B. Remote handling equipment				
C. Survey instruments				
V. CASE HISTORIES				
A. Cause				
B. Prevention				
VI. TITLE 10, CHAPTER 1 C.F.R.				
A. Part 19				
B. Part 20				
C. Part 34				

# MID AMERICAN

INSPECTION SERVICES • NDE DIVISION

650 ALPINE ROAD  
GAYLORD, MICHIGAN 49735  
(517) 732-8059

We are requesting verification of training on the following individuals, in accordance with Part 34, Title 10.

Check applicable:

- A. \_\_\_\_\_ Has completed 40 hours of radiation safety in accordance with our licensed program.
- B. \_\_\_\_\_ Has acted as Radiographer for at least one year under our license.

Company \_\_\_\_\_

Material License Number \_\_\_\_\_

\_\_\_\_\_  
RADIATION SAFETY OFFICER

# MID AMERICAN

INSPECTION SERVICES • NDE DIVISION

Date \_\_\_\_\_

Gentlemen:

As a former employee of yours, it is necessary that I request a copy of my radiation history stating the amount of radiation absorbed for each quarter while in your employ.

My Social Security Number is \_\_\_\_\_, and my employment was during the year(s) \_\_\_\_\_.

Please forward this information to the Radiation Safety Department of MAIS, INC., at the above address.

This request is in accordance with Part 19.13(C) of Title 10, Code of Federal Regulations.

Sincerely,

\_\_\_\_\_

# DOSIMETER PENCIL READINGS

U. S. NUCLEAR REGULATORY COMMISSION

## CURRENT OCCUPATIONAL EXTERNAL RADIATION EXPOSURE

See Instructions on Back

### IDENTIFICATION

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

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

8. PERIOD OF EXPOSURE (From - To)	DOSE FOR THE PERIOD (rem)				13. RUNNING TOTAL FOR CALENDAR QUARTER (rem)
	9. X OR GAMMA	10. BETA	11. NEUTRON	12. TOTAL	
JANUARY FEBRUARY MARCH QTR. TOTAL CUMULATIVE					
APRIL MAY JUNE QTR. TOTAL CUMULATIVE					
JULY AUGUST SEPTEMBER QTR. TOTAL CUMULATIVE					
OCTOBER NOVEMBER DECEMBER QTR. TOTAL CUMULATIVE					

### LIFETIME ACCUMULATED DOSE

14. PREVIOUS TOTAL (rem)	15. TOTAL QUARTERLY DOSE from rem	16. TOTAL ACCUMULATED DOSE (rem)	17. PERM. ACC. DOSE (5 R in 10) (rem)	18. UNUSED PART OF PERMISSIBLE ACCUMULATED DOSE (rem)



## CURRENT OCCUPATIONAL EXTERNAL RADIATION EXPOSURE

See Instructions on Back

## IDENTIFICATION

1. NAME (PRINT - Last, first, and middle)		2. SOCIAL SECURITY NO.	
3. DATE OF BIRTH (Month, day, year)		4. NAME OF LICENSEE	
5. DOSE RECORDED FOR (Specify: Whole body; skin of whole body; or hands and forearms, feet and ankles.)		6. WHOLE BODY DOSE STATUS (rem)	7. METHOD OF MONITORING (e.g., Film Badge - FB; Pocket Chamber - PC; Calculations - Calc.) X OR GAMMA _____ BETA _____ NEUTRONS _____

8. PERIOD OF EXPOSURE (From - To)	DOSE FOR THE PERIOD (rem)				13. RUNNING TOTAL FOR CALENDAR QUARTER (rem)
	9. X OR GAMMA	10. BETA	11. NEUTRON	12. TOTAL	
JANUARY					
FEBRUARY					
MARCH					
QTR. TOTAL CUMULATIVE					
APRIL					
MAY					
JUNE					
QTR. TOTAL CUMULATIVE					
JULY					
AUGUST					
SEPTEMBER					
QTR. TOTAL CUMULATIVE					
OCTOBER					
NOVEMBER					
DECEMBER					
QTR. TOTAL CUMULATIVE					

## LIFETIME ACCUMULATED DOSE

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

## OCCUPATIONAL EXTERNAL RADIATION EXPOSURE HISTORY

See Instructions on the Back

## IDENTIFICATION

1. NAME (PRINT - LAST, FIRST, AND MIDDLE)

2. SOCIAL SECURITY NO.

3. DATE OF BIRTH (MONTH, DAY, YEAR)

4. AGE IN FULL YEARS (N)

## OCCUPATIONAL EXPOSURE - PREVIOUS HISTORY

5. PREVIOUS EMPLOYMENTS INVOLVING  
RADIATION EXPOSURE—LIST NAME AND  
ADDRESS OF EMPLOYER6. DATES OF EMPLOYMENT  
(FROM-TO)

7. PERIODS OF EXPOSURE

8. WHOLE BODY  
(REM)9. RECORD OR CALCULATED  
(INSERT ONE)

10. REMARKS

11. ACCUMULATED OCCUPATIONAL DOSE  
- TOTAL13. CALCULATIONS - PERMISSIBLE DOSE  
WHOLE BODY:(A) PERMISSIBLE ACCUMULATED DOSE =  $5(N-18)$  \* \_\_\_\_ REM

(B) TOTAL EXPOSURE TO DATE (FROM ITEM 11) \* \_\_\_\_ REM

(C) UNUSED PART OF  
PERMISSIBLE ACCUMULATED  
DOSE (A-B) \* \_\_\_\_ REM12. CERTIFICATION: I CERTIFY THAT THE EXPOSURE HISTORY  
LISTED IN COLUMNS 5, 6, AND 7 IS CORRECT AND COMPLETE  
TO THE BEST OF MY KNOWLEDGE AND BELIEF.

EMPLOYEE'S SIGNATURE

DATE

14. NAME OF LICENSEE

REPORT OF TERMINATING INDIVIDUAL'S  
OCCUPATIONAL EXPOSURE

2. NRC LICENSE NUMBER(S)

SEE ATTACHED INSTRUCTIONS

PART I. LICENSEE AND INDIVIDUAL IDENTIFICATION DATA

3. NAME AND ADDRESS OF REPORTING LICENSEE

4. NAME OF INDIVIDUAL (first, middle initial, last) AND ADDRESS (optional)

5. NAME AND ADDRESS OF EMPLOYER, IF DIFFERENT FROM ABOVE (Optional)

6. SOCIAL SECURITY NUMBER

7. DATE OF BIRTH MONTH DAY YEAR

PART II. EXTERNAL DOSE DATA

8. PERSONNEL MONITORING FOR EXTERNAL EXPOSURE TO RADIATION WAS NOT PROVIDED

9. PERIOD(S) OF EXPOSURE  
(earliest date first)

10. WHOLE BODY DOSE (rem)

DEEP

SHALLOW (skin)

11. EXTREMITY DOSE (rem)

a. TOTAL

b. NEUTRON

c. TOTAL

d. BETA

SHALLOW (skin)

PART III. INTERNAL EXPOSURES TO RADIOACTIVE MATERIAL

12. PERSONNEL MONITORING FOR EXPOSURE TO RADIOACTIVE MATERIAL WAS NOT PROVIDED

13. PERIOD(S) OF EXPOSURE  
(earliest date first)

14. NUCLIDE

15. FORM  
(S, I)

16. BIOASSAY RESULTS

a. IN VIVO (mCi)

b. URINALYSIS  
RESULTS ( /L)

17. DOSE ESTIMATES (rem)

a. COM-  
MITTED  
DOSE

b. ANNUAL  
DOSE

c. ORGAN

18. INTAKE  
(MPC-Hrs.)

19. OTHER BIOASSAY RESULTS

a. Percent MPBB

b. Percent MPOB

c. MPC-hrs

d. Nanocurie intake

e. General

20. IF THIS REPORT IS BEING USED TO SATISFY THE NOTIFICATION REQUIREMENTS OF 10 CFR §19.13, CHECK THE FOLLOWING BOX

**INSTRUCTIONS FOR COMPLETING NRC FORM 439.**  
**Report of Terminating Individual's Occupational Exposure**

If you are licensed by the U.S. Nuclear Regulatory Commission (NRC) as specified in §20.408(a), 10 CFR Part 20, you are required to submit termination radiation exposure reports on certain individuals to the Director, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, DC 20555. This information is to be taken from those records that must be maintained under §20.401 for individuals likely to receive exposure to radiation that exceeds a certain percentage of the NRC dose standards for the whole body, skin or extremities—25% for workers of age 18 years or more, 5% for workers younger than 18. The term "individual" is used below to represent the worker for whom this report is submitted. The term "dose" as used in Form 439 and in these instructions refers to the dose in rems as defined in §20.4(a) and subsequently designated "dose equivalent" in ICRU Report II (1968). The time to be covered by this report is that period of employment or work assignment in your facility that satisfies the following conditions: personnel monitoring was required by §20.202(a) or bioassays were required by your license; the period ended with the most recent termination; the period has not already been reported to the NRC. "Termination" is defined in §20.3(a)(19). Parts II and III of this form reflect regulatory requirements as well as requests intended to standardize reporting methods; requests are clearly identified as such.

**PART I. LICENSEE AND INDIVIDUAL IDENTIFICATION DATA**

This part identifies the licensee submitting the report and the terminating individual. It must be completed even if only one of the remaining Parts of this form is applicable. Enter the following data:

**ITEM NUMBER**

- 1 Date that the report was prepared.
- 2 Current NRC license number assigned to the facility(s) in which the individual received the reported dose. If more than one license is involved, enter the license number for the facility or activity under which most of the dose was incurred as the first number. If this is not practical, enter the license numbers in the order of original issuance.
- 3 Name and address of your facility as it appears on your NRC license.
- 4 The individual's first name, middle initial, and surname. (Address of the individual may be included, but it is not entered into the NRC records system.)
- 5 The name and address of the individual's employer, if it is different from the reporting licensee. (Optional; not entered into the NRC records system.)
- 6 The individual's social security number; if not available, enter the word "unknown."
- 7 The individual's date of birth.

**PART II. EXTERNAL DOSE DATA**

For the purpose of this form, the deep dose is defined as the dose assessed at a tissue depth of 300 mg/cm<sup>2</sup> (or less) or 1,000 mg/cm<sup>2</sup> (or less), the shallow dose is defined as the dose to the skin of any part of the body, and the extremities are defined as hands and forearms, feet and ankles.

Item Number 8 If the individual was not monitored for external exposure to radiation, you are requested to check the box to the left and go to Part III.

**COLUMN NUMBER**

- 9 Specify the reporting intervals (periods of exposure) that the individual was monitored at your facility(s) pursuant to §20.202. You are requested to use annual increments up to the year of termination and increments not to exceed one quarter for the year in which the individual terminated:  
 ANNUAL: Indicate the month and year of the beginning date of exposure when showing annual increments (e.g., May 1979) and indicate the year only for subsequent annual increments;  
 QUARTER: For each completed quarter of the year of termination, indicate the quarter and year by date;  
 CURRENT QUARTER: Specify the beginning and ending dates of the actual exposure period (month, day, year);  
 Enter the following data:
- 10a Unless the eyes are shielded, enter the deep dose assessed at a tissue depth of 300 mg/cm<sup>2</sup> (less depth) or less. If the eyes are protected by shielding which has a tissue equivalent thickness of 700 mg/cm<sup>2</sup> or more, the deep dose may be assessed at 1000 mg/cm<sup>2</sup> (gonad depth) or less. Enter the total dose of record, i.e., the highest dose received at the selected depth, from all types of external radiation sources, at any location on the body except the skin and the extremities (hands and forearms, feet and ankles).
- 10c For all skin areas, except that of the extremities, enter in column 10c the shallow dose of record. Record the total dose to the skin, i.e., the highest dose delivered by all radiation incidents on the skin, including non-trivial doses from skin contamination, which penetrates to the depth at which the shallow dose is determined. The dose at a depth of 7 mg/cm<sup>2</sup> or less, averaged over 1 cm<sup>2</sup>, is acceptable. If Column 10c is left blank, it will be assumed that the entry in 10a is applicable also for the shallow dose. Therefore, an entry for shallow dose is required only if it exceeds the deep dose.
- 10b & d As an option, you may enter in column 10b the contribution made by neutron radiation to the dose reported in Column 10a, and enter in Column 10d the contribution made by beta radiation to the dose reported in Column 10c. Enter XXX if it is known that there was no exposure to radiation of the type specified in the column heading. Enter UNK if a detectable exposure is reported in 10a or 10c which could have included a beta or neutron contribution of unknown magnitude.
- 10 & 11 You are requested to enter m or zero (in each column of 10 or in 11) if the dose was undetectable; i.e., the radiation to which the worker's dosimeter was exposed produced a response that you considered to be statistically indistinguishable from the response caused by inherent variabilities of the dosimeter system. Note: It is sometimes required to add m (or its equivalent) to a real number; although NRC regulations do not specify a summation procedure, the NRC staff arbitrarily assigns 10 mrem to be a value of m (assuming 0.5 L ≤ 10 ≤ L, where L is the detection limit) for the purposes of statistical analyses.
- 11 Reporting of the extremity dose is required. You are requested to comply in the following manner. Enter the dose of record, i.e., the highest dose averaged over an area of 1 cm<sup>2</sup> determined for the skin of the hands and forearms or feet and ankles during the reported period. It is unnecessary to specify the extremity that received the dose; doses to different extremities should not be added together. The dose is to include that delivered by all radiation incident on the skin, including non-trivial doses from skin contamination, which penetrates to the depth at which the shallow dose is determined. The dose at a depth of 7 mg/cm<sup>2</sup> or less is acceptable. If Column 11 is left blank, it will be assumed that the entry in 10c is applicable also for the extremity dose; an entry in Column 11 is required only if the shallow dose exceeded the deep dose.

**PART III. INTERNAL EXPOSURES TO RADIOACTIVE MATERIAL**

The reporting of information concerning internal exposures that you have obtained in compliance with §20.103(a)(3) and §20.103(c)(2) and recorded in compliance with §20.401(b) is required only if bioassays are necessary for timely detection and assessment of individual intakes; otherwise, the reporting of bioassay results is optional. Part III provides for the reporting of the results of internal monitoring procedures in terms of bioassay results, dose estimates, or intake in Columns 13 through 18 and in general summary statements in Item 19. Any one (or more) of these reporting methods may be used. The term "individual" is used below to represent the worker for whom this report is submitted. The term "exposures to radioactive material" is used in this part to represent the entry of radioactive material into the body.

Item Number 12 If the individual was not monitored for exposure to radioactive material, you are requested to check the box to the left; otherwise, enter the following data:

Column Number 13 If bioassay results are reported (Column 16), you are requested to use the following format. Summarize by year, separately listing the number of measurements which indicated quantities or concentrations that were undetectable; i.e., in the detection system used, the radionuclide present (if any) produced a response that you considered to be statistically indistinguishable from its background. In Column 13 enter each year bioassay was performed, including the year of termination. In Columns 14 through 16, use two lines for each year as in the example shown below: the upper line for detectable results and the lower line for those undetectable. In 16a and/or 16b, enter in the upper line, the number (including zero) of detectable measurements followed in parenthesis by the highest verified result, if any; enter in the lower line, the number (including zero) of measurements indicating undetectable amounts.



## INSTRUCTIONS FOR COMPLETING NRC FORM 439 (Continued)

## COLUMN NUMBER

13 (Continued)

Column 13

Column 14

Column 15

Column 16

			16a(1)	16a(2)	16b (pCi/L)
1982	U-nat	"I"	0	lung	2(1)
1983	U-nat(Th 234)	"I"	2	lung	10
			1(7)	lung	4(6)
1984	U-nat(Th 234)	"I"	1	lung	8
			2(14)	lung	12(13)
			0	lung	0

Units for the numbers in parentheses shown in Column 16b are to be specified in the heading for Column 16b. If Columns 17 or 18 are completed, notations in Column 16 are unnecessary.

If the dose commitment (50-year integrated dose) is reported, indicate in Column 13 by beginning and ending dates (month, day, year) the period during which the associated radioactive material was taken into the body.

If annual doses are reported, enter in Column 13 the calendar year over which each dose was integrated, including the first and any succeeding years of this employment or work assignment and the year following the termination date.

For entries in Column 18 (intake), specify the reporting intervals (periods of exposure) during which the individual was exposed to concentrations of radioactive material, using annual increments up to the year of termination and increments not to exceed one quarter for the year in which the individual terminated. The periods of exposure for intakes should appear as follows:

ANNUAL: Indicate the month and year of the beginning date of exposure when showing annual increments (e.g., June 1983) and indicate the year only for subsequent annual increments.

QUARTER: For each completed quarter of the year of termination, indicate the quarter and year by date.

CURRENT QUARTER: Specify the beginning and ending dates of the actual exposure period (month, day, year).

Reported intakes which include only the quantities required to be assessed in accordance with §20.103(a)(3) are acceptable.

- 14 Identify the symbol used in 10 CFR Part 20, Appendix B, for the radionuclide or mixture of radionuclides for which in vivo and/or urinalysis measurements were performed (e.g., Co 60, U 235). If the measured quantity of activity for one radionuclide is also used to estimate other radionuclide quantities, identify the radionuclide actually measured in parentheses immediately after the radionuclide listed in Column 14. See the example given in the directions for Column 13 where U-nat(Th 234) is entered in Column 14 indicating that the uranium lung burden was determined from measurements of Th 234 photons.
- 15 Enter the form, S for soluble or I for insoluble, of the radionuclide to which the worker was exposed. If unknown, use quote around the letter, thus indicating which concentration value in Part 20, Appendix B, Table 1, Column 1, was assumed to apply.
- 16, 17 & 18 These columns allow for the reporting of the results of the internal monitoring procedures in terms of bioassay results, dose estimates, or intakes. You may use one or more of these methods.
- 16a(1) & a(2) For each year in which in vivo measurements were performed, as shown in Column 13, enter in Column 16a(1) the number of detectable measurements followed by the highest verified result (in nanocuries) in parentheses. On the next line in this column, enter the number of measurements that indicated undetectable amounts. Specify in Column 16a(2) the organ in which the indicated radionuclide was found. See the example given in the directions for Column 13.
- 16b First, enter the gravimetric or radiometric unit in which the urinalysis results are reported (e.g., micrograms per liter, nanocuries per liter) in the blank space of the heading for Column 16b. In Column 16b, for each year during which urinalyses were performed, enter the number of detectable results followed by the highest numerical value of the concentration in urine of the radionuclide listed in Column 14 for the year specified in Column 13. On the next line in this column, enter the number of measurements indicating undetectable amounts. See the example given in the directions for Column 13.
- 17a, b, & c Specify in Column 17c the organ or tissue receiving doses estimated in Column 17a or 17b. (Note that it is not necessary to provide both the committed and annual doses.) For Columns 17a and 17b you are requested to follow the procedures below; if any alternative procedures are used, describe them on the back of this form. In 17a, enter the dose integrated from t to 50 years, where t is the beginning date shown in Column 13. In 17b enter the dose integrated over each calendar year shown for this purpose in Column 13. Include the first and any succeeding years of this employment or work assignment and the year following the termination date. Base dose estimates on the quantity (as a minimum) of the radionuclide, Column 14, taken into the body at your facility(s) during this employment or work-assignment period.
- 18 Reporting of radionuclide intakes, as determined by air sampling, is not required by 10 CFR 20.408. However, if you choose to do so, indicate the time-weighted concentrations of radioactive material (i.e., MPC-hours) to which the individual was exposed during the time periods indicated in Column 13. Refer to the last paragraph of the instructions for Column 13 for the time intervals to be used. Complete Columns 13, 14, and 15 for each entry in Column 18.
- Item Number 19, a, b, c, d, or e As another option you may show the summation of non-nuclide-specific data in terms of a. percent of maximum permissible body burden (% MPBB); b. percent of maximum permissible organ burden (% MPOB); c. total exposure to time-weighted concentrations of radioactive material (MPC-hrs); or d. total nanocurie intake. These summations can be indicated as Item 19, rows a, b, c, or d, respectively. General statements such as "no significant intake was detected during the period covered by this report," can be shown in 19e. Any other bioassay results that cannot be reported elsewhere in Part III may also be entered in 19e or on the reverse of the form.
- Item Number 20 If you intend to send a copy of this report to the terminating individual to satisfy the notification requirements of 10 CFR §19.13, check the "Yes" box.

## PRIVACY ACT STATEMENT

Pursuant to 5 U.S.C. 552a(e)(3), enacted into law by section 3 of the Privacy Act of 1974 (Public Law 93-579), the following statement is furnished to individuals and persons who supply information to the Nuclear Regulatory Commission on NRC Form 439. This information is maintained in a system of records designated as NRC-27 and described as 40 Federal Register 45344 (October 1, 1975).

- 1. AUTHORITY.** Sections 53, 63, 65, 81, 103, 104, 161(b), and 161(o) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2073, 2093, 2095, 2111, 2133, 2134, 2201(b), and 2201(o)). The authority for soliciting the social security number is 10 CFR Part 20.
- 2. PRINCIPAL PURPOSE(S).** The information is used by the NRC in its evaluation of the risk of radiation exposure associated with the licensed activity and in exercising its statutory responsibility to monitor and regulate the safety and health practices of its licensees. The data permit a meaningful comparison of both current and long-term exposure experience among types of licensees and among licensees within each type. Data on your exposure to radiation are available to you upon request.
- 3. ROUTINE USES.** The information may be used to provide data to other Federal and State agencies involved in monitoring and/or evaluating radiation exposure received by individuals employed as radiation workers on a permanent or temporary basis and exposure received by monitored visitors. The information may also be disclosed to an appropriate Federal, State, or local agency in the event the information indicates a violation or potential violation of law and in the course of an administrative or judicial proceeding.
- 4. WHETHER DISCLOSURE IS MANDATORY OR VOLUNTARY AND EFFECT OF NOT PROVIDING INFORMATION ON INDIVIDUAL OR PERSON.** It is voluntary that you furnish the requested information, including name, date of birth, and social security number. The social security number is used to ensure that NRC has an accurate identifier not subject to the coincidence of similar names or birth dates among the large number of persons on whom data is maintained. Please note, however, that the licensee must file a termination report containing certain required information such as social security number for each individual whose employment or work assignment has terminated and for whom personnel monitoring was required under 10 CFR §20.202. Failure of the licensee to provide the information under 10 CFR §20.202 and §20.408 may subject the licensee to enforcement action under 10 CFR §20.601.
- 5. SYSTEM MANAGER(S) AND ADDRESS:** Director, Office of Nuclear Regulatory Research  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555



# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

### HISTORY OF EMPLOYMENT AND QUALIFICATION

PLEASE COMPLETE THE FOLLOWING QUESTIONS. USE ADDITIONAL PIECES OF PAPER TO SUPPLEMENT ANY ANSWERS. INCLUDE COPIES OF CERTIFICATIONS, DIPLOMAS, ETC. WHERE INDICATED BY AN ASTERISK (\*).

NAME: \_\_\_\_\_

(As you wish it to appear on your certification documents)

SOCIAL SECURITY NUMBER: \_\_\_\_\_

BIRTHDATE: \_\_\_\_\_

\*HIGH SCHOOL: \_\_\_\_\_

NAME & \_\_\_\_\_

ADDRESS \_\_\_\_\_

GRAD. DATE \_\_\_\_\_

\*COLLEGES AND/OR \_\_\_\_\_

TECHNICAL SCHOOL(S): \_\_\_\_\_

(NAME & ADDRESS) \_\_\_\_\_

\*LIST ALL SOURCES OF FORMAL TRAINING YOU HAVE RECEIVED. (INCLUDE ALL TRAINING ON THE SUBJECTS OF RADIATION THEORY, SAFETY, AND NRC REGULATIONS)

COMPANY: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

COURSE TITLE: \_\_\_\_\_

DATE: \_\_\_\_\_ INSTRUCTOR: \_\_\_\_\_ HOURS: \_\_\_\_\_

COMPANY: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

COURSE TITLE: \_\_\_\_\_

DATE: \_\_\_\_\_ INSTRUCTOR: \_\_\_\_\_ HOURS: \_\_\_\_\_

COMPANY: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

COURSE TITLE: \_\_\_\_\_

DATE: \_\_\_\_\_ INSTRUCTOR: \_\_\_\_\_ HOURS: \_\_\_\_\_

CONTROL NO. 397275

# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

### FORMAL TRAINING (Continued)

COMPANY: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

COURSE TITLE: \_\_\_\_\_

DATE: \_\_\_\_\_ INSTRUCTOR: \_\_\_\_\_ HOURS: \_\_\_\_\_

COMPANY: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

COURSE TITLE: \_\_\_\_\_

DATE: \_\_\_\_\_ INSTRUCTOR: \_\_\_\_\_ HOURS: \_\_\_\_\_

COMPANY: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

COURSE TITLE: \_\_\_\_\_

DATE: \_\_\_\_\_ INSTRUCTOR: \_\_\_\_\_ HOURS: \_\_\_\_\_

### EMPLOYMENT EXPERIENCE

(List latest employer first)

COMPANY & ADDRESS: \_\_\_\_\_

FROM: Mo \_\_\_\_\_ Yr \_\_\_\_\_

TO: Mo \_\_\_\_\_ Yr \_\_\_\_\_

JOB TITLE: \_\_\_\_\_

CERTIFICATIONS HELD:	METHOD	SPECIFICATION(S)
----------------------	--------	------------------

(List methods & the specification certified to)	_____	_____
	_____	_____
	_____	_____
	_____	_____

JOB DESCRIPTION: \_\_\_\_\_

WORKED WITH RADIOACTIVE MATERIAL DURING MY EMPLOYMENT. YES \_\_\_\_\_ NO \_\_\_\_\_

DURING MY EMPLOYMENT I WAS ISSUED PERSONNEL DOSIMETRY. YES \_\_\_\_\_ NO \_\_\_\_\_

# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

### EMPLOYMENT EXPERIENCE (Continued)

COMPANY & ADDRESS: \_\_\_\_\_

FROM: Mo \_\_\_\_\_ Yr \_\_\_\_\_

TO: Mo \_\_\_\_\_ Yr \_\_\_\_\_

JOB TITLE: \_\_\_\_\_

CERTIFICATIONS HELD:

METHOD

SPECIFICATION(S)

(List methods &  
the specification  
certified to)

JOB DESCRIPTION: \_\_\_\_\_

WORKED WITH RADIOACTIVE MATERIAL DURING MY EMPLOYMENT. YES \_\_\_\_\_ NO \_\_\_\_\_

DURING MY EMPLOYMENT I WAS ISSUED PERSONNEL DOSIMETRY. YES \_\_\_\_\_ NO \_\_\_\_\_

COMPANY & ADDRESS: \_\_\_\_\_

FROM: Mo \_\_\_\_\_ Yr \_\_\_\_\_

TO: Mo \_\_\_\_\_ Yr \_\_\_\_\_

JOB TITLE: \_\_\_\_\_

CERTIFICATIONS HELD:

METHOD

SPECIFICATION(S)

(List methods &  
the specification  
certified to)

JOB DESCRIPTION: \_\_\_\_\_

WORKED WITH RADIOACTIVE MATERIAL DURING MY EMPLOYMENT. YES \_\_\_\_\_ NO \_\_\_\_\_

DURING MY EMPLOYMENT I WAS ISSUED PERSONNEL DOSIMETRY. YES \_\_\_\_\_ NO \_\_\_\_\_

CONTROL NO. 397275

# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

### EMPLOYMENT EXPERIENCE (Continued)

COMPANY & ADDRESS: \_\_\_\_\_

FROM: Mo \_\_\_\_\_ Yr \_\_\_\_\_

TO: Mo \_\_\_\_\_ Yr \_\_\_\_\_

JOB TITLE: \_\_\_\_\_

CERTIFICATIONS HELD:

METHOD

SPECIFICATION(S)

(List methods &  
the specification  
certified to)

JOB DESCRIPTION: \_\_\_\_\_

WORKED WITH RADIOACTIVE MATERIAL DURING MY EMPLOYMENT. YES \_\_\_\_\_ NO \_\_\_\_\_

DURING MY EMPLOYMENT I WAS ISSUED PERSONNEL DOSIMETRY. YES \_\_\_\_\_ NO \_\_\_\_\_

COMPANY & ADDRESS: \_\_\_\_\_

FROM: Mo \_\_\_\_\_ Yr \_\_\_\_\_

TO: Mo \_\_\_\_\_ Yr \_\_\_\_\_

JOB TITLE: \_\_\_\_\_

CERTIFICATIONS HELD:

METHOD

SPECIFICATION(S)

(List methods &  
the specification  
certified to)

JOB DESCRIPTION: \_\_\_\_\_

WORKED WITH RADIOACTIVE MATERIAL DURING MY EMPLOYMENT. YES \_\_\_\_\_ NO \_\_\_\_\_

DURING MY EMPLOYMENT I WAS ISSUED PERSONNEL DOSIMETRY. YES \_\_\_\_\_ NO \_\_\_\_\_

# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

### EMPLOYMENT EXPERIENCE (Continued)

COMPANY & ADDRESS: \_\_\_\_\_

FROM: Mo \_\_\_\_\_ Yr \_\_\_\_\_

TO: Mo \_\_\_\_\_ Yr \_\_\_\_\_

JOB TITLE: \_\_\_\_\_

CERTIFICATIONS HELD:

METHOD

SPECIFICATION(S)

(List methods &  
the specification  
certified to)

JOB DESCRIPTION: \_\_\_\_\_

WORKED WITH RADIOACTIVE MATERIAL DURING MY EMPLOYMENT. YES \_\_\_\_\_ NO \_\_\_\_\_  
DURING MY EMPLOYMENT I WAS ISSUED PERSONNEL DOSIMETRY. YES \_\_\_\_\_ NO \_\_\_\_\_

COMPANY & ADDRESS: \_\_\_\_\_

FROM: Mo \_\_\_\_\_ Yr \_\_\_\_\_

TO: Mo \_\_\_\_\_ Yr \_\_\_\_\_

JOB TITLE: \_\_\_\_\_

CERTIFICATIONS HELD:

METHOD

SPECIFICATION(S)

(List methods &  
the specification  
certified to)

JOB DESCRIPTION: \_\_\_\_\_

WORKED WITH RADIOACTIVE MATERIAL DURING MY EMPLOYMENT. YES \_\_\_\_\_ NO \_\_\_\_\_  
DURING MY EMPLOYMENT I WAS ISSUED PERSONNEL DOSIMETRY. YES \_\_\_\_\_ NO \_\_\_\_\_



# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

### EMPLOYMENT EXPERIENCE (Continued)

COMPANY & ADDRESS: \_\_\_\_\_

FROM: Mo \_\_\_\_\_ Yr \_\_\_\_\_

TO: Mo \_\_\_\_\_ Yr \_\_\_\_\_

JOB TITLE: \_\_\_\_\_

CERTIFICATIONS HELD:	METHOD	SPECIFICATION(S)
(List methods & _____	_____	_____
the specification _____	_____	_____
certified to) _____	_____	_____
	_____	_____

JOB DESCRIPTION: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

WORKED WITH RADIOACTIVE MATERIAL DURING MY EMPLOYMENT. YES \_\_\_\_\_ NO \_\_\_\_\_

DURING MY EMPLOYMENT I WAS ISSUED PERSONNEL DOSIMETRY. YES \_\_\_\_\_ NO \_\_\_\_\_

TO BE COMPLETED BY RADIOGRAPHIC PERSONNEL ONLY! Complete A. OR B.

A. During the current calendar quarter, I had NO prior occupational dose.

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

B. I HAVE HAD prior occupational dose(s) during this current calendar quarter. Below is a description of the nature and amount I have received.

Period of	Type of				
Exposure	Radiation	Part of Body	Employer	Est. of Dose	
to					
to					

I hereby certify that, to the best of my knowledge, the above information is true and accurate.

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

CONTROL NO. 897275

# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

### TRAINING PROGRAM

#### PURPOSE:

The function of this program is to assure that all individuals working with or around radioactive material will have the proper training in the use of/and protection against radiation exposure. For any individual to act as a Radiographer or Radiographer's Assistant, they must meet the requirements pertaining to that particular classification. The minimum requirements are covered in the following Sections of this Manual.

#### SCOPE:

There are three classifications covered in the training program.

- A. Radiographer: Means 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 Commission's regulations and the conditions of the license.
- B. Radiographer's Assistant: Means any individual who, under the personal supervision of a Radiographer, uses radiographic exposure devices, sealed sources or related handling tools, or radiation survey instruments in radiography.
- C. Radiography Trainee: Means any individual with no prior training, who under the personal supervision of a Radiographer is restricted to a limited assignment of duties. Under no circumstances is the Trainee allowed to use radiographic exposure devices for the purpose of industrial radiography.

For any individual to act as a Radiographer or Radiographer's Assistant, they must meet the requirements of this Company's training manual.

# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

### TRAINING OF RADIOGRAPHER'S ASSISTANT, RADIOGRAPHER, RADIOGRAPHY TRAINEE

The Radiation Safety Officer shall be responsible for training all radiographic personnel. The Radiation Safety Officer may delegate certain training functions to individuals or qualified agencies with programs involving Gamma Ray Radiography.

The Radiation Safety Officer shall evaluate a POTENTIAL INSTRUCTORS Program and approve program content.

Individuals may assist the Radiation Safety Officer in presenting training or examinations. These individuals shall be identified as Radiation Safety Monitors as defined in the Management Manual of this license.

# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

### RADIOGRAPHY TRAINEE - REQUIRED TRAINING

1. Must complete 8 hours classroom instruction in the following areas.

#### SECTION I - FUNDAMENTALS OF RADIATION SAFETY

- A. Why radiation safety is important
- B. What is Radiation/Radioactivity
- C. Harmful effects of radiation
- D. Levels of radiation from licensed material
- E. Methods of controlling radiation dose
  1. Working Time
  2. Working Distance
  3. Shielding

#### SECTION II - DETECTION INSTRUMENTS TO BE USED

- A. Use of radiation survey instruments
    1. Operation
    2. Calibration
    3. Limitations
  - B. Survey Techniques
  - C. Use of personnel monitoring equipment
    1. Film Badges
    2. Dosimeters
- I Operating Procedures
  - II Emergency Procedures
  - III Radiation Level Distance Charts
  - IV Instruction for Operation of Radiographic Survey Instruments
  - V NRC Rules and Regulations Part 19
- Appendix A - Required Daily Reports
- Appendix B - a. Lost or overexposed film badge reports  
b. Radiation incident reports
- Appendix C - Warning and posting signs
- Appendix D - Case histories radiographic incidents

2. After completion, the individual will be required to take a written examination on the material covered, and a minimum passing grade of 80% will be required with discussion on any questions answered incorrectly.
3. A Trainee will be required to have a minimum of 90 days of on the job training before they will be allowed to reclassify as a Radiographer's Assistant. And then only after completing the Radiographer's Assistant - Required Training criteria.

# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

### RADIOGRAPHER'S ASSISTANT-REQUIRED TRAINING

1. Must complete 6 hours class room instruction on Operating and Emergency Procedures Sections:
  - I Operating Procedures
  - II Emergency Procedures
  - III Radiation Level Distance Chart
  - IV Operating Instructions for Radiographic Exposure Devices
  - VI Instruction for Operation of Radiation Survey Instruments
  - VII N.R.C. Rules and Regulations Parts 19, 20, 34

Appendix A - Required Daily Reports  
Appendix B - A. Lost or Overexposed Film Badge Reports  
                  B. Radiation Incident Report  
Appendix C - Warning and Posting Signs  
Appendix D - Case Histories Radiography Incidents
2. Complete 2 hours instruction in the use of radiographic equipment and radiation survey equipment.
3. After the individual has satisfied these requirements, they will be given a written examination on the Operating and Procedure Manual to assure their understanding of the contents. A minimum 80% passing grade will be required on this examination. Reinstruction will be given on any question(s) that are incorrect, to assure complete understanding.
4. Practical examination will be given in the use of radiographic equipment and proper procedures used while performing radiography. A minimum passing grade of 90% will be required, with reinstruction in any areas that are found to be deficient.

All reinstruction will be based on material listed in the outline. All reinstruction to be done by the listed Instructor.

These are minimum requirements, and additional instruction or examinations may be given, if in the opinion of the Instructor or RSO it is needed.



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**RADIOGRAPHER - REQUIRED TRAINING**

1. Must have a minimum of (520 hours) of on the job training as Radiographer's Assistant.
2. Must have minimum 40 hours of classroom instruction in topics covered in Appendix A 10 CFR Part 34.

For an individual who has no previous experience as a Radiographer but has the minimum (520 hours) on the job training, the following training outline must be completed. After completion the individual will be required to test on the material covered, and a minimum passing grade of 80% will be required. With discussion on any questions answered incorrectly (by the Instructor).

**Minimum  
Required Hours**

**SECTION I - FUNDAMENTALS OF RADIATION SAFETY**

- |   |   |
|---|---|
| 1 | A. Why radiation safety is important          |
| 3 | B. What is Radiation/Radioactivity            |
| 3 | C. Harmful effects of radiation               |
| 2 | D. Levels of radiation from licensed material |
| 8 | E. Methods of controlling radiation dose      |
|   | 1. Working Time                               |
|   | 2. Working Distance                           |
|   | 3. Shielding                                  |

**4                      SECTION II - DETECTION INSTRUMENTS TO BE USED**

- |    |  |
|----|--|
| A. | Use of radiation survey instruments      |
|    | 1. Operation                             |
|    | 2. Calibration                           |
|    | 3. Limitations                           |
| 2  | B. Survey Techniques                     |
| 2  | C. Use of personnel monitoring equipment |
|    | 1. Film badges                           |
|    | 2. Dosimeters                            |

**5                      SECTION III - RADIOGRAPHIC EQUIPMENT TO BE USED**

- |    |                               |
|----|-------------------------------|
| A. | Remote handling equipment     |
| B. | Radiographic exposure devices |
| C. | Storage containers            |

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Minimum Required Hours	
4	SECTION IV - INSPECTIONS AND MAINTENANCE PERFORMED A. Exposure devices/changers B. Remote handling equipment (source guide tubes, control cables ie) C. Survey Instruments
3	SECTION V - CASE HISTORIES OF RADIOGRAPHIC ACCIDENTS A. Cause B. Prevention
1	SECTION VI - TITLE 10, CHAPTER 1 CFR A. Part 19
1	B. Part 20
1	C. Part 34

Also required will be a practical examination in the use of radiographic equipment in accordance with operating procedures to evaluate individuals, and assure complete understanding of procedures and proper use. Minimum passing grade of 100% will be required.

Additional instruction or examinations may be given if Instructor or RSO feel it is needed.

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TRAINING PROGRAM

REFERENCE MATERIAL

NDT Radiography Manual OE-84036

Harry D. Richardson

Division of Nuclear Education and Training

Chapters 1 through 7 and Chapter 13

Appendix A

Industrial Radiography - Instructor's Guide OE-84034

Industrial Radiography - Student Guide and Laboratory Exercises  
OE-84035

Working Safely in Gamma Radiography

Stephen A. McGuire, Carol A. Peabody

Office of Nuclear Regulatory Research

Case Histories of Radiography Events

Office of Inspection and Enforcement

United States Nuclear Regulatory Commission

Rules and Regulations - Title 10, Chapter 1 C.F.R.

Parts 19, 20, 34

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For individuals who have been Radiographers for other licensees they must:

1. Have documentation of completing 40 hours of radiation safety as outlined in Title 10, Chapter 1 C.F.R. Part 34, Appendix A.
2. Complete 6 hours classroom instruction on Operating and Emergency Procedures Manual Sections.
  - I Operating Procedures
  - II Emergency Procedures
  - III Radiation Level Distance Chart
  - IV Operating Instructions for Radiographic Exposure Devices
  - V Source Transfer Procedures and Source Changers
  - VI Instruction for Operation of Radiation Survey Instruments
  - VII N.R.C. Rules and Regulations, Parts 19, 20, 34

Appendix A - Required Daily Reports  
Appendix B - A. Lost or Overexposed Film Badge Reports  
                  B. Radiation Incident Report  
Appendix C - Warning and Posting Signs  
Appendix D - Case Histories Radiography Incidents
3. Complete 2 hours instruction in the use of radiographic equipment and radiation survey equipment.
4. After the individual has satisfied these requirements, they will be required to take a written examination. The examination will be based on material contained in the Operating and Emergency Procedures Manual. Minimum passing score will be 80% with discussion on any questions answered incorrectly.
5. Also required will be a practical examination in the use of radiographic equipment in accordance with operating procedures to evaluate individual, and assure complete understanding of procedures and proper use. Minimum passing score of 100% will be required for Radiographer and 90% for Radiographer's Assistant.

Additional instruction or examination may be given if Instructor or RSO feel it is needed.

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**PERIODIC TRAINING**

Any individual acting as a Radiographer or Radiographer's Assistant will be required at least annually to take written examinations and/or practical examinations on material covered in Operating and Emergency Procedures Manual. Any individuals who do not meet the passing grade of 80% will be required to complete the additional training with satisfactory test results to verify understanding of material. Results of training and/or quizzes shall be recorded on the periodic training record (form RSF 13) and retained in each individual's file. Minimum requirements for reinstruction will be 8 hours classroom on Operating and Emergency Procedures Manual. Along with written examination on material covered in Operating and Emergency Procedures Manual, with minimum passing score of 80%.



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### RADIOGRAPHER'S SAFETY EXAMINATION

---

1. What are three major mistakes by a Radiographer that cause Radiography overexposure?
2. In what way can you avoid the types of mistake made in Question 1?
3. When you are working with a radiography source whose safety are you responsible for?
4. Radiation is a form of energy?  
True  
False
5. What are radiation waves called?
6. Gamma Rays come from the \_\_\_\_\_ of certain atoms that have too much energy?
7. Ripping the electron off an atom is called?
8. What is REM an abbreviation for?
9. Define dose rate.
10. The time required for one-half of the unstable atoms of an isotope to decay is known as the?
11. What are the half life of the following isotopes?  
Iridium - 192 \_\_\_\_\_  
Cobalt - 60 \_\_\_\_\_  
Cesium - 137 \_\_\_\_\_
12. Can radiography sources make things radioactive?
13. What are the two types of harmful effects that can be caused by radiation, and define them?
14. What are some symptoms of radiation sickness?
15. If the entire body is exposed to a radiation dose exceeding 500 REMS in one exposure, what would most likely happen?
16. Explain some of the genetic effects caused from radiation?

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17. Why is it mandatory for a licensee to instruct on N.R.C. Guide 8.13 "Instruction Concerning Prenatal Radiation Exposure"?
18. What are the three basic ways to minimize dose when working with radiography sources?
  1. \_\_\_\_\_
  2. \_\_\_\_\_
  3. \_\_\_\_\_
19. What is the dose rate for a 1 curie source at one foot?  
Iridium - 192 \_\_\_\_\_  
Cobalt - 60 \_\_\_\_\_
20. Why is time an important factor to minimize the radiation dose you receive?
21. What is meant by half-value layer when used in radiography?
22. What are the half value thickness' for the following materials, using Iridium - 192?  
Steel \_\_\_\_\_  
Lead \_\_\_\_\_  
Tungster \_\_\_\_\_
23. How many half-value layers of steel would it take to reduce a radiation dose of 100 MR/HR to approximately 3 MR/HR for Iridium - 192?
24. Using the same radiation doses from Question 23, how many half-value layers of steel for Cobalt-60?
25. What are the two types of gas filled tubes found in survey meters to measure "x" or gamma radiation?
26. What is the most common cause of survey meter failure?
27. Name some of the factors that can cause a survey meter to malfunction?
28. If it is found that the survey meter is not working properly what must you do?
29. What are the most important surveys that you must make?
30. Why is it mandatory to make a survey of the front of the exposure device after an exposure?

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31. How often must a survey meter be calibrated?
  32. In addition to a radiation survey meter, you are required to carry two other radiation detection devices to measure radiation dose. What are these devices?
  33. A pocket dosimeter can be used in place of a survey meter?  
True  
False
  34. When should a dosimeter be charged?
  35. What steps should you take if you find your dosimeter to be off scale?
  36. What is the purpose of a film badge in radiography?
  37. What are some factors that may damage or ruin a film badge?
  38. What are the two basic types of exposure devices used in gamma radiography?
  39. The tube that passes through the shielded area of an exposure device is called the \_\_\_\_\_?
  40. Before you start work with a radiographic exposure device what steps should you take?
  41. Who regulates most activities involving the use of gamma radiography?
  42. What is an agreement state?
  43. In particular, what parts of Title 10, Chapter 1, C.F.R. must be provided, and instruction given in a training program?
  44. In accordance with Title 10, Chapter 1, if you file a complaint of a safety problem with your employer, you take a chance of being fired.  
True  
False
  45. What is the radiation dose rate limits for whole body exposure for any calendar quarter?

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46. Define the following terms:
1. Unrestricted area
  2. Radiation area
  3. High radiation area
  4. Restricted area
47. Any storage area for a radioactive source must be locked and posted with what sign?
48. Survey meters must be capable of registering from \_\_\_\_\_ MR/HR to \_\_\_\_\_ R/HR.
49. Radiography sources cannot be used unless they have been leak tested within the last \_\_\_\_\_?
50. A Radiographer who is supervising a Radiographer's Assistant must be present whenever the Assistant uses a radiography source?  
True  
False
51. Who regulates the transportation of radioactive material?

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ANSWERS - RADIOGRAPHER EXAMINATION

1. 1. Source left out of camera when it should not be.  
2. Required survey not performed  
3. Source not locked in device after exposure
2. Follow Company's Operating and Emergency Procedures.
3. Yours, and others in the area.
4. True
5. Electromagnetic waves.
6. Nucleus (or) core.
7. Ionization.
8. Roentgen equivalent in man
9. The measure of how fast radiation dose is being received.
10. Half-life
11. 1.75 days, 2.53 years, 3.<sup>37</sup> years
12. No, unless the source is leaking
13. Prompt effects - radiation burns, radiation sickness effects from a very large dose of radiation.  
Delayed effects - cancer, genetic defects, effects that can happen years after exposure.
14. Diarrhea, vomiting, nausea, loss of hair, weakness, internal bleeding.
15. Death
16. Cell damage, future children, genes, color blindness, hemophilia.
17. Because of exposure risk to unborn
18. 1. time  
2. distance  
3. shielding



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19.
  1. 5.9 R/HR
  2. 14.4 R/HR
20. Less time spent near radiation source, less radiation dose you receive.
21. The thickness of a material required to reduce radiation dose by one-half.
22.
  1. .50"
  2. .19"
  3. .13"
23. 5 half-valve layers
24. 5 half-valve layers
25. Geiger muller, ionization chamber
26. Weak batteries
27. Water (or) moisture, corrosion, physical abuse
28. Stop work until you get a replacement meter
29. All of them, after each exposure
30. Source that is not completely retracted, can have a thin beam of radiation coming out the front of camera.
31. At least every 90 days.
32.
  1. Pocket dosimeter
  2. Film Badge (or) TLO
33. False
34. At the start of each work shift.
35. Notify RSO, send in film badge for processing, stop work until RSO determination that there is no hazard.
36. Form the basis of your permanent record, and if dosimeter goes off scale tell the dose received.
37. Light, heat, water

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- 38.
  - 1. Crank out
  - 2. Beam type
- 39. "S" tube
- 40. Detailed procedures provided by the employer.
- 41. W.R.C. Nuclear Regulatory Commission
- 42. States that regulate gamma radiography performed within their boundaries.
- 43. Parts 19, 20, 34
- 44. False
- 45. 1.25 REMS
- 46.
  - 1. An area where access is not restricted.
  - 2. Where anyone could receive a dose to a major portion of the body in excess of 5 MREM in any 1 hour or 100 MREM in 5 consecutive days.
  - 3. Where anyone could receive a dose in excess of 100 MREM in any 1 hour.
  - 4. An area the licensee restricts access for the purpose of radiation protection.
- 47. "Caution Radioactive Materials"
- 48. 2 MR/HR to 1 R/HR
- 49. 6 months
- 50. True
- 51. U.S. Department of Transportation (D.O.T.)

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OPERATING AND PROCEDURE EXAM  
FOR RADIOGRAPHERS AND RADIOGRAPHER'S ASSISTANT

1. How often must a survey meter be calibrated?
2. A survey shall be performed on the exposure device prior to?
3. When surveying an exposure device, readings shall not exceed \_\_\_\_\_ MR/HR at 6 inches, and \_\_\_\_\_ MR/HR at a distance of 1 meter from the surface of the device.
4. Where should the following signs be posted?
  - A. Caution Radiation Area \_\_\_\_\_ MR/HR
  - B. Caution High Radiation Area \_\_\_\_\_ MR/HR
5. A survey of the exposure device and guide tube shall be performed?
6. Whenever a source is transported by a vehicle, the outer surface of the vehicle shall be treated as an \_\_\_\_\_ area.
7. A physical radiation survey shall be made after the exposure device is secured in (or) on the vehicle to assure that radiation levels do not exceed?
8. What are the maximum readings in the passenger compartment of transporting vehicles?
9. All restricted areas must be under \_\_\_\_\_ by the Radiographer and/or Radiographer's Assistant.
10. Pocket dosimeters and film badges shall be carried by?
11. Explain the steps to be taken if a dosimeter is found to be off scale?
12. When should a dosimeter be charged?
13. The maximum permissible radiation dose is \_\_\_\_\_ REMS per calendar quarter.
14. Leak tests will be performed on all exposure devices at intervals not to exceed?

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- 2 -



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ANSWERS TO O & E EXAM

1. Every 90 days (minimum)
2. Removing it from storage area.
3. 50 MR/HR and 10 MR/HR
4. A. 2 MR/HR  
B. 100 MR/HR
5. After each exposure
6. Unrestricted.
7. 2 MR/HR
8. Not to exceed 2 MR/HR
9. Constant surveillance
10. All personnel engaged in radiography
11. Cease work, contact RSO, send in film badge
12. Recharged daily or more often, as may be required  
(beginning of every work shift)
13. 1 1/4 REMS
14. 6 months
15. .005
16.
  1. Return source to device (if possible) and lock device.
  2. Survey device to ascertain that source has returned safely to device.
  3. Do not use source again until you have made an inspection of the device and personnel monitoring equipment to be certain no danger exists and no over-exposure has been received. If either of these two conditions exists, notify the Radiation Safety Officer immediately.

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4. In the event the source cannot be returned to device, immediately do the following:
  - a. Set up and post a restricted area as specified in Section I, page 1, Paragraph C, of this manual, using a survey meter to determine the perimeter of the area.
  - b. The Radiographer and/or Radiographer's Assistant shall maintain constant visual surveillance of the area and will not allow anyone to enter this area.
  - c. Notify Radiation Safety Officer for instructions.
  - d. In the event you cannot contact a Radiation Safety Officer as instructed above, notify the Nuclear Regulatory Commission and/or the appropriate State Health Department. You will find the telephone numbers of the Radiation Safety Officers and the Nuclear Regulatory Commission on page 1 of this Section.
17.
  1. Retract the source into exposure device (if possible). Should this not be practical, set up restricted area as specified in Section I, page 1, Paragraph C of this manual. Use survey meter to determine the perimeter of the area.
  2. The Radiographer and/or Radiographer's Assistant shall maintain constant visual surveillance of the area and will not allow anyone to enter this area.
  3. Take names and addresses of non-monitored persons.
  4. Notify the Radiation Safety Officer for instructions.
18.
  1. Notify Radiation Safety Officer of the incident immediately.
  2. Survey area with survey meter, rope off and post area at the 2 MR/HR level.
  3. Should one of these sources be lost from the camera, you will locate it with the use of a survey meter.

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19.
  1. In the event of a vehicular accident involving by-product material, a restricted area must be established as specified in Section 1, page 1, Paragraph C of this manual.
  2. If the survey meter is operable, use it to establish the perimeter of the restricted area.
  3. If the survey meter is inoperable, assume that the source is in the exposed position. Use calculations and/or the chart as outlined in Section III of this Manual to establish the perimeter of the restricted area. In case of minor accidents where it can be visually determined that the source is safely stored in its container, no restrictions of area is required.
  4. If the survey meter is operable, no radiation hazard exists and the vehicle is movable, continue.
  5. In any case, immediately after establishing the restricted area, notify the Radiation Safety Officer.
20.
  1. Notify the foreman at job location to assure that no person will leave the premises without first being monitored.
  2. Notify Radiation Safety Officer giving him complete details, so that he may in turn notify the proper authorities.
  3. Gather all information pertaining to the theft, and be prepared to present the facts to the proper authorities.
21. Part 19 - 19.1
22.
  1. Notice to Employees
  2. Shall be posted by each licensee whenever individuals work in or frequent any portion of a restricted area.
23. Radiation Safety Officer
24. Radiographer
25. Under direct supervision of Radiographer.

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QUIZ 1, PERIODIC TRAINING

1. Explain function of Operating and Emergency Procedure Manual.

ANSWER: \_\_\_\_\_

2. Explain your responsibilities in respect with the O & E Manual?

ANSWER: \_\_\_\_\_

3. Who is allowed to make changes in operating and emergency procedures?

ANSWER: \_\_\_\_\_

4. Who must comply with operating procedures?

ANSWER: \_\_\_\_\_

5. What are the minimum requirements for reading dosimeters?

ANSWER: \_\_\_\_\_

6. What steps should be taken if your dosimeter is found off scale?

ANSWER: \_\_\_\_\_

7. What steps should you take if your survey instrument becomes inoperable?

ANSWER: \_\_\_\_\_

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### ANSWERS TO QUIZ 1 - PERIODIC TRAINING

1. The function of this manual is to guide and assist you in your job by providing specific procedures for the use of radiographic equipment.
2. A. Radiographers are expected to follow procedures in this Manual and abide with the regulations governing our radiography program.  
  
B. Radiographer's Assistant duties are to assist the Radiographer in his work, and is responsible for the following:
  1. Demonstrating an understanding of operating and emergency procedures contained in this Manual.
  2. Showing the ability to safely use radiographic equipment. Proper use of survey meters, personal monitoring devices and required reports under direct supervision of the Radiographer.
3. No changes are to be made in any part of operating and emergency procedures until the proposed changes have been submitted to the Radiation Safety Officer and approved by him.
4. All personnel involved with Radiographic Operations must comply with operating procedures set forth in this Section.
5. Dosimeters shall be read as often as necessary (minimum three times per day, morning, mid-day and evening) to determine if an abnormal dose of radiation has been received.
6. Should the dosimeter go off scale (exceed 200 MR) cease work and contact the Radiation Safety Officer immediately since, when a dosimeter goes off scale, the film badge must be processed to determine if an overexposure has occurred. The film badge shall be forwarded to the office for emergency processing. Having done this, recharge the dosimeter and place it in an area free of radiation for approximately one hour. If it is again discharged totally or partially, in all probability you have not received excessive radiation and the dosimeter is probably faulty.



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Should this be the case, inform the Radiation Safety Officer. Only he may decide, after careful study of the situation, whether or not you may return to radiation work.

7. Should the radiation survey instrument become inoperable, halt operations. Do not resume operations until the survey instrument has been repaired and/or an operable, calibrated instrument obtained. Contact the Radiation Safety Officer for instructions.

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QUIZ 2 - PERIODIC TRAINING

1. Define a "High Radiation Area".

ANSWER: \_\_\_\_\_

2. Define a "Radiation Area".

ANSWER: \_\_\_\_\_

3. Explain procedure if an exposure device cannot be returned to a storage area, or otherwise physically secured.

ANSWER: \_\_\_\_\_

4. Why must care be taken when performing the final survey?

ANSWER: \_\_\_\_\_

5. Where are your designated storage areas?

ANSWER: \_\_\_\_\_

6. Explain requirements for transportation of radiographic devices.

ANSWER: \_\_\_\_\_

CONTROL NO. 397275

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### ANSWERS TO QUIZ 2 - PERIODIC TRAINING

1. "High Radiation Areas" are those which contain radiation levels such that a person in the area could receive an exposure in excess of 100 millirem in any one continuous hour. The limits of this radiation area shall be posted with signs bearing the radiation caution symbol and the words "Caution High Radiation Area". These signs will be posted at the 100 MR/HR level.
2. "Radiation Areas" shall be posted with signs bearing the radiation caution symbol and the words "Caution Radiation Area". Company policy is to utilize these signs to post the perimeter of a "restricted area". The signs are posted at the perimeter of the restricted area as designated in Paragraph C below. Therefore, no action concerning the perimeter of the radiation area need be taken. "Radiation Areas" are those which contain radiation levels such that a person in the area could receive an exposure in excess of 5 millirem in any one continuous hour, or in any five consecutive days a dose in excess of 100 millirems.
3. If exposure device cannot be returned to a locked storage area, or otherwise physically secured, Radiographer or Radiographer's Assistant will establish a safe area around exposure device and maintain constant surveillance to prevent unauthorized persons from entering the area.
4. Care must be exercised when performing the final survey, to assure source is in the shielded position in device and not behind a temporary barrier.
5. A. Dark room of vehicle at temporary job site and for transportation purposes when properly labeled "Caution Radioactive Material".  
B. Designated storage area at 650 Alpine Road, Gaylord, Michigan, properly identified with the mark "Caution Radioactive Material" on the entrance.
6. A. Transportation of these materials must be approved by the Radiation Safety Officer, and must conform to rules, as outlined in the procedures.  
B. Devices shall be checked by Radiographer, using a survey meter, prior to removal from any storage area.

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- C. A Radiographer or Radiographer's Assistant shall be in constant attendance during movement.
- D. No device shall be transported unless all safety plugs are inserted and it is locked.
- E. The outer surface of the transportation vehicle must be treated as an unrestricted area. A physical radiation survey must be made after the exposure device is secured in the vehicle to assure that radiation levels do not exceed 2 MR/HR. The radiation level in the passenger compartment must not exceed 2 MR/HR. Vehicle must be posted with a "Caution Radioactive Material" on the entrance or access door. The storage compartment must be kept locked at all times when not under direct surveillance by the Radiographer or Radiographer's Assistant.

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QUIZ 3 - PERIODIC TRAINING

1. Explain the steps involved in shipment of radioactive material.

ANSWER: \_\_\_\_\_

2. Explain steps involved in the receipt of radioactive material.

ANSWER: \_\_\_\_\_



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### ANSWERS TO QUIZ 3 - PERIODIC TRAINING

1. A. On material transportation forms Source Shipment Survey the source S/N, Camera S/N, and destination must be noted. If source was transferred to exchanger, the type and S/N of exchanger must be listed.
- B. Perform a physical radiation survey on the device to be shipped, as outlined in page 1, part B of this Section, and results of this survey shall be recorded on material transportation forms shown in this section.
- C. For air shipment, a device must be packed in a Type B container. A Type B container is a container which has an identification mark with the inscription "Type B".
- D. Another physical survey shall be performed on the shipping container. This survey shall be performed at a distance of 1 meter from the outer surface of shipping container and shall not exceed 10 MR/HR. The results of this survey shall be recorded on the Material Transportation Report.
- E. Container must then be securely sealed.
- F. Container must be labeled with the two radioactive yellow labels furnished. Each label will have three areas requiring completion as follows:
  1. Contents: Enter in this area the type of radioactive material being shipped such as IR 192.
  2. Number of Curies: Enter the number of curies being shipped.
  3. Transport Index: Enter the MR/HR ascertained by surveying the shipping container from a distance of 1 meter (39.37 inches) from the exterior surface.
- G. The radioactive yellow II labels will then be secured to container at opposite sides where they can clearly be seen. (Remove any previously attached labels.) Enter on lower portion of Source Shipment Survey material transportation forms the source type, number of curies, transport index number, and sign.

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- H. One (1) orange and black peligro label will then be secured to container on sides where they can clearly be seen.
- I. On top half of Form, date and sign your name as agent for the Company, enter the number of curies being shipped under activity column, and enter transport index in column provided.
- J. Distribution of material transportation forms will be as indicated on bottom of form. Shipping copies will be attached to freight bill.
- 2. A. A prompt physical radiation survey of each package upon receipt will be made. Immediate notification to the Radiation Safety Officer will be made provided an abnormality is found.
- B. After seal is broken and lid is removed, another physical radiation survey must be made before handling device.
- C. Record above surveys in space provided on the "Source Receipt Survey" Report.
- D. Upon completion of the "Source Receipt Survey" Report, forward copies in accordance with instructions outlined on the form. In addition, attach a copy of freight bill.

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QUIZ 4 - PERIODIC TRAINING

- 
1. What are the steps involved in the daily radiographic device maintenance check list?

ANSWER: \_\_\_\_\_

2. What are the accidents that might occur, that require emergency procedures?

ANSWER: \_\_\_\_\_

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ANSWERS TO QUIZ 4 - PERIODIC TRAINING

1. A. Check source connector for wear, bending or unusual signs of abuse. Be sure holding pin is still 90 degree elbow and straight with connector.
- B. Check lock plunger for free operation, the full length of its travel.
- C. Check outlet nipple after removing safety plug, for physical damage or excessive wear.
- D. Check labeling and warning signs for legibility.
- E. Check source tube for damage, such as crimps, foreign matter and ease of connect and disconnect or damaged threads.
- F. Check source connector on drive cable assembly. This hole should not be worn out-of-round to the extent that it may disconnect in any position other than the correct disconnect position. Also check for cracking.
- G. Check first 18 inches of drive cable for still, rusty or frayed areas. This shall be done by rolling out about 18 inches of the drive cable and physically flexing by hand and looking for defective areas.
- H. Inspect control assembly and cable housing for unusual wear, free and ease of operation. Look at cable housings for kinks or mashed places. Look at cable housing termination points for breaks or fraying. Look for damage by heat, such as falling against a heater or other hot material.
- I. Upon completion of above daily checks each employee shall initial in space provided in section entitled "Daily Maintenance Check". By initialing employee is certifying that the above checks were performed in accordance with these instructions on radiation survey reports.

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2.
  - A. Accident involving exposure device or related equipment.
  - B. Accident involving exposure of non-monitored persons.
  - C. Lost source.
  - D. Vehicular accident.
  - E. Theft of a sealed source.



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RADIOGRAPHY TRAINEE EXAMINATION

---

1. What is radiation?
2. What does MR/HR stand for?
3. Can a sealed source make things radioactive?
4. What is a radioisotope?
5. Name the two harmful effects of radiation.
6. What type of instrument would be used to detect radiation?
7. How often must a survey meter be calibrated?
8. If a survey meter indicator reads 6 on the meter what would the dose rate be on the following range settings?
  - A. X1\_\_\_\_\_MR/HR
  - B. X10\_\_\_\_\_MR/HR
  - C. X100\_\_\_\_\_MR/HR
9. What are the two devices you are required to carry to measure the radiation dose you have received?
10. When must you charge your dosimeter and record the reading?
11. Where should the dosimeter and film badge be worn?
12. What should you do if you find your dosimeter to be faulty?
13. What part of Title 10, Chapter 1, CFR is titled "Notices, Instructions and Reports to Workers"?
14. A film badge is worn only by Radiographers.  
True  
False
15. Radiation is only harmful to individuals under 18 years in age.  
True  
False
16. Dosimeters are to be read only at the end of a work shift.  
True  
False

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- 
17. If your survey meter does not work, you may continue to work as long as you have a film badge and dosimeters.  
True  
False
18. As a Trainee, under no circumstances are you allowed to use radiographic exposure devices.  
True  
False
19. A.L.A.R.A. stands for as long as radiographer agrees.  
True  
False
20. R.S.O. stands for Radiation Safety Officer.  
True  
False
21. If your dosimeter should go off scale, you should recharge it and go back to work.  
True  
False
22. As a Trainee, it is your responsibility to read and obtain an understanding of Company operating and emergency procedures.  
True  
False
23. As a Trainee, you are required to have a minimum of 90 days of on the job training before you can be considered for Radiographer's Assistant training.  
True  
False
24. As a Trainee, you are allowed to work in high radiation areas at all times.  
True  
False
25. As a Trainee, you are not required to maintain any reports.  
True  
False

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ANSWERS TO RADIOGRAPHY TRAINEE EXAM

1. A form of energy.
2. Milli Roentgen per hour
3. No
4. An unstable element that emits radiation.
5. Prompt effects, delayed effects
6. Survey meter.
7. Every 90 days (minimum)
8. A. 6 MR/HR  
B. 60 MR/HR  
C. 600 MR/HR
9. Dosimeter, film badge
10. At the beginning of each work shift.
11. Upper Torso (between the neck and waist).
12. Stop working, call RSO, have dosimeter replaced.
13. Part 19
14. False
15. False
16. False
17. False
18. True
19. False
20. True
21. False

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- 22. True
- 23. True
- 24. False
- 25. False

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**RAIOGRAPHER'S EXAMINATION**

EXAMINER: \_\_\_\_\_

NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

SOCIAL SECURITY NO.: \_\_\_\_\_

\_\_\_\_\_ FINAL GRADE O & E WRITTEN      80% MINIMUM PASSING

\_\_\_\_\_ FINAL GRADE PRACTICAL      100% MINIMUM PASSING



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**RADIOGRAPHER'S ASSISTANT EXAMINATION**

EXAMINER: \_\_\_\_\_

NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

SOCIAL SECURITY NO.: \_\_\_\_\_

\_\_\_\_\_ FINAL GRADE O & E WRITTEN 80% MINIMUM PASSING

\_\_\_\_\_ FINAL GRADE PRACTICAL 90% MINIMUM PASSING

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**RADIOGRAPHY TRAINEE EXAMINATION**

EXAMINER: \_\_\_\_\_

NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

SOCIAL SECURITY NO. \_\_\_\_\_

\_\_\_\_\_ FINAL GRADE O & E WRITTEN 80% MINIMUM PASSING

\_\_\_\_\_ FINAL GRADE PRACTICAL 90% MINIMUM PASSING

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### PERIODIC TRAINING RECORD

Name: \_\_\_\_\_ Social Security #: \_\_\_\_\_

Classification: \_\_\_\_\_ Year: \_\_\_\_\_

#### Written Material(s)

Quiz/Exam Number	Date Completed	Results

#### PRACTICAL APPLICATION/FIELD DEMONSTRATION AND TRAINING

Date	Location	Subject(s) or Topic(s) of Discussion	Instructor

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## INSPECTION SERVICES • NDE DIVISION RECORD OF RADIATION SAFETY TRAINING

Name \_\_\_\_\_ S. S. \_\_\_\_\_

SUBJECT	DATE	HOURS	INSTRUCTOR	COMMENTS BY INSTRUCTOR
I. FUNDAMENTALS of RADIATION SAFETY				
A. Why radiation safety is important				
B. What is radiation/radioactivity				
C. Harmful effects of radiation				
D. Levels of radiation from licensed material				
E. Methods of controlling radiation dose				
1. Working time				
2. Working distance				
3. Shielding				
II. RADIATION DETECTION				
Instruments to be used				
A. Use of radiation survey instruction				
1. Operation				
2. Calibration				
3. Limitations				
B. Survey techniques				
C. Use of personnel monitoring equip.				
1. Film badges				
2. Dosimeters				
III. RADIOGRAPHIC EQUIPMENT TO BE USED				
A. Remote handling equipment				
B. Radiographic exposure devices				
C. Storage containers				
IV. INSPECTION AND MAINTENANCE PERFORMED BY THE RADIOGRAPHER				
A. Exposure devices/changers				
B. Remote handling equipment				
C. Survey instruments				
V. CASE HISTORIES				
A. Cause				
B. Prevention				
VI. TITLE 10, CHAPTER 1 C.F.R.				
A. Part 19				
B. Part 20				
C. Part 34				

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### CONTENTS

SECTION I .....	Operating Procedures
SECTION II .....	Emergency Procedures
SECTION III .....	Radiation Level Distance Chart
SECTION IV .....	Operating Instructions for Radiographic Exposure Devices
SECTION V .....	Source Transfer Procedures and Source Changers
SECTION VI .....	Instructions for Operation of Radiation Survey Instruments
SECTION VIII .....	NRC Rules and Regulations, Part 19, Part 20 and Part 34

\* \* \* \* \*

APPENDIX A	Required Daily Reports
APPENDIX B	Lost or Over-Exposed Film Badges
APPENDIX C	Warning and Posting Signs
APPENDIX D	Case Histories/Radiography Incidents

CONTROL NO. 397275



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### OPERATING & EMERGENCY PROCEDURE MANUAL

The function of this Manual is to guide and assist you in your job by providing specific procedures for the use of radiographic equipment. You as an employee of the Company are expected to read and understand the contents of this Manual. If you do not understand, or have any questions concerning this Manual, it is essential that they are clarified. We are committed to safety and will work to ensure you fully understand the concepts of our program. Remember, not only your livelihood, but your health will depend on your willingness to operate in a safe and professional manner. A radiation safety awareness is essential to minimizing your radiation exposure. By practicing A. L. A. R. A. (As Low As Reasonably Achievable), you demonstrate your personal commitment to the Company's radiation safety policy.

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### RESPONSIBILITIES OF EMPLOYEES IN RESPECT TO THIS MANUAL

#### RADIOGRAPHERS:

Radiographers are expected to follow procedures in this Manual and abide with the regulations governing our Radiography program. Assume responsibility for the safe use of all radiographic equipment, radiation instruments and safety equipment that has been furnished. The Radiographer is held accountable to the Radiation Safety Officer for the following:

1. Contacting Radiation Safety Officer in the event of an emergency involving radiation.
2. Performing required radiation surveys.
3. Supervising the safe use, transportation, storage and return of all radiographic equipment.
4. Preparing required records and reports.
5. Maintaining a copy of operating and emergency manual and NRC license.
6. Assure that no radiography will be performed unless all radiographic personnel have film badges and dosimeter pencils, a calibrated survey meter, and that he can perform the required radiography without undue risk.
7. Conduct daily inspections required on equipment, and see that all equipment is kept in safe operational condition.
8. Maintain supply of radiation warning signs, and see that they are used as required.
9. Periodically review copy of Operating and Emergency Manual.

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### RADIOGRAPHER'S ASSISTANT:

Duties are to assist the Radiographer in his work and is responsible for the following:

1. Demonstrating an understanding of operating and emergency procedures contained in this Manual.
2. Showing the ability to safely use radiographic equipment. Proper use of survey meters, personal monitoring devices and required reports under direct supervision of the Radiographer.

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## RADIOGRAPHY TRAINEE:

A Trainee is restricted to a limited assignment of duties under the Radiographer's supervision. He is responsible for obtaining and understanding radiographic methodology and the operating and emergency procedures of this Manual. With the Radiographer's personal supervision, the Trainee may assist in the movement of equipment, the posting of areas, and the processing of the film. Under no circumstances is the Trainee allowed to use Radiographic exposure devices for the purpose of industrial radiography.

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## CHANGES IN OPERATING PROCEDURES

No changes are to be made in any part of operating and emergency procedures until the proposed changes have been submitted to the Radiation Safety officer and approved by him.

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### SECTION I

#### OPERATING PROCEDURES

##### PURPOSE:

This Section was prepared with the purpose of furnishing employees with practical information that will permit the safe and efficient use of radioactive sources. The procedures set forth in this Section were designed not only to protect radiographic personnel, but to insure that all individuals will be protected from the hazards of radiation exposure.

##### SCOPE:

All personnel involved with Radiographic Operations must comply with operating procedures set forth in this Section.



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### PERSONAL MONITORING

- A. Pocket dosimeters, film or Thermoluminescent Dosimetry (TLD) badges shall be carried by all personnel engaged in Radiography. For the purpose of this manual, the terminology "film badge" shall be interpreted to mean either film badge or TLD monitoring device. Rate Alarm Meters shall be used in conjunction with film badges and dosimeters.
- B. Operating instructions for use of dosimeters, dosimeter chargers and film badges and rate alarm meters are outlined on pages 6 through 10A of this section.
- C. Dosimeters shall be read as often as necessary (minimum three times per day, morning, mid-day and evening) to determine if an abnormal dose of radiation has been received. Should a dosimeter be found to read off-scale, an emergency situation shall be considered to exist.
- D. Dosimeter reading shall be recorded three times daily (morning, mid-day and evening), on proper forms as outlined in this section. This Radiographer shall ascertain that the Radiographer's Assistant's dosimeter readings are properly documented.
- E. Dosimeter recording forms will be checked to confirm the validity of listed readings.
- F. Radiographic personnel shall maintain a safe distance from radiation areas to minimize radiation exposure. Normally, this will mean an individual shall not operate in a radiation area where the limits exceed 2 MR/HR. However, at times this may be impractical. Therefore, radiographic personnel may operate in a 5 MR/HR radiation area providing the dosage received does not exceed that specified on page 8 of this Section and this situation does not become a regular routine.

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## OPERATING INSTRUCTIONS FOR DOSIMETER CHARGERS

- A. Insert dosimeter into socket of charger.
- B. Press down firmly on dosimeter, look through dosimeter at scale and hairline.
- C. Turn adjustment knob until hairline is in line with zero area.
- D. Remove dosimeter from charger, point dosimeter at a light source and check hairline alignment. Should it be misaligned, repeat the above procedure.

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### DOSIMETERS

- A. Issued pocket dosimeters are delicate instruments which measure the accumulated dose of gamma radiation received. The range of these instruments is 0 MR to 200 MR. They can be damaged by jarring, dropping or high humidity. This could contribute to an erroneous reading. Should you suspect the instrument is damaged, contact the Radiation Safety Officer immediately.
- B. Should the dosimeter go off scale (exceed 200 MR), cease work and contact the Radiation Safety Officer immediately since, when a dosimeter goes off scale, the film badge shall be processed immediately to determine if an overexposure has occurred. The film badge shall be forwarded to the office for immediate processing. Having done this, immediately recharge the dosimeter and place it in an area free of radiation for approximately one hour. If it is again discharged totally or partially, in all probability you have not received excessive radiation and the dosimeter is probably faulty. Should this be the case, inform the Radiation Safety Officer. Only he may decide, after careful study of the situation, whether or not you may return to radiation work. Provided the dosimeter is faulty, the man would be issued a new dosimeter and film badge before continuing work.
- C. Dosimeters shall be recharged daily or more often, as may be required, so that at the beginning of each work shift the dosimeter is capable of reading 0 to 200 milliroentgens. If, at any time during a work shift it is ascertained that the indicator needle is approaching mid-scale, the dosimeter shall be recharged immediately.

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### PROCEDURES FOR ISSUANCE, WEARING, AND PROCESSING OF FILM BADGES

- A. Film badges shall be issued by office personnel. The name of the wearer shall be inscribed on each badge and this name and number entered in a log book for record purposes.
- B. Film badges in proper holders shall be worn by all radiography personnel during working hours.
- C. Film badges are not interchangeable among personnel (issued to one individual, worn by one individual).
- D. Film badges shall be worn for the issued calendar month.
- E. Upon completion of the wearing time, return the badge immediately to office for processing.
- F. Should an unforeseen situation require an individual wear a film badge for a time exceeding the calendar period, return the badge when a replacement is obtained. A written note explaining the reason for overwearing shall accompany the film badge.
- G. Upon receipt of each badge, office personnel shall record receipt date in the log book and forward badge for processing.
- H. The film badge record will be reviewed for possible excessive or unusual radiation dosages. Any individual having received possible excessive or unusual radiation dosage, shall be notified.

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### OPERATING INSTRUCTIONS FOR RATE ALARM METER

#### OPERATION:

Slide on-off selector switch to on position. Check battery and alarm tone use a paper clip or equivalent and push where indicated. The red LED battery light will light if the battery is ok and the alarm should sound. Do not use if either test fails, replace battery if indicated.

\* Note: It is recommended that the unit be tested periodically in a radiation field.

#### SPECIFICATIONS:

Radiation Detected.....Gamma & X-Ray 80 to 1500 KeV.

Controls.....On/Off - Battery indicator LED Light -  
Battery and Audio check push button switch

Detector.....Halogen Quenched GM tube type 716. Areal density 90  
mg/cm squared. eff. length .25 in. eff. diameter  
.19 in. material 446 SS.

Alarm Output.....Solid state audio tone transducer. At 450 mR/hr  
starts to activate - will emit a loud crackling  
sound - as the field intensifies the alarm  
becomes one solid tone. Accuracy + or  
-20%

Power.....9 Volt (Eveready EN95 or equivalent) comes with EV22

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### RADIATION DOSES

Exposure of individuals to radiation in restricted areas.

- A. The present maximum permissible radiation dose is 5--REMS per calendar year.
- B. Even though the above doses are permitted, our goal is to keep your exposure below this limit. Reduced exposures are possible by using time, distance, and shielding in all radiography projects. (A.L.A.R.A. Concept)
- C. Adequate checking of the dosimeter will give immediate indication of excessive radiation exposure. Proper use of the survey meter and dosimeter will prevent accidental over-exposure.
- D. The Company maintains records outlined by the United States Nuclear Regulatory Commission and/or forms approved by Agreement State.
- E. Personnel will be informed of permissible dosage limits allowed by Management and Supervision.



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### RADIATION SURVEYS

- A. All radiation surveys to be performed in accordance with instructions outlined in the Manual.

### PHYSICAL RADIATION SURVEYS

- A. A calibrated and operable survey instrument shall be maintained at each location where radioactive material is being utilized, transported and/or stored. Each instrument shall be calibrated each 90 day period (maximum), and/or after each servicing. Frequent checking of the last calibration date will be performed so that recalibration shall be performed before the expiration date.
- B. A survey shall be performed on the exposure device prior to removing it from a storage area. When utilizing all other exposure devices, the survey shall be performed circumferential at a 6 inch distance from the outer surface of the exposure device. The reading shall not exceed 50 MR/HR at 6" away from the surface. The results of these surveys shall be recorded in the utilization logs.
- C. After performing the above survey and prior to beginning production radiography, a survey of the posted perimeter with source in position, shall be made to verify the restricted area. This area will be established at the 2 MR/HR level. Regulations state that "Caution Radiation Area" signs shall be posted at the 5 MR/HR level, however, as a matter of policy, a 2 MR/HR perimeter will be established and proper signs posted.

"CAUTION HIGH RADIATION AREA" signs shall be posted at the 100 MR/HR level. All restricted areas shall be under constant surveillance of the Radiographer and/or Radiographer's Assistant. Proper barriers shall be established to designate the perimeter of each restricted area except when sources are utilized at remote, isolated areas.

Results of the surveys shall be recorded on the proper forms as illustrated in the diagrams under heading "RADIATION AREA SURVEYS".

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Additional radiation area surveys shall be performed each time a handling procedure varies which will change the previously established radiation output perimeter. These surveys shall be recorded as outlined above.

- D. A survey of the exposure device and exposure tube shall be performed after each exposure in order to ascertain the source has returned to the shielded position. Zero radiation levels would indicate source did not return to the shielded position, or a very high reading as you approach the device would also indicate the source had not returned to the shielded position. Should the survey determine the source has not returned to the shielded position, follow the Emergency Procedures outlined in Section II of this Manual.
- E. At the completion of each work shift, a final survey of the exposure device shall be performed prior to returning the exposure device to storage area. The survey shall be performed circumferential at a distance of 6 inches from the outer surface of the exposure device. The reading shall not exceed 50 MR/HR, and 10 MR/HR at a distance of 1 meter (39.37 inches) from the surface. The results of these surveys shall be recorded in the utilization log.
- F. Whenever a source is transported by a vehicle, the outer surface of the vehicle shall be treated as an unrestricted area. A physical radiation survey shall be made after the exposure device is secured in/on the vehicle to assure that radiation levels do not exceed 2 MR/HR. Should radiation levels exceed 2 MR/HR, the exposure device must be repositioned in/on the vehicle or further shielding must be employed to reduce the radiation level of 2 MR/HR.

Passenger compartments of transporting vehicles shall also be surveyed. The radiation level in passenger compartments shall not exceed 2 MR/HR.

Results of the surveys shall be recorded on proper forms as illustrated in the "Vehicle Survey".

- G. Should the radiation survey instrument become inoperable, halt operations. Do not resume operations until the survey instrument has been repaired and/or in operable, calibrated instrument obtained. Contact the Radiation Safety Officer for instruction.

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### RESTRICTED AREAS FOR RADIOGRAPHY

- A. Post all restricted areas with warning signs as outlined on pages 3 and 4 of this Section. The signs shall bear the words "Caution Radiation Area", and shall bear the standard three bladed Radiation sign. The blade is colored magenta or purple on a yellow background.
- B. Post all high radiation areas with warning signs as outlined on pages 3 and 4 of this Section. The signs shall bear the words "Caution High Radiation Area", and the above described radiation symbol.
- C. All restricted areas must be under constant surveillance by the Radiographer and/or Radiographer's Assistant. Proper barriers shall be established to designate the perimeter of each restricted area, except when sources are utilized at remote isolated areas.

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### INSTRUCTIONS FOR POSTING AND RESTRICTING RADIOGRAPHIC AREAS

- A. "High Radiation Areas" are those which contain radiation levels such that a person to the area could receive an exposure in excess of 100 millirem in any one continuous hour. The limits of this radiation area shall be posted with signs bearing the radiation caution symbol and the words "Caution High Radiation Area". These signs will be posted at the 100 MR/HR level.
- B. "Radiation Areas" shall be posted with signs bearing the radiation caution symbol and the words "Caution Radiation Area". Company policy is to utilize these signs to post the perimeter of a "restricted area". The signs are posted at the perimeter of the restricted area as designated in Paragraph C below. Therefore, no action concerning the perimeter of the radiation area need be taken. "Radiation Areas" are those which contain radiation levels such that a person in the area could receive an exposure in excess of 5 millirem in any one continuous hour, or in any five consecutive days a dose in excess of 100 millirems.
- C. A Restricted Area is that area into which the Radiographer and/or Radiographer's Assistant shall control access for purposes of radiation safety. This restriction shall be extended to include those areas containing radiation levels such that a person continuously present in the area could receive a dose in excess of 2 millirems in any one hour and/or 100 MR in 7 consecutive days. Normally, the perimeter of the restricted area will be at the 2 MR/HR line. However, in a situations where it is impossible to rope off to a 2 MR/HR distance, the charts in Section III of this Manual shall be utilized to assist you in determining the MR/HR level at the perimeter of the roped off area, as well as the appropriately reduced amount of time the source can be in the exposed position.
- D. The very nature of pipeline work usually means that the work is done in isolated areas so that the hazard to the general public is limited. Even so, the rules of Radiation Safety still apply. Consequently, when radiographically inspecting pipelines using isotopes, utilizing external shot techniques, the area will be posted in accordance with **INSTRUCTIONS FOR POSTING AND RESTRICTING RADIOGRAPHIC AREAS**, items A, B, and C.

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### SECURING EXPOSURE DEVICE WHEN NO ADDITIONAL EXPOSURES ARE REQUIRED

- A. Return locked exposure device to storage area and perform the physical surveys as outlined on page 2 of this Section.
- B. If exposure device cannot be returned to a locked storage area, or otherwise physically secured, Radiographer or Radiographer's Assistant will establish a safe area around exposure device and maintain constant surveillance to prevent unauthorized persons from entering the area.
- C. Care must be exercised when performing the final survey to assure source is in the shielded position in device and not behind a temporary barrier. With a source in the shielded position, radiation levels at the surface may vary from 10 MR/HR to 50 MR/HR at a distance of 6 inches from the surface of the device.
- D. Zero radiation levels would indicate source did not return to the shielded position or a very high reading as you approach the device would also mean the source had not returned to the shielded position.



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- E. Radioactive material transporting vehicles shall be posted on the four outer surfaces with "Caution Radiation Area" signs and "Caution Radioactive Material" sign shall be posted on the access door whenever radioactive material is present. The radioactive material storage compartment shall be locked when not under the direct surveillance of the Radiographer and/or Radiographer's Assistant. The only time Radiation signs on all four sides of truck will be used will be when yellow II criteria are exceeded.



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### SECURITY OF SEALED SOURCES IN RADIOGRAPHIC DEVICES

- A. Never leave a radiographic exposure device unattended when outside a storage area.
- B. Before placing an exposure device in a storage area, with an approved calibrated survey meter, ascertain the source is safely located and locked in the device.
- C. Storage areas shall remain locked at all times while containing radioactive material and not under surveillance.
- D. Storage area shall be properly identified using the radiation signs provided, which bear the words "Caution Radioactive Material".
- E. Return locked exposure device to storage area and perform a physical survey on the outer perimeter of designated storage area to ascertain that radiation levels do not exceed 2 MR/HR. Should the radiation levels exceed 2 MR/HR, the exposure device must be repositioned or further shielding must be employed to reduce the radiation level to 2 MR/HR.
- F. Designated Storage Area Is:
  - 1. 650 Alpine Road, Gaylord, Michigan, properly identified with the mark "CAUTION RADIOACTIVE MATERIAL" on the entrance, or Darkroom of vehicles when properly posted and secured.

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### TRANSPORTATION OF RADIOGRAPHIC DEVICES

- A. The NRC and/or Agreement State has authorized use of by-product material at various locations throughout the country. Transportation of these materials must be approved by the Radiation Safety Director, and must conform to DOT 49 CFR as outlined in the procedures.
- B. Devices shall be checked by Radiographer, using a survey meter, prior to removal from any storage area.
- C. A Radiographer or Radiographer's Assistant shall be in constant attendance during movement.
- D. No device shall be moved unless all safety plugs are inserted and it is locked.
- E. Whenever a source is required to be transported by a vehicle, the outer surface of the transportation vehicle must be treated as an unrestricted area. A physical radiation survey must be made after the exposure device is secured in/on the vehicle to assure that radiation levels do not exceed 2 MR/HR. If radiation levels exceeding 2 MR/HR are found, the exposure device must be repositioned in /on the vehicle or further shielding must be employed.

The passenger compartment of the transporting vehicles must be surveyed, as well as the outer surface of the storage area. The radiation level in the passenger compartment must not exceed 2 MR/HR.

In addition, the transporting vehicle must be posted with a "CAUTION RADIOACTIVE MATERIAL" sign on the entrance or access door whenever radioactive material is present. The storage compartment must be kept locked at all times when not under direct surveillance by the Radiographer or Radiographer's Assistant.

- F. The following equipment must be packed in the transporting vehicle prior to departing for a field exposure site:
  - 1. An operable approved survey instrument which has been calibrated within the 90 day period as required by the NRC and/or Agreement State.
  - 2. A minimum of 4 "CAUTION RADIATION AREA" signs.
  - 3. A minimum of 4 "CAUTION HIGH RADIATION AREA" signs.
  - 4. The Exposure Device and all related cable.

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### SHIPMENT OF RADIOACTIVE MATERIAL

Prior to shipment, the Radiographer must perform the following:

- A. On material transportation forms Source Shipment Survey, the source S/N, Camera S/N, and destination must be noted. If source was transferred to exchanger, the type and S/N of exchanger must be listed.
- B. Perform a physical radiation survey on the device to be shipped, as outlined in page 1, part B of this Section, and results of this survey shall be recorded on material transportation forms shown in this Section.
- C. For air shipment, a device must be packed in a Type B container, A Type B container is a container which has an identification mark with the inscription "Type B".
- D. Another physical survey shall be performed on the shipping container. This survey shall be performed at a distance of 1 meter from the outer surface of shipping container and shall not exceed 10 MR/Hr. The results of this survey shall be recorded on Survey page of this Section.
- E. Container must then be securely sealed.
- F. Container must be labeled with the two Radioactive yellow labels furnished. Each label will have three areas requiring completion as follows:
  1. Contents: Enter in this area the type of radioactive material being shipped such as IR192.
  2. Number of Curies: Enter the number of curies being shipped.
  3. Transport Index: Enter the MR/HR ascertained by surveying the shipping container from a distance of 1 meter (39.37 inches) from the exterior surfaces.
- G. The two radioactive yellow labels will then be secured to container at opposite sides where they can clearly be seen. (Remove any previously attached labels). Enter on lower portion of Source Shipment Survey material transportation forms the source type, number of curies, transport index number, and sign.

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- H. One (1) orange and black peligro label will then be secured to container on sides where they can clearly be seen.
- I. On top half of Form, date and sign your name as agent for the Company, enter the number of curies being shipped under activity column, and enter transport index in column provided.
- J. Distribution of material transportation forms will be as indicated on bottom of form. Shipping copies will be attached to freight bill.

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### RECEIPT OF RADIOACTIVE MATERIAL

- A. A prompt physical radiation survey of each package upon receipt will be made. Immediate notification to the Radiation Safety Officer will be made provided an abnormality is found.
- B. After seal is broken and lid is removed, another physical radiation survey must be made before handling device.
- C. Record above surveys in space provided on the "Source Receipt Survey" portion of Receipt Inspection Form #RSF 4 illustrated in this Section.
- D. Upon completion of Receipt Inspection Form # RSF 4, forward copies in accordance with instructions outlined on the form. In addition, attach a copy of freight Bill.



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### QUARTERLY INVENTORY

- A. Physical quarterly inventory will be performed on each source every 90 days.
- B. Every 90 days a Quarterly Inventory Form will be mailed to each Radiogrpaher who has in his possession radioactive materials.
- C. Physical Quarterly Inventory forms will be a two part form.
  - 1. Complete the form being sure that each and every blank is filled out completely.
  - 2. Sign and date the form, and forward to division office or corporate office as applicable.
  - 3. Forms must be returned within the required 10 day interval.



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### LEAK TESTS

Leak tests will be performed on all sealed sources (IR 192) at intervals not to exceed 6 months. Field personnel will be provided with leak test kits. The test must be completed and returned to appropriate office within the required 10 day interval. The test will be performed in accordance with the following instructions. Leak tests shall be capable of detecting the presence of 0.005 micro-curies of contamination.

### INSTRUCTIONS FOR PERFORMING LEAK TESTS

1. Wash hands thoroughly.
2. Remove cap from plastic bottle.
3. Remove cotton swab from plastic envelope.
4. Insert swab into bottle to moisten cotton with solvent.
5. Using an operable survey meter, check the camera to insure that the source is in the shielded position. Remove the source transfer tube from its aperture in the camera. Using the moistened swab, wipe thoroughly around the inside of the aperture from which the source transfer tube was removed.
6. Reinsert swab into plastic bottle.
7. Screw cap on plastic bottle firmly.
8. Fill out Leak Test Information Form, which is provided with Leak Test kit.
9. Tear off information form and attach it to the plastic bottle with tape.
10. Attach return mailing label to mailing envelope.
11. Insert plastic bottle and information form into mailing envelope.
12. Attach postage for first class mailing to mailing envelope.

**CAUTION:** A separate leak test kit must be used for each source or surface to be tested. Otherwise, if contamination is present, it will be spread and ambiguous information will result.

**NOTE:** Using your survey meter set on the lowest available range, survey the mailing envelope containing the wipe test. If any radiation is detected, contact a Radiation Safety Officer immediately for instruction. Do Not Mail The Envelope.

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B.

1. Fill out identification form. Put original in plastic envelope and keep duplicate copy.
2. Survey device with calibrated survey meter to assure source is in shielded position, and secured.
3. Remove safety plug from front of exposure device.
4. Insert cotton swab that is supplied in test kit approximately 1" into opening, wiping circumference of opening to assure maximum coverage of the "S" tube.
5. After wipe test is completed, remove swab. DO NOT TOUCH cotton tip or allow contact with clothing or other material. Place swab in plastic envelope supplied.
6. Survey envelope with survey meter. If meter detects any radiation DO NOT mail envelope.

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### DAILY RADIOGRAPHIC DEVICE MAINTENANCE CHECK LIST FOR THE FOLLOWING RADIOGRAPHIC EXPOSURE DEVICES

SPEC Model 2-T Technical Operations 660,  
Industrial Nuclear IR-100, Automated Industries 520,  
Gamma Century

THESE CHECKS TO BE PERFORMED BY THE RADIOGRAPHER AT THE BEGINNING OF EACH WORK SHIFT.

1. Check source connector for wear, bending or unusual signs of abuse. Be sure holding pin is still 90 degree elbow and straight with connector.
2. Check lock plunger for free operation, the full length of its travel.
3. Check outlet nipple after removing safety plug for physical damage or excessive wear.
4. Check labeling and warning signs for legibility and R.A.M. ASSAY TAG.
5. Check source tube for damage, such as crimps, foreign matter and ease of connect and disconnect or damaged threads.
6. Check source connector on drive cable assembly. This hole should not be worn out-of-round to the extent that it may disconnect in any position other than the correct disconnect position. Also check for cracking.
7. Check first 18 inches of drive cable for stiff, rusty or frayed areas. This shall be done by rolling out about 18 inches of the drive cable and physically flexing by hand and looking for defective areas.
8. Inspect control assembly and cable housing for unusual wear, free and ease of operation. Look at cable housing for kinds or mashed places. Look for damage by heat, such as falling against a heater or other hot material.
9. Upon completion of above daily checks each employee shall initial in space provided in section entitled "DAILY MAINTENANCE CHECK". By initialing, employee is certifying that the above checks were performed in accordance with these instructions on radiation survey reports.

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SHOULD ANY OF THE ABOVE CHECKS REVEAL A SITUATION NECESSITATING REPAIRS TO A DEVICE, RADIOGRAPHIC EXPOSURES SHALL BE DISCONTINUED IMMEDIATELY AND NO FURTHER WORK PERFORMED UNTIL A RADIATION SAFETY OFFICER HAS BEEN NOTIFIED OF THE SITUATION AND NECESSARY REPAIRS HAVE BEEN MADE TO THE DEVICE.

UNDER NO CIRCUMSTANCES, IN THE PERFORMANCE OF THE ABOVE INSPECTION, SHALL YOU REMOVE THE SOURCE FROM ITS SHIELDED POSITION.

## 517-732-8059

When utilizing Gamma Ray complete the Radiation Device Utilization Log in its entirety if X-Ray is the source of radiation complete all columns except the Source BN and Camera Model column.

I certify that I have completed all the requirements as outlined above. SIGNATURE \_\_\_\_\_



**MID AMERICAN**  
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# ACTIVE MATERIAL TRANSPORT RECORD

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED  
DATE 01-27-2001 BY 60322 UCBAW

© 1991 CIMA, INCORPORATED

800-368-6263

PROPER SHIPPING NAME: UH - 2074, RADIOACTIVE MATERIAL

Special Form, 2.0.2.

TYPE OF CONTAINER: TYPE B

**PHYSICAL DESCRIPTION:** Special Form

**TRANSPORT GROUP: Special Form**

## CONTAINER INFORMATION

HAZARD CLASS: Radioactive Material

Volume: 0.0002 cubic inch

2000-01-01

Labet Radioactive

**Medicine**

Quantity: \_\_\_\_\_

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650 Alpine Rd.

Gaylord, MI 49735

**COLLEGE OF THE OREGON GRADUATES**

Shopper's Certification

**Supplier:**

This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

SEND VIA

Signed for Sniper:

Dedekind

[illegible]

**Labeling Criteria**  
**Maximum Survey Limit(s)**

White I	Yellow II	Yellow III
5 mR/hr Surface	50 mR/hr Surface	200 mR/hr Surface
0 mR/hr @ 1 Meter	1.0 mR/hr @ 1 Meter	10 mR/hr @ 1 Meter

•PLACARD REQUIRED



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880 ALPINE ROAD

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### DAILY RADIOGRAPHIC DEVICE MAINTENANCE CHECK LIST FOR THE FOLLOWING RADIOGRAPHIC EXPOSURE DEVICES

#### X-RAY PRODUCING EQUIPMENT

These checks to be performed by the Radiographer at the beginning of each shift.

#### A. X-RAY PRODUCING EQUIPMENT

1. Check all plugs on cables.
2. Check receptacles for plugs on both the control panel and x-ray machine.
3. Check for proper operation for meter on the control panel.
4. Check labeling on control panel and x-ray machine.
5. Check locking device on control panel.

SHOULD THE ABOVE CHECKS REVEAL A SITUATION NECESSITATING REPAIRS OF A DEVICE, RADIOGRAPHIC EXPOSURES SHALL BE DISCONTINUED IMMEDIATELY AND NO FURTHER WORK PERFORMED UNTIL A RADIATION SAFETY OFFICER HAS BEEN NOTIFIED OF THE SITUATION AND NECESSARY REPAIRS HAVE BEEN MADE TO THE DEVICE.

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### SECTION II

#### EMERGENCY PROCEDURES

##### PURPOSE:

Radiation accidents can occur whenever radiation equipment (or) radioactive materials are used or stored. Adequate instruction and care can avoid most accidents, and minimize radiation exposure resulting from accidents if they do occur.

##### SCOPE:

When any of the following occur, it shall be considered an accident, and the following emergency procedures must be followed.

- A. Accident involving exposure device or related equipment.
- B. Accident involving exposure of non-monitored persons.
- C. Lost Source.
- D. Vehicular Accident.
- E. Theft of a Sealed Source.

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### PERSONS TO CONTACT IN THE EVENT OF AN EMERGENCY

#### GENERAL INFORMATION

In the event of an accident or any difficulty involving the use of radioactive materials, the Radiation Safety Officer is to be notified immediately. **DO NOT** minimize the seriousness of the emergency. Improper or incomplete information over the telephone may be misconstrued and might result in improper corrective action.

#### PERSONS TO NOTIFY

##### CORPORATE RADIATION SAFETY OFFICER:

Name ..... Terry L Wilkins  
Office Phone ..... (517) 732-8059  
Home Phone ..... (517) 732-8253

##### ALTERNATIVE:

Name ..... Robert E Story  
Office Phone ..... (517) 732-8059  
Home Phone ..... (517) 732-8238

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### EMERGENCY PROCEDURE FOR RADIOGRAPHIC PERSONNEL

A. In the event of an accident, to the source or device, immediately do the following:

1. Return source to device (if possible) and lock device.
2. Survey device to ascertain that source has returned safely to device.
3. Do not use source again until you have made an inspection of the device and personnel monitoring equipment to be certain no danger exists and no over-exposure has been received. If either of these two conditions exists, notify the Radiation Safety Officer immediately.
4. In the event the source cannot be returned to device, immediately do the following:
  - a. Set up and post a restricted area as specified in section I, page 1, paragraph C, of this manual, using a survey meter to determine the perimeter of the area.
  - b. The Radiographer and/or Radiographer's Assistant shall maintain constant visual surveillance of the area and will not allow anyone to enter this area.
  - c. Notify Radiation Safety Officer for instructions.
  - d. In the event you cannot contact a Radiation Safety Officer as instructed above, notify the Nuclear Regulatory Commission and/or the appropriate State Health Department. You will find the telephone numbers of the Radiation Safety Officers and the Nuclear Regulatory Commission on Page 1, of this Section.

B. In the event of accident involving the exposure of non-monitored persons to radiation, immediately do the following:

1. Retract the source into exposure device (if possible) Should this not be practical, set up restricted area as specified in Section 1, Page 1, paragraph C of this Manual. Use survey meter to determine the perimeter of the area.

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2. The Radiographer and/or Radiographer's Assistant shall maintain constant visual surveillance of the area and will not allow anyone to enter this area.
3. Take names and addresses of non-monitored persons.
4. Notify the Radiation Safety Officer Immediately for instructions.

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### C. LOST SOURCE

1. Notify Radiation Safety Officer of the incident immediately.
2. Survey area with survey meter, rope off and post area at the 2 MR/HR level.
3. Should one of these sources be lost from the camera, you will locate it with the use of a survey meter.

In the event you cannot visibly locate the source, a survey meter is employed in the following manner.

1. Locate direction of source by approaching area where source is considered to be, pointing survey meter in direction of area. Should meter needle climb, you will know source is in this direction. If it fails, you will be going away from the source.
2. After locating direction of source, place the survey meter on the ground floor, place a shielding object on the floor and move the meter behind it until you find the "shade" of the shielding. You now have a "fix" on the source. Repeat the above from another sector, and obtain a second fix. The intersection of these fixes will narrow down the location of the exposed sources.
3. Check non-monitored personnel and handle as outlined in this Section, Page 3, Paragraph B.
4. In the event you cannot contact a Radiation Safety Officer as instructed above, notify the Nuclear Regulatory Commission and/or the appropriate State Health Department. You will find the telephone numbers of the Radiation Safety Officers and the Nuclear Regulatory Commission on Page 1, of this Section. For the State Health Department's telephone numbers, refer to the index for the Section number pertaining to that state. The phone numbers will be listed on page 1 of that Section.



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### D. VEHICULAR ACCIDENT

1. In the event of a vehicular accident involving by-product material, a restricted area must be established as specified in Section 1, page 1, paragraph C, of this Manual.
2. If the survey meter is operable, use it to establish the perimeter of the restricted area.
3. If the survey meter is inoperable, assume that the source is in the exposed position. Use calculations and/or the chart as outlined in Section III of this Manual to establish the perimeter of the restricted area. In case of minor accidents, where it can be visually determined that the source is safely stored in its container, no restriction of area is required.
4. If the survey meter is operable, no radiation hazard exists and the vehicle is movable, continue.
5. In any case, immediately after establishing the restricted area, notify the Radiation Safety Officer.

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### E. THEFT OF SEALED SOURCE

1. Notify the foreman at job location to assure that no person will leave the premises without first being monitored.
2. Notify Radiation Safety Officer giving him complete details, so that he may in turn notify the proper authorities.
3. Gather all information pertaining to the theft, and be prepared to present the facts to the proper authorities.

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## SECTION III

### RADIATION LEVEL DISTANCE CHARTS

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The Following Chart May Be Used To Assist You In Determining Different Time Levels For Different Radiation Levels:

60 Minutes	2 MR/HR
30 Minutes	4 MR/HR
10 Minutes	12 MR/HR
5 Minutes	24 MR/HR
1 Minute	120 MR/HR

The above levels were determined in the following manner:

Multiply 60 minutes by 2 MR/HR, answer 120 per minute.  
Now use the 120 MR/minute as the starting point.

### EXAMPLE 1

When the perimeter of the restricted area is established at the 12 MR/HR level, what length of time may the source be in the exposed position and still conform to the 2 MR/HR requirement?

120 MR/HR divided by 12 MR/HR equals ten.

### EXAMPLE 2

When the perimeter of the restricted area is established at the 40 MR/HR level, what length of time may the source be in the exposed position and still conform to the 2 MR/HR requirement?

120 MR/HR divided by 40 MR/HR equals three.

The factors of 10 and 3 as illustrated in examples 1 & 2 represent the number of minutes in a given hour that the source of radiation can be in the exposed position when the perimeter of the restricted area has been established at a level of 12 MR/HR and 40 MR/HR respectively. In so doing, we have limited the total amount of radiation available in a given hour to 2 MR/HR at the perimeter of the restricted area.

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IRIDIUM - 192

### RADIATION LEVELS AT VARIOUS DISTANCES

#### 80 CURIE SOURCE

480'	2 MR/HR
380'	3 MR/HR
280'	6 MR/HR
180'	15 MR/HR
100'	47 MR/HR
90'	58 MR/HR
80'	74 MR/HR
70'	96 MR/HR
60'	131 MR/HR
50'	189 MR/HR
40'	295 MR/HR
30'	524 MR/HR
20'	1180 MR/HR
10'	4720 MR/HR
5'	18880 MR/HR
2'	118000 MR/HR

#### 70 CURIE SOURCE

450'	2 MR/HR
350'	3 MR/HR
250'	7 MR/HR
150'	18 MR/HR
100'	41 MR/HR
90'	51 MR/HR
80'	65 MR/HR
70'	84 MR/HR
60'	115 MR/HR
50'	165 MR/HR
40'	258 MR/HR
30'	459 MR/HR
20'	1033 MR/HR
10'	4130 MR/HR
5'	16520 MR/HR
2'	103250 MR/HR

#### 60 CURIE SOURCE

420'	2 MR/HR
320'	3 MR/HR
220'	7 MR/HR
120'	25 MR/HR
100'	35 MR/HR
90'	44 MR/HR
80'	55 MR/HR
70'	72 MR/HR
60'	98 MR/HR
50'	142 MR/HR
40'	221 MR/HR
30'	393 MR/HR
20'	885 MR/HR
10'	3540 MR/HR
5'	14160 MR/HR
2'	88500 MR/HR

#### 50 CURIE SOURCE

380'	2 MR/HR
280'	4 MR/HR
180'	9 MR/HR
100'	30 MR/HR
90'	36 MR/HR
80'	46 MR/HR
70'	60 MR/HR
60'	82 MR/HR
50'	118 MR/HR
40'	184 MR/HR
30'	328 MR/HR
20'	738 MR/HR
10'	2950 MR/HR
5'	11800 MR/HR
2'	73750 MR/HR

#### 40 CURIE SOURCE

340'	2 MR/HR
240'	4 MR/HR
140'	12 MR/HR
100'	24 MR/HR
90'	29 MR/HR
80'	37 MR/HR
70'	48 MR/HR
60'	66 MR/HR
50'	94 MR/HR
40'	148 MR/HR
30'	262 MR/HR
20'	590 MR/HR
10'	2360 MR/HR
5'	9440 MR/HR
2'	59000 MR/HR

#### 30 CURIE SOURCE

300'	2 MR/HR
200'	4 MR/HR
100'	18 MR/HR
90'	22 MR/HR
80'	28 MR/HR
70'	36 MR/HR
60'	49 MR/HR
50'	71 MR/HR
40'	111 MR/HR
30'	197 MR/HR
20'	442 MR/HR
10'	1770 MR/HR
5'	7080 MR/HR
2'	44250 MR/HR

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IRIDIUM - 192

### RADIATION LEVELS AT VARIOUS DISTANCES

#### 20 CURIE SOURCE

240'	2 MR/HR
140'	6 MR/HR
100'	12 MR/HR
90'	15 MR/HR
80'	18 MR/HR
70'	24 MR/HR
60'	33 MR/HR
50'	47 MR/HR
40'	74 MR/HR
30'	131 MR/HR
20'	295 MR/HR
10'	1180 MR/HR
5'	4720 MR/HR
2'	29500 MR/HR

#### 10 CURIE SOURCE

170'	2 MR/HR
100'	6 MR/HR
90'	7 MR/HR
80'	9 MR/HR
70'	12 MR/HR
60'	16 MR/HR
50'	24 MR/HR
40'	37 MR/HR
30'	66 MR/HR
20'	148 MR/HR
10'	590 MR/HR
5'	2360 MR/HR
2'	14750 MR/HR

#### 5 CURIE SOURCE

120'	2 MR/HR
100'	3 MR/HR
90'	4 MR/HR
80'	5 MR/HR
70'	6 MR/HR
60'	8 MR/HR
50'	12 MR/HR
40'	18 MR/HR
30'	33 MR/HR
20'	74 MR/HR
10'	300 MR/HR
5'	1180 MR/HR
2'	7375 MR/HR

#### 100 CURIE SOURCE

548'	2 MR/HR
448'	3 MR/HR
338'	5 MR/HR
228'	11 MR/HR
128'	36 MR/HR
100'	59 MR/HR
90'	73 MR/HR
80'	92 MR/HR
70'	120 MR/HR
60'	164 MR/HR
50'	236 MR/HR
40'	369 MR/HR
30'	656 MR/HR
20'	1475 MR/HR
10'	5900 MR/HR
5'	23600 MR/HR
2'	147500 MR/HR

#### 90 CURIE SOURCE

510'	2 MR/HR
410'	3 MR/HR
310'	6 MR/HR
210'	12 MR/HR
110'	44 MR/HR
100'	53 MR/HR
90'	66 MR/HR
80'	83 MR/HR
70'	108 MR/HR
60'	148 MR/HR
50'	212 MR/HR
40'	332 MR/HR
30'	590 MR/HR
20'	1328 MR/HR
10'	5310 MR/HR
5'	21240 MR/HR
2'	132750 MR/HR



# MID AMERICAN

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INSPECTION SERVICES • NDE DIVISION

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650 ALPINE ROAD

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• 517-732-8059

## SECTION IV

### OPERATING INSTRUCTIONS FOR RADIOGRAPHIC EXPOSURE DEVICES

1. Gulf Nuclear, Model 20V
2. SPEC, Model 2-T
3. Gamma Century
4. Automation Industries, Model 520
5. Tech/Ops, Model 660/660A
6. Tech/Ops, Model 660B
7. Industrial Nuclear, Model IR-100
8. SPEC, Model SPEC Check I
9. Gamma Industries Pipeliner I
10. SPEC, Model SPEC Check II
- \* 11. Operating Instructions

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### OPERATING INSTRUCTIONS

1. When operating this device, a calibrated, operable survey meter must be used and all personnel must have their assigned film badges and dosimeters.
2. Perform physical survey to ascertain that the source is in the shielded position.
3. Place camera in position and be certain that it is quite stable. Do not place camera in such a way that it may fall off during exposure.
4. Secure AREA and post appropriate signs. Clear all personnel from posted perimeter.
5. Remove lock box safety cap.
6. Source pigtail should extend approximately 1/4 inch from rear of camera.
7. Connect source pigtail to control drive cable, turn crank handle to take up excess slack.
8. Thread drive cable housing into rear of device.
9. Remove front safety plug from front of camera.
10. Thread source exposure tube into front of camera and position to exposure site.
11. Unlock exposure device.
12. Crank source to the exposed position remaining as far away as possible.

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13. Survey perimeter and adjust as necessary to 2 MR/HR.
14. After exposure, return source to the shielded position, and adjust warning signs if needed.
15. Perform circumference (360 degrees) survey of the exposure device and the entire length of guide tube, to ascertain that source has returned to shielded position.
16. Lock the exposure device.
17. The exposure device shall be locked at all times except when in direct use to make an exposure. The Radiographer shall ensure the exposed device is under constant surveillance at all times when removed from the storage container.

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## SECTION V

### SOURCE TRANSFER PROCEDURES & SOURCE CHARGERS

Gamma Industries C-10

SPEC C-1

Tech/Ops 650

Automation Industries 500 SU

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## SOURCE CHANGING INSTRUCTIONS FOR C-10 SHIPPING CONTAINER Single Source Configuration

ALWAYS HAVE A PROPERLY OPERATING SURVEY METER AT HAND WHEN  
CHANGING SOURCES!!!

1. Survey the C-10 shipping container with meter. The radiation intensity should not exceed 10 MR/HR at 1 meter from any surface of the C-10.
2. Open the lower lock of the C-10 shipping container. Remove the safety plug.
3. Connect one end of short exchange tube (provided in the shipping barrel) to the lower lock box of the C-10 shipping container. Attach the other end of the short exchange tube to your camera.
4. Crank your old source into the C-10 shipping container until it reaches a definite stop.
5. Survey to assure that the old source has reached a safe position.
6. Lock the lower lock of the C-10 shipping container onto the old pigtail locking ball. You must be aware that the source could be removed from the open end of the lock box if the lower lock is not locked.
7. Remove the short exchange tube from the C-10 shipping container. Disconnect the control cable from the old pigtail. (Attempt to move the pigtail into and out of the C-10 shipping container to assure the lock is depressed upon the pigtail locking ball. If the pigtail can be moved, then open the lower lock, CAREFULLY PUSH THE PIGTAIL INTO THE CONTAINER, and lock the lock upon the pigtail locking ball. This will assure that the old source will remain properly locked and shielded during the return shipment.

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8. Remove the source protector cap from the upper lock box and in the lower lock box.
9. Attach the control cable to the new pigtail which is in the upper lock box.
10. Attach short exchange tube to the C-10 shipping container upper lock box.
11. Unlock the upper lock from the new source.
12. Standing as far away as possible, crank the new source from the C-10 shipping container into your camera.
13. SURVEY.
14. Lock your camera lock.
15. Remove the short exchange tube from your camera. Remove the short exchange tube from the C-10 shipping container.
16. Insert the safety plug into the upper tube of the C-10 shipping container. Lock the upper lock of the C-10 shipping container.
17. SURVEY.
18. Place the C-10 into the barrel in the same orientation which it was received. Place the short exchange tube into the barrel. Place the top on the barrel and secure with the locking ring.
19. Insert a safety seal into the barrel locking ring.
20. SURVEY. (The radiation intensity should not exceed 200 MR/HR at any barrel surface or 10 MR/HR at one meter from any barrel surface).



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### SPEC C-1 SOURCE EXCHANGER OPERATING INSTRUCTIONS

**IMPORTANT:** Use only a properly functioning and calibrated survey meter at all times!!

#### EXCHANGING SOURCE FROM EXPOSURE DEVICE TO C-1

1. Attach control assembly according to normal operating procedures.
2. With survey meter in hand, extend control assembly to its fullest extent, unlock exposure device and crank source into C-1.
3. While applying slight forward pressure on crank arm, approach C-1 with survey meter. Carefully survey exchange tube, C-1, and exposure device. If high radiation intensity is detected, return source to exposure device and notify RSO. If radiation intensity is safe, proceed as follows:
4. Rotate plunger knob until plunger snaps into its original engaged (closed) position.
5. Extend control assembly, and very gently attempt to crank source out of C-1. Resistance will indicate that the source is properly secure. Verify by surveying.
6. While applying forward pressure on crank arm, carefully disconnect end of exchanger tube attached to C-1. **CAUTION: ONCE DISCONNECTED, DO NOT PULL EXCHANGER TUBE AWAY FROM C-1.** Remember, the source is still attached to the drive cable.
7. Gently crank FORWARD until approximately two feet of drive cable has been exposed.
8. Carefully disconnect drive cable from source according to normal operating procedures.
9. Verify that the source has been properly secured in the shielded position by surveying.

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## INSPECTION SERVICES • NDE DIVISION

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### EXCHANGING SOURCE FROM C-1 TO EXPOSURE DEVICE

**CAUTION:** The C-1 lock plunger must remain in its original, fully engaged (closed) position until instructed otherwise. (Step 14).

10. Connect control assembly to EMPTY exposure device according to normal operating procedures.
11. Connect exchanger tube to exposure device and loaded side of C-1 to establish proper distance between the two units. Disconnect exchanger tube from C-1 and crank forward until approximately two feet of drive cable is exposed.
12. Connect drive cable to source according to normal operating procedures.
13. Gradually crank drive cable backward until all slack is removed. Connect the exchanger tube to C-1 and gently pull both exchanger tube ends to insure secure connections.
14. Open lock plunger by pulling up and rotating slightly. (Refer to Step 6 above).
15. With survey meter in hand, extend the control assembly completely and crank source into exposure device.
16. Approach exposure device with survey meter in hand, survey exchanger tube, exposure device and C-1. If high radiation intensity is detected, crank source back into C-1 following steps 2 through 5 above and notify RSO.  
**NOTE:** If unable to shield source in either unit, immediately follow your Company's established Emergency Procedures.  
If survey indicates safe radiation intensity, lock exposure device, & proceed as follows:
17. Disconnect exchanger tube, insert inside of C-1, close and lock C-1, and prepare for shipping.

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### AUTOMATION INDUSTRIES SOURCE CHANGER MODEL 500-SU OPERATING INSTRUCTIONS

#### OPERATION:

After unlocking the access cover plate, proceed as follows:

1. Be certain you have an operating SURVEY METER ON HAND.
2. Locate the Source Changer within two feet of the shielded head.
3. Remove plug or source tube from your machine outlet.
4. Remove ROUND PLUG from Source Changer. Save (new) source number plate.
5. Connect the short change tube supplied, to your machine outlet, and to the Source Changer outlet. (Empty hole).
6. Connect Source Position Indicator control to your machine, lock box and extend control, so that operator is positioned full 25 feet from machine. (Now unlock your machine).
7. Run decayed sourced into Source Changer, by turning control handle clockwise until source stops in the changer.
8. At this point, the survey meter MUST be employed to insure that source has been SAFELY LOCATED IN SHIELDED POSITION.
9. Disconnect short change tube at Source Changer, and disengage disconnects, being careful not to pull out source.
10. Replace ROUND PLUG, securing decayed source in Changer.
11. Remove HEX HEAD PLUG from Source Changer, being careful not to pull out source cable inside. (This is your new source).
12. Carefully pull the source cable disconnect only enough to allow joining of disconnects.
13. Join disconnects on control cable and source cable.
14. Connect short Change tube to Source Changer outlet.

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15. Pull source into machine by turning control handle counter-clockwise. (Check Radiation Levels and Lock your Machine).
16. After a MONITOR CHECK HAS BEEN MADE WITH A SURVEY METER, remove short change tube.
17. Replace HEX HEAD PLUG on empty Source Changer hole.
18. Remove decayed source number plate from plate holder on your machine, and replace with new source number plate attached to lead seal wire. Attach old source number plate to Source Changer cap plug, by lacing seal wire provided through number plate when sealing returned source.
19. A Lead Seal Wire has been furnished with your new source. It is to be used for re-sealing SourceChanger cap plugs and attaching old source number plate.
20. Two D.O.T. style shipping labels are included in the envelope. These are to be pasted over the similar labels on the shipping box. The blank spaces should be filled in as follows:

Principal Radioactive Content-SPELL OUT:

Iridium-192

(Not IR-192)

Activity of Contents.....Number of Curies

Transportation Index.....By radiation survey  
MH/HR at 3 feet

21. Place the short Change Tube within the compartment, close the hinged cover, and secure with the padlock.
22. Return the Source Changer, with freight PREPAID to:

Automation Industries, Inc.  
Sperry Division  
Route #113, Kimberton Road  
Phoenixville, PA 19460

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## INSPECTION SERVICES • NDE DIVISION

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517-732-8069

### TECHNICAL OPERATIONS (TECH/OPS) SOURCE CHANGER, MODEL 650

#### OPERATION:

NOTE: All the precautions used when making radiographic exposures must be followed.

Wear personnel monitoring devices during all source changing operations. Monitor all operations with a calibrated, operable survey meter.

1. Upon receipt of the source changer, survey the source changer to ensure that the source is in the proper storage position.
2. Locate the source changer and projector in a restricted area. Locate the devices so as to avoid sharp bends in the guide tube or control housing.
3. Set the projector as for an exposure.
4. Remove the cover form the source changer by breaking the seal wire and removing the bolts.
5. Remove the source holddown cap by breaking the seal wire and unbolting.

**CAUTION:** When the source holddown cap is removed, the source connector is exposed. Care must be taken to ensure the source is not dislodged when handling the changer.

6. Connect one end of a guide tube extension to the projector and the other end to the fitting above the empty chamber in the source changer.
7. Close and latch the source guides.
8. At the projector controls, crank the source from the projector to the source changer.
9. Approach the projector with the survey meter. Survey the projector on all sides, survey the guide tube and survey the source changer on all sides, to ensure the source has been properly transferred. The maximum radiation level at the source changer should be less than 200 milliroentgens per hour at contact.



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10. Open the source guides. Disconnect the drive cable from the source assembly by moving the lock pin down and sliding the drive cable connector out through the keyway.
11. Disconnect the guide tube from the source changer. Connect the guide tube to the fitting above the chamber containing the new source.
12. Couple the drive cable to the source by depressing the lock pin, sliding the drive cable connector into the keyway, and releasing the lock pin. Test for proper engagement.
13. Close and latch the source guides.
14. At the projector controls, crank the source from the source changer to its storage position in the projector.
15. Approach the projector with the survey meter, Survey the projector on all sides, survey the guide tube, and survey the source changer on all sides to ensure the source has been properly transferred.
16. Lock the projector.
17. Disconnect the source guide tube from the source changer.
18. Affix the identification plate of the new source to the projector and attach the identification plate of the old source to the source holddown cap.
19. Bolt the source holddown cap in place and seal wire.
20. Bolt the source changer cover in place and seal wire.
21. Survey all exterior surfaces of the source changer to ensure that the radiation level does not exceed 200 milliroentgens per hour at contact.
22. Measure the radiation level three feet from all exterior surfaces of the source changer and ensure that the radiation level is less than 10 milliroentgens 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 milliroentgens per hour, the Transport Index is 2.2).



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23. Select the proper shipping labels (Radioactive II or Radioactive III) according to the radiation levels at the surface and at 3 feet from the container. Complete the labels listing the radioisotope contained (Iridium-192). Indicate the activity as the number of Curies. Record the Transport Index as determined above.
24. If a shipping container is packaged inside a crate or other packaging, mark the outside package "INSIDE PACKAGE COMPILES WITH PRESCRIBED SPECIFICATIONS USA/9032/B (U) TYPE B".
25. Apply the shipping labels, properly completed, to two opposite sides of the container.
26. Properly complete the shipping papers indicating:

Radioactive Material, Special Form n.o.s. NA 9182

Iridium-192 (X) \_\_\_\_\_ Curies, and

Radioactive Device n.o.s. UN 2911

Uranium-238, Solid Metal, 0.005 Curies

Radioactive (X) \_\_\_\_\_ Labels

Transport Index (X) \_\_\_\_\_

Package Identification Number USA/9032/B(U)

All (X) marks must be completed by the shipper.

And the Shippers Certification:

"This is to certify that the above named materials are properly classified, described, package, marked and labeled and are in proper condition for transport according to the applicable regulations of the Department of Transportation".

NOTES: 1. For air shipments, the following shipper's certification may be used:

"I hereby certify that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked and labeled and are in proper condition for carriage by air according to applicable national government regulations".

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2. For air shipments, the package must be labeled with a "CARGO AIRCRAFT" label and the shipping papers must state:  
"THIS SHIPMENT IS WITHIN THE LIMITATIONS  
PRESCRIBED FOR CARGO ONLY AIRCRAFT"
27. Return the container to Tech/Ops, Inc. according to proper procedures from transporting radioactive material as established in Title 49 Code of Federal Regulations, Parts 172-178.
28. See following page (s) for sample forms.

Complete the Shipping Certificates and Bill of Lading and fill in the necessary information in blocks marked (X).

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## SECTION VI

### INSTRUCTION FOR OPERATION OF RADIATION SURVEY INSTRUMENTS

# MID AMERICAN

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GAYLORD, MICHIGAN 49735

617-732-8056

A. No radiography will be performed without a calibrated and operable survey meter capable of detecting 2 MR/HR through 1 R/HR of "X" or GAMMA RADIATION.

1. The following radiation survey instruments will be used for surveying radiographic operations:

Victoreen 492

Victoreen 592B

Victoreen 400

Canadian Admiral RD5016C

Gamma Industries 250

Gamma Industries 200

N.D.S. Model ND-2000

The Radiation Safety Officer may introduce other meters into the program, providing the operating characteristics meet or exceed regulatory requirements. Training in the use of any additional survey meter will be provided prior to distribution.

B. Meters shall be calibrated at intervals not to exceed (90) days, or after any service work is performed.

C. Survey meters are delicate instruments, proper calibration can be affected by excessive moisture, heat or physical abuse. It is your job to see that meters are properly used and stored to assure reliability.

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### TYPICAL OPERATING INSTRUCTIONS FOR RADIATION SURVEY INSTRUMENTS

1. Check survey meter to assure proper calibration.
2. Check meter for physical damage that may affect proper operation.
3. Turn control knob to battery check position. The meter should indicate within the battery OK area. (If battery check does not check within OK area, batteries must be replaced).
4. Turn control knob to position desired according to radiation intensity field being surveyed.

#### Typical knob settings:

- a. X1, X10, X100 (meter reading must be multiplied by the number at which the knob is positioned).
  - b. High-upper scale .1 R/HR to 10 R/HR  
Low-lower scale 0 MR/HR to 100 MR/HR
5. After all required surveys are completed, be sure meter is put away and position knob is in the OFF position to maintain good batteries.

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## SECTION VII

### NUCLEAR REGULATORY COMMISSION

Title 10, Chapter 1, CFR

Part 19  
Part 20  
Part 34



# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

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GAYLORD, MICHIGAN 49735

517-732-8059

### NOTICE TO ALL EMPLOYEES

In accordance with 19.11, the documents listed below are available to any person who is working at a) MAIS, INC and b) within the conditions of MAIS, INC. held NRC License. They may be examined during normal working hours at:

MID AMERICAN INSPECTION SERVICES, INC.

650 ALPINE ROAD

GAYLORD, MICHIGAN 49735

- I. 10 CFR 10 Notices, Instructions and Reports to Workers Inspections
- II. 10 CFR 20 Standards for Protection Against Radiation
- III. 10 CFR 34 License for Radiography and Radiation Safety Requirements for Radiographic Operations
- IV. MAIS INC., Procedures Manual-Radiographic Personnel Operations and Emergency Procedures Manual
- V. Any notice of Violation of Regulations and associated response form licensee

## MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 40 and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

## Licensee

1. Pipeline Inspection & Engineering  
N.D.E. Division2. P. O. Box 1013  
Gaylord, MI 49735

3. License number 21-26060-01

4. Expiration date August 31, 1994

5. Docket or  
Reference No. 030-311606. Byproduct, source, and/or  
special nuclear material7. Chemical and/or physical  
form8. Maximum amount that licensee  
may possess at any one time  
under this license

A. See Item 9.

A. Sealed Sources

A. See Item 9.

9. Sealed Sources, Exposure Devices and Source Changers authorized for industrial radiography are as follows:

<u>Isotope</u>	<u>Maximum Activity Per Sealed Source</u>	<u>Manufacturer's Name &amp; Model No. of Sealed Source</u>	<u>Manufacturer's Name &amp; Model No. of Exposure Device</u>	<u>Manufacturer's Name &amp; Model No. of Source Changer</u>
Iridium-192	100 curies	Tech/Ops 866, Gamma Ind. B-8-A, Gulf Nuc. RAG-17, or SPEC G-1	Tech/Ops 520	AMSHM 650, Gamma Ind. C-10, or SPEC C-1
Iridium-192	100 curies	Tech/Ops 848, Gamma Ind. A-2-A, Gulf Nuc. RG-13 or SPEC G-1	SPEC 2-T	Gamma Ind. C-10, SPEC C-1, or AMSHM 650
Iridium-192	100 curies	Tech/Ops 848, Gamma Ind. A-2-A, Gulf Nuc. RG-13 or SPEC G-1	Gamma Ind. Century S	SPEC C-1, AMSHM 650, or Gamma Ind. C-10
Iridium-192	100 curies	Tech/Ops 848, Gamma Ind. A-2-A, Gulf Nuc. RGSA-13, or SPEC G-3	Gamma Ind.	AMSHM 500 Su, AMSHM 650, Gamma Ind. C-10, or SPEC C-1

MATERIALS LICENSE  
SUPPLEMENTARY SHEET

PAGE 2 OF 3 PAGES

License number

21-26060-01

Docket or Reference number

030-31160

## 9. (Continued)

<u>Isotope</u>	<u>Maximum Activity Per Sealed Source</u>	<u>Manufacturer's Name &amp; Model No. of Sealed Source</u>	<u>Manufacturer's Name &amp; Model No. of Exposure Device</u>	<u>Manufacturer's Name &amp; Model No. of Source Changer</u>
Iridium-192	100 curies	Tech/Ops 848, Gamma Ind. A-2-A, Gulf Nuc. RG-13, or SPEC G-1	Gulf Nuc. 20V	SPEC C-1, AMSHM 500 SU, AMSHM 650, or Gamma Ind. C-10

CONDITIONS

10. Licensed material may be stored at 650 Alpine Road, Gaylord, Michigan and may be used at temporary job sites of the licensee anywhere in the United States where the U.S. Nuclear Regulatory Commission maintains jurisdiction for regulating the use of licensed material.
11. The individuals listed below are the only persons authorized by this license to act as radiographers or radiographers' assistants as defined in Section 34.2 of 10 CFR Part 34:

RADIOGRAPHERS

Terry L. Wilkins  
Robert E. Story  
Gregory A. Key  
Richard A. Barnes

RADIOGRAPHERS' ASSISTANTS

None

12. Radiation Safety Officer: Terry L. Wilkins
13. A. Notwithstanding the periodic leak test required by Section 34.25(b) of 10 CFR Part 34, such requirement does not apply to radiography sources that are stored and not being used. The sources excepted from this test shall be tested for leakage before use or transfer to another person.
- B. Sealed sources authorized for a use other than radiography shall be tested as radiography sources in accordance with Section 34.25 of 10 CFR Part 34.
14. The licensee is authorized to receive, possess, and use sealed sources of iridium-192 or cobalt-60 where the radioactivity exceeds the maximum amount of radioactivity specified in this license provided.
- A. Such possession does not exceed the quantity per source specified in Item 8 by more than 20% for iridium-192 or 10% for cobalt-60;

MATERIALS LICENSE  
SUPPLEMENTARY SHEET

PAGE 3 OF 3 PAGES  
License number 21-26060-01  
Docket or Reference number 030-31160

## 14. (Continued)

- B. Records of the licensee show that no more than the maximum amount of radioactivity per source specified in this license was ordered from the supplier or transferor of the byproduct material; and
- C. The levels of radiation for radiographic exposure devices and storage containers do not exceed those specified in Section 34.21 of 10 CFR Part 34.
15. Pursuant to 10 CFR Part 40, "Domestic Licensing of Source Material," the licensee is authorized to possess, use, transfer, and import up to 999 kilograms of uranium contained as shielding material in the radiography exposure devices and source changers authorized by this license.
16. Sealed sources containing licensed material shall not be opened.
17. The licensee may transport licensed material in accordance with the provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material".
18. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents including any enclosures, listed below. The Nuclear Regulatory Commission's regulations shall govern unless the statements, representations and procedures in the licensee's application and correspondence are more restrictive than the regulations.
- A. Application dated May 9, 1989 (with attached manual).

For the U.S. Nuclear Regulatory Commission

Date:

6/15/89

By

Materials Licensing Section, Region III

**MATERIALS LICENSE  
SUPPLEMENTARY SHEET**

License number	21-26060-01
Docket or Reference number	030-31160
Amendment No.	04

Mid American Inspection Services, Inc.  
650 Alpine Road  
Gaylord, MI 49735

In accordance with letter dated October 19, 1990, License Number 21-26060-01 is amended as follows:

Condition 11. is amended to read:

11. The individuals listed below are the only persons authorized by this license to act as radiographers or radiographer's assistants as defined in Section 34.2 of 10 CFR Part 34:

RADIOGRAPHERS

Terry L. Wilkins  
Robert E. Story  
Gregory A. Key  
Richard A. Barnes  
Roger D. Blakeney  
Michael J. Cotten  
Tommy J. Curtis  
Vincent Keating  
Harold J. Lay  
Johnny L. Moore  
Wesley W. Shaklee  
Merle K. Turney, Jr.  
Daniel Woodcock  
Steven K. Underwood  
Andrew Womack

RADIOGRAPHERS' ASSISTANTS

James Keating  
William Shaw-Dah  
Lorie A. Schaklee

For the U.S. Nuclear Regulatory Commission

Date: 12/3/90

By K. G. N. 11  
Materials Licensing Section, Region III



MATERIALS LICENSE  
SUPPLEMENTARY SHEET

License number

21-26060-01

Docket or Reference number

030-31160

Amendment No. 06

Mid American Inspection  
Services, Inc.  
650 Alpine Road  
Gaylord, MI 49735

In accordance with letter dated February 4, 1992, License No. 21-26060-01 is amended as follows:

Item 9. is amended to read:

9. Sealed Sources, Exposure Devices and Source Changers authorized for industrial radiography are as follows:

<u>Isotope</u>	<u>Maximum Activity Per Sealed Source</u>	<u>Manufacturer's Name and Model No. of Sealed Source</u>	<u>Manufacturer's Name and Model No. of Exposure Device</u>	<u>Manufacturer's Name and Model No. of Source Changer</u>
Iridium-192	100 curies	Tech/Ops 866 Tech/Ops 899 Spec B-16 Spec B-16F Industrial Nuclear-5	Tech/Ops 520	AI-500SU Gulf Nuclear U-110 Amersham 650 Gamma Industries C-10 Spec C-1
Iridium-192	100 curies	Spec G-3F Spec G-1F Tech/Ops 848	Spec 2-T	AI-500SU Gulf Nuclear U-110 Gamma Industries C-10 Spec C-1 Amersham 650
Iridium-192	100 curies	Spec G-3F Spec G-1F Tech/Ops 848 Tech/Ops 899	Gamma Industries Century S	AI-500SU Gamma Industries C-10 Spec C-1 Amersham 650
Iridium-192	100 curies	Tech/Ops 848 Spec G-3F	Gamma Industries Century SA	AI-500SU Gulf Nuclear U-110 Gamma Industries C-10 Spec C-1 Amersham 650
Iridium-192	100 curies	Spec G-3F Spec G-1F	Gulf Nuclear 40V	AI-500SU Gulf Nuclear U-110 Gamma Industries C-10



**MATERIALS LICENSE  
SUPPLEMENTARY SHEET**

License number

21-26060-01

Docket or Reference number

030-31160

Amendment No. 06

<u>Isotope</u>	<u>Maximum Activity Per Sealed Source</u>	<u>Manufacturer's Name and Model No. of Sealed Source</u>	<u>Manufacturer's Name and Model No. of Exposure Device</u>	<u>Manufacturer's Name and Model No. of Source Changer</u>
Iridium-192	100 curies	Tech/Ops 848 Spec G-3F Spec G-1F	Gulf Nuclear 20V	AI-500SU Gulf Nuclear U-110 Gamma Industries C-10 Spec C-1 Amersham 650

For the U.S. Nuclear Regulatory Commission

FEB 25 1992

By

By

*Robert E. Lathrop Jr.*

Materials Licensing Section, Region III

# MID AMERICAN

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650 ALPINE ROAD

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517-732-8059

## APPENDIX A

### REQUIRED DAILY REPORTS

- A. Material Transportation
- B. Radiation Survey Reports





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## APPENDIX B

- A. Lost or Overexposed Film Badge Reports
- B. Radiation Incident Report



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### FILM BADGE OVEREXPOSURE OR LOSS

If you have reason to believe that your film badge has been overexposed or lost, complete this form immediately.

Name \_\_\_\_\_

Social Security Number \_\_\_\_\_

### POSSIBLE OVEREXPOSURE

1. When did the possible overexposure occur? Time: \_\_\_\_\_ Date: \_\_\_\_\_
2. Location: \_\_\_\_\_ Customer: \_\_\_\_\_ Address: \_\_\_\_\_
3. When did you notify your R.S.O.? Time: \_\_\_\_\_ Date: \_\_\_\_\_
4. Did you stop work immediately? \_\_\_\_\_ Yes \_\_\_\_\_ No Is your badge on its way to the R.S.O. \_\_\_\_\_ Yes \_\_\_\_\_ No
5. Did your dosimeter go off scale? \_\_\_\_\_ Yes \_\_\_\_\_ No If no, what did it read? \_\_\_\_\_
6. Was there anyone else involved? \_\_\_\_\_ Yes \_\_\_\_\_ No If Yes, who? \_\_\_\_\_
7. Approximately how far were you from the source? \_\_\_\_\_ For how long? \_\_\_\_\_
8. Do you believe you have overexposed? \_\_\_\_\_ Yes \_\_\_\_\_ No

Give specific details of exactly everything that happened: \_\_\_\_\_

(over)

### LOST FILM BADGE

1. Did you lose your film badge? \_\_\_\_\_ Yes \_\_\_\_\_ No Was it stolen? \_\_\_\_\_ Yes \_\_\_\_\_ No
2. Was your film badge destroyed? \_\_\_\_\_ Yes \_\_\_\_\_ No If yes, how? \_\_\_\_\_
3. Were you working at the time you discovered it missing? \_\_\_\_\_ Yes \_\_\_\_\_ No
4. When did you notice your badge missing? Time: \_\_\_\_\_ Date: \_\_\_\_\_
5. Did you continue working or report to work without a film badge? \_\_\_\_\_ Yes \_\_\_\_\_ No
6. If your answer is yes to Question #5-EXPLAIN WHY!!! (Use Reverse Side)
7. When did you notify the R.S.O.? Time: \_\_\_\_\_ Date: \_\_\_\_\_

I \_\_\_\_\_ certify that the above information is correct.

Signature \_\_\_\_\_

Date: \_\_\_\_\_



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### RADIATION INCIDENT REPORT

NAME: \_\_\_\_\_ SOCIAL SECURITY #: \_\_\_\_\_

DATE: \_\_\_\_\_ TIME: \_\_\_\_\_

☐ POSSIBLE OVEREXPOSURE:

1. When did the incident occur? Time: \_\_\_\_\_ Date: \_\_\_\_\_

2. LOCATION: Customer Name: \_\_\_\_\_

Address: \_\_\_\_\_

3. When did you notify the RSO? Time: \_\_\_\_\_ Date: \_\_\_\_\_

4. Did you stop work immediately? \_\_\_\_\_ Yes \_\_\_\_\_ No

5. Is the film badge submitted for processing? \_\_\_\_\_ Yes \_\_\_\_\_ No

6. Did your dosimeter pencil(s) go off-scale? \_\_\_\_\_ Yes \_\_\_\_\_ No

7. Was anyone else involved in the exposure? \_\_\_\_\_ Yes \_\_\_\_\_ No

Name(s): \_\_\_\_\_

Telephone Number(s): \_\_\_\_\_

8. On the reverse side, give a complete written account of all events of the incident. Be specific and provide details of the cause and/or sketches of the actual worksite.

9. Could this incident have been prevented? \_\_\_\_\_ Yes \_\_\_\_\_ No

How? \_\_\_\_\_

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### 10. Equipment Data:

Exposure Device:

(No. and Model)

(Serial #)

Isotope: ☐ IR-192

(Serial #)

Curies

☐ Co-60

☐ Cs-137

I certify the statements and information provided in this report are correct and further understand the penalties for falsification of record.

Signature

Date

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### APPENDIX C

#### WARNING AND POSTING SIGNS

- A. Inside Packages Comply With Prescribed Specifications
- B. D.O.T. White I
- C. D.O.T. Yellow II
- D. D.O.T. Yellow III
- E. RAM Signs (Storage Areas, Containers, Exposure Devices)
- F. RAM Signs (Storage Areas)
- G. Radiation Area (2 MR/HR)
- H. High Radiation Area (100 MR/HR)
- I. D.O.T. Peligro
- J. Caution X-Rays (Displayed on X-Ray Machines)

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**INSIDE PACKAGES  
COMPLY WITH  
PRESCRIBED  
SPECIFICATIONS**

© LABELMASTER CHICAGO, IL 60646

STYLE B-10-P

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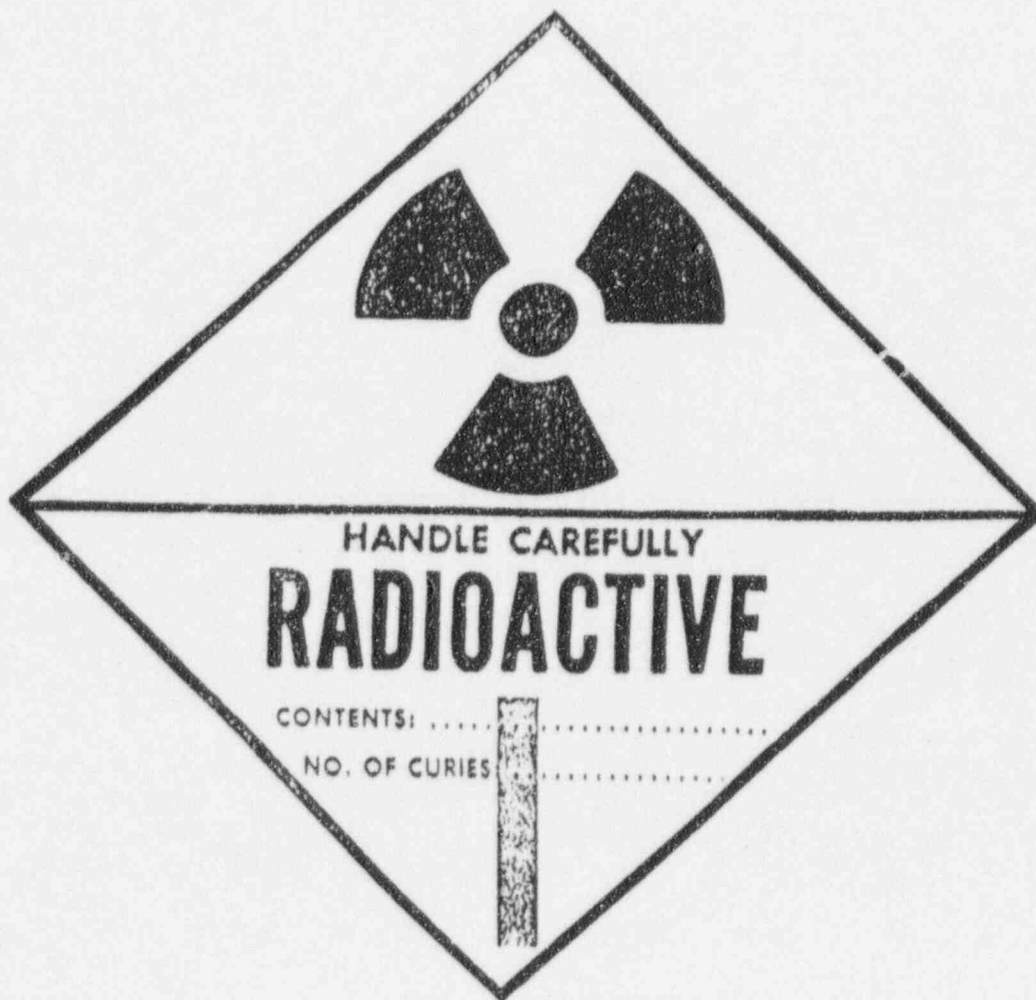
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517-732-8059

REFERENCE DOCUMENT: 49 CFR 172.436



Radiation Survey Limits:

Maximum Surface Reading: 0.5 mR/hr

Maximum Reading at 3 Ft.: 0 mR/hr

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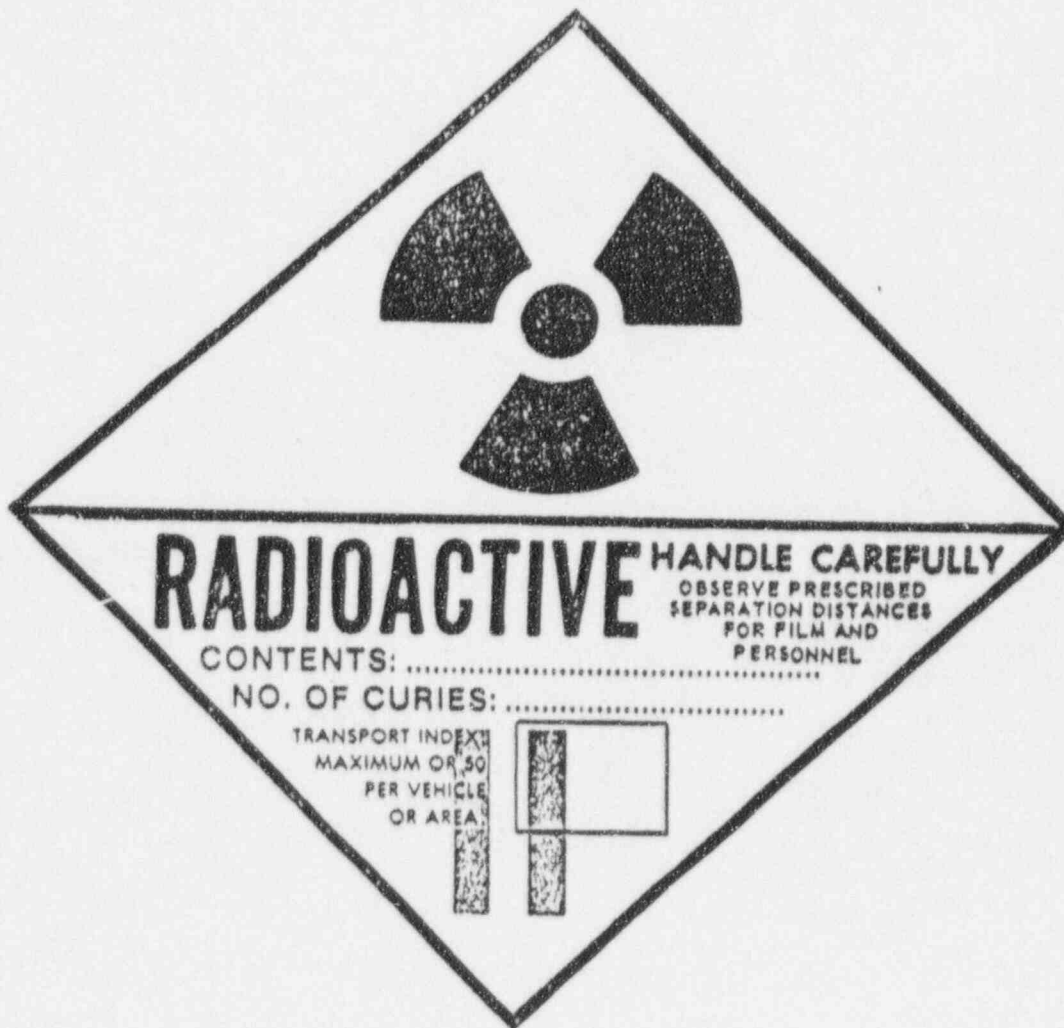
650 ALPINE ROAD

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DOT - YELLOW II

REFERENCE DOCUMENT: 49 CFR 172.438



Radiation Survey Limits:

Maximum Surface Reading: 50 mR/hr

Maximum Reading at 3 Ft.: 1.0 mR/hr



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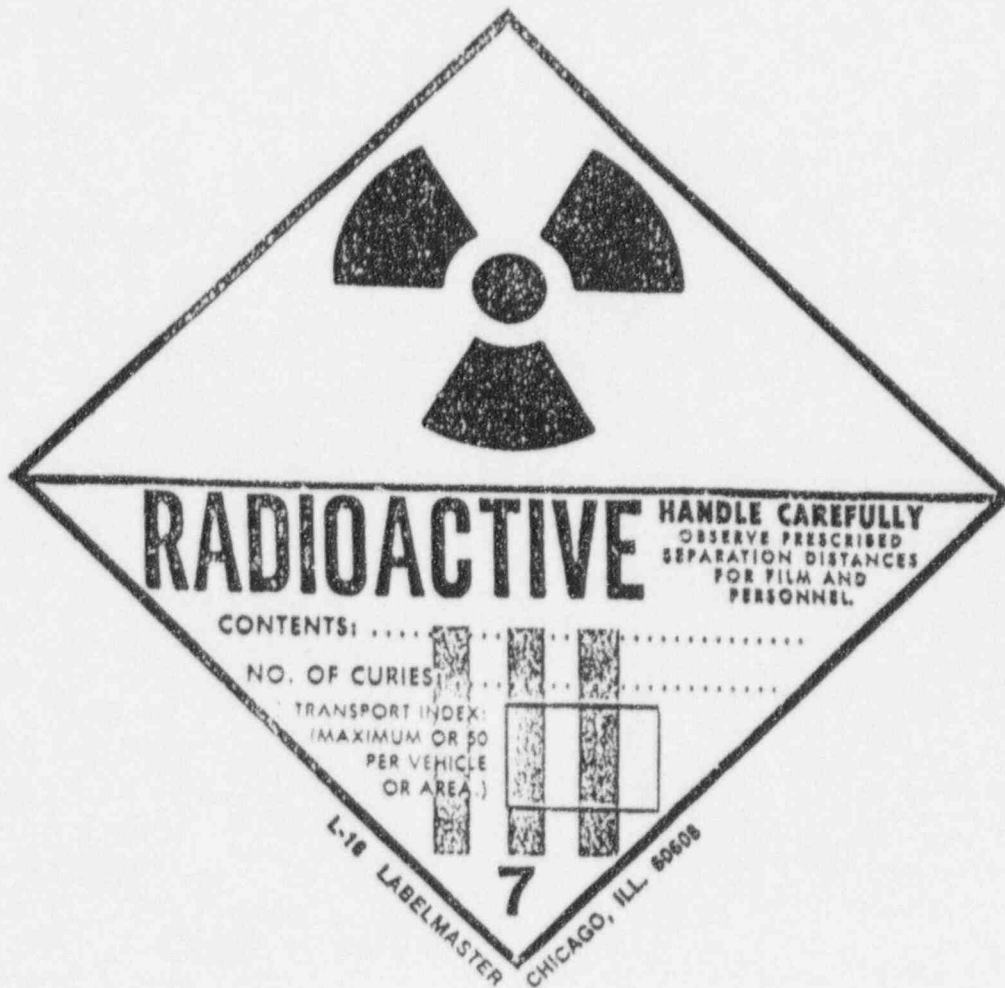
650 ALPINE ROAD

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517-732-8059

DOT - YELLOW III

REFERENCE DOCUMENT: 49 CFR 172.440



## Radiation Survey Limits:

Maximum Surface Reading: 200 mR/hr

Maximum Reading at 3 Ft.: 10 mR/hr

\* NOTE: Packages bearing Yellow III Labels require the transport vehicle to be PLACARDED on all four sides.

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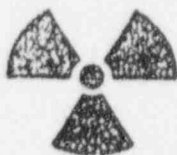
INSPECTION SERVICES • NDE DIVISION

850 ALPINE ROAD

GAYLORD, MICHIGAN 49735

517-732-8059

SAMPLE RAM SIGNS USED TO DENOTE STORAGE AREAS, CONTAINERS AND  
EXPOSURE DEVICES CONTAINING RADIOACTIVE MATERIAL



CAUTION  
RADIOACTIVE  
MATERIAL

ISOTOPE  
AMOUNT  
DATE

CAUTION



RADIOACTIVE MATERIAL

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650 ALPINE ROAD

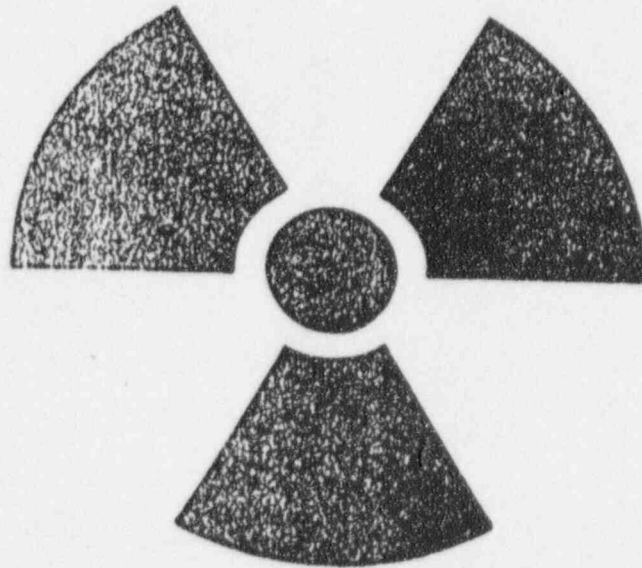
GAYLORD, MICHIGAN 49735

517-732-6059

INSPECTION SERVICES • NDE DIVISION

SAMPLE RAM SIGNS USED TO DENOTE STORAGE AREAS, CONTAINERS,  
AND EXPOSURE DEVICES CONTAINING RADIOACTIVE MATERIAL

# CAUTION



# RADIOACTIVE MATERIALS

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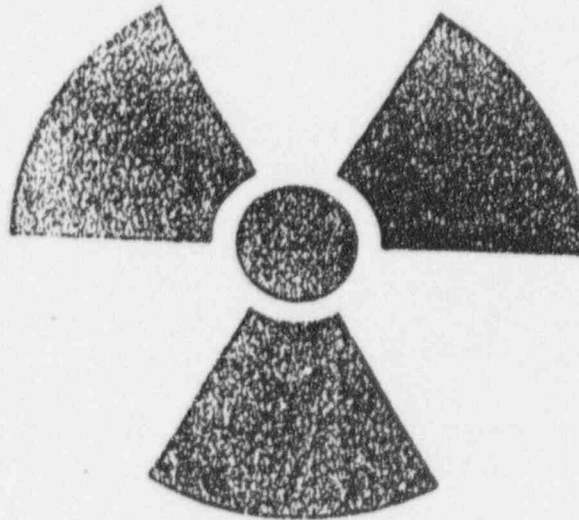
880 ALPINE ROAD

GAYLORD, MICHIGAN 49735

517-732-8069

SAMPLE SIGNS USED TO DENOTE BOUNDARIES  
OF RESTRICTED AREAS - 2 mR/hr

## CAUTION



## RADIATION AREA

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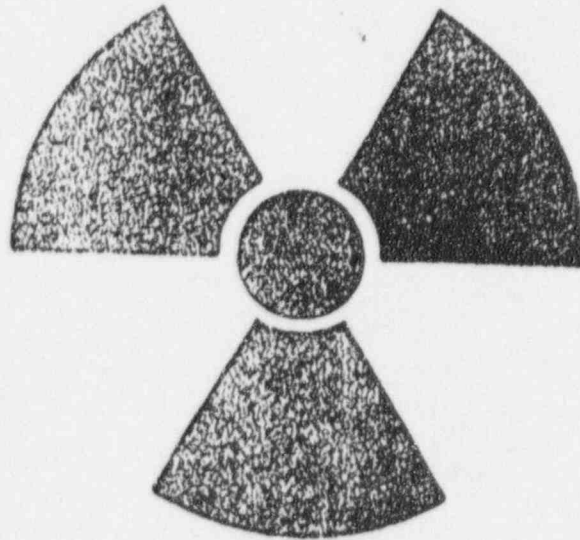
660 ALPINE ROAD

GAYLORD, MICHIGAN 49735

517-732-8059

SAMPLE SIGN USED TO DENOTE BOUNDARIES OF  
HIGH RADIATION AREAS - 100 mR/hr.

## CAUTION



## HIGH RADIATION AREA

\* NOTE: DO NOT perform surveys of this boundary. Estimates based on calculations are to be used.



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517-732-8058

DOT - PELIGRO

REFERENCE DOCUMENT: 49 CFR 172.448



LABEL MASTER, CHICAGO, ILL. 60660 L-20 CARGO AIRCRAFT ONLY LABEL

To be affixed by RSO when offering packages containing Radioactive Material  
for shipment by a COMMERCIAL AIR CARRIER.



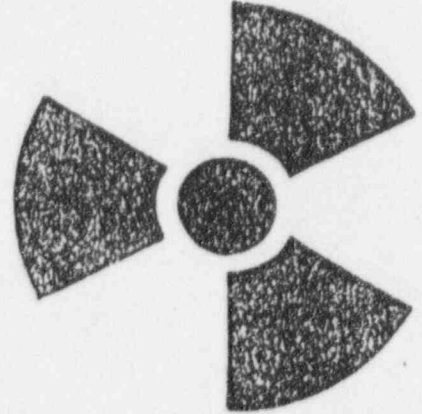
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517-732-8059



**CAUTION**  
**X-RAYS**  
This Equipment Produces  
X-rays When Energized



**CAUTION**  
**RADIATION**  
THE EQUIPMENT PRODUCES  
X-RAYS WHEN ENERGIZED

SAMPLE SIGNS THAT MUST BE DISPLAYED ON X-RAY MACHINES.  
NOT REQUIRED FOR TRANSPORTATION PURPOSES.

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## APPENDIX D

### CASE HISTORIES OF RADIOGRAPHY INCIDENTS

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## CASE HISTORIES RADIOGRAPHY INCIDENTS

A number of accidents have occurred in industrial radiography over the course of time. These accidents were the result of a number of different causes, but the common denominator was usually the failure to follow established safety procedures, especially the failure to make an adequate radiation survey.

With the hope that individuals will learn from the mistakes of others, the US Nuclear Regulatory Commission requires that radiographers receive instructions in the case histories of radiography accidents. This section of the handbook describes summaries of selected radiography accidents. These cases have been selected because they highlight errors which unfortunately are not uncommon. We hope that by understanding the causes of these accidents, and the results, you may be less likely to make the same errors.

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## EXPECTED EFFECTS OF ACUTE WHOLE-BODY RADIATION DOSES\*

<i>Acute dose (rem)</i>	<i>Probable effect</i>
0 to 50	No obvious effect, except possibly minor blood changes.
80 to 120	Vomiting and nausea for about 1 day in 5 to 10 percent of exposed personnel. Fatigue but no serious disability.
130 to 170	Vomiting and nausea for about 1 day, followed by other symptoms of radiation sickness in about 25 percent of personnel. No deaths anticipated.
180 to 220	Vomiting and nausea for about 1 day, followed by other symptoms of radiation sickness in about 50 percent of personnel. No deaths anticipated.
270 to 330	Vomiting and nausea in nearly all personnel on first day, followed by other symptoms of radiation sickness. About 20 percent deaths within 2 to 6 weeks after exposure; survivors convalescent for about 3 months.
400 to 500	Vomiting and nausea in all personnel on first day, followed by other symptoms of radiation sickness. About 50 percent deaths within 1 month; survivors convalescent for about 6 months.
550 to 750	Vomiting and nausea in all personnel within 4 hours from exposure, followed by other symptoms of radiation sickness. Up to 100 percent deaths; few survivors convalescent for about 6 months.
1000	Vomiting and nausea in all personnel within 1 to 2 hours. Probably no survivors from radiation sickness.
5000	Incapacitation almost immediately. All personnel will be fatalities within 1 week.

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### SUMMARY OF CLINICAL SYMPTOMS OF RADIATION SICKNESS\*

<i>Time after exposure</i>	<i>Survival improbable (700 rem or more)</i>	<i>Survival possible (550 rem to 300 rem)</i>	<i>Survival probable (250 rem to 100 rem)</i>
	Nausea, vomiting and diarrhea in first few hours.	Nausea, vomiting and diarrhea in first few hours.	Possibly nausea, vomiting and diarrhea on first day.
1st week	No definite symptoms in some cases (latent period). Diarrhea Hemorrhage Purpura Inflammation of mouth and throat. Fever	No definite symptoms (latent period).	No definite symptoms (latent period).
2nd week	Rapid emaciation Death (mortality probably 100 percent).	Epilation Loss of appetite and general malaise. Fever	
3rd week		Hemorrhage Purpura Petechiae Nosebleeds Pallor Inflammation of mouth and throat Diarrhea Emaciation Moderate emaciation.	Epilation Loss of appetite and malaise Sore throat Hemorrhage Purpura Petechiae Pallor Diarrhea
4th week		Death in most serious cases. (Mortality 50 percent for 450 rem).	Recovery likely in about 3 months unless complicated by poor previous health or superimposed injuries or infections.

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### SAFETY

#### Case A

A radiographer retracted a 27 curie cobalt<sup>60</sup> source until he felt it hit hard and stop. He assumed that the source had returned to the fully shielded position within the exposure device and did not make a physical radiation survey. He then proceeded to disconnect the source guide tube from the exposure device. Upon removal of the source guide tube, the radiographer recognized that the source extended approximately two inches out of the exposure device. He attempted to push the source back into the device with his hand, but was unsuccessful. He then retreated to the control crank and was able to retract the source.

The radiographer's film badge indicated a dose equivalent of 760 millirem. However, the film badge was partially shielded during the incident. A reenactment of the incident indicated that the dose equivalent to the radiographer's hand was 574 rem.

The principal cause of the incident was the failure to make a radiation survey after retracting the source. The radiographer also showed a lack of judgement by attempting to force the source into a shielded position with his hand, which further increased his dose.

#### Case B

Two radiographers were performing pipeline radiography with a 70 curie Iridium<sup>192</sup> source. The source assembly became detached from the driving cable and remained exposed in the guide tube for two hours. During this period, the radiographers continued to radiograph pipeline welds.

The incident was discovered when the film was processed and found to be overexposed. The radiographers' pocket dosimeters were checked and found to be off-scale. No radiation surveys were made because the survey meter at the site was inoperative.

Film badges indicated whole body dose equivalents for the two radiographers to be 21rem and 15rem respectively. The senior radiographer had slight swelling of the right hand after seven days with some discomfort in the fingers. Blistering of the palm occurred in two weeks. Treatment of the hand continued for six months during which time the injury showed continued regression. At eighteen months, the right fourth finger was slightly atrophied with a decreased ability to flex.

The principal cause of the incident was the performance of radiography without the availability of an operable radiation survey meter.

CONTROL NO. 897275



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### IS

#### Case C

During a radiographic operation, a 48 curie cobalt<sup>60</sup> source assembly became stuck in the source guide tube. While the radiographer attempted to retract the source, it became disconnected from the driving cable. The radiographer, with the help of his supervisor, removed the source from the guide tube, and manually returned the source to a shielded position.

A reenactment of the incident indicated that the supervisor received a whole body dose equivalent of 3 rem and 1500 rem to one hand. The radiographer suffered severe radiation burns to the exposed hand.

The principal cause of the incident was the failure to follow appropriate emergency procedures when the abnormal occurrence was recognized.

#### Case D

After completion of a radiographic operation using a 90 curie Iridium<sup>192</sup> source, the radiographer surveyed the exposure device and source guide tube and assured that the source was in the proper shielded position. However, he did not lock the exposure device after the survey. He picked up the exposure device, with the controls and source guide tubes attached, and moved the device to another location. In the course of moving the device, the crank of the control unit caught on an obstruction and caused the source to be moved to an unshielded position.

The film badge, which was worn in the shirt pocket approximately three feet from the source, indicated 8.8 rem. The estimated dose equivalent to the thigh, which was closer to the source, was 70 rem.

The principal cause of the incident was the failure to lock the exposure device at the completion of the operation. The radiographer could have minimized his dose by observing his survey meter while moving the exposure device.

#### Case E

A radiographer was performing radiography with an 80 curie Iridium<sup>192</sup> source. At the conclusion of the exposure, he retracted the source into the exposure device. He approached the exposure device with the survey meter and noted normal radiation levels. He did not survey the exit port area of the device.

He then disconnected the source guide tube from the exposure device and attempted to install the storage plug. When the storage plug could not be properly installed, he recognized that the source was not fully retracted into the device.

A reenactment of the incident indicated that the radiographer received a whole body dose equivalent of 3 rem, 45 rem to the left hand and 600 rem to the right hand.

The principal cause of the incident was the failure to make a complete radiation survey of all sides of the exposure device at the completion of the operation.

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# NO

### Case F

While performing radiography with a 78 curie Iridium<sup>192</sup> source, the radiographer recognized that the source did not retract to the shielded position in the exposure device. Further investigation revealed that the source assembly had become disconnected from the driving cable. The radiographer disconnected the source guide tube, extracted the source assembly, reattached it to the driving cable, and retracted the source.

By the eleventh day following the incident, redness, swelling and tenderness of the palm and finger tips had developed. About the sixteenth day, blisters appeared. In approximately one month, the involved areas healed, but the skin remained thin, atrophic and sensitive. The symptoms still persisted one year after the event.

A reenactment indicated that the radiographer received a whole body dose equivalent of approximately 50rem and 1500rem to the hand.

The principal cause of the incident was the failure to follow the appropriate safety procedures once an emergency situation had been recognized.

### Case G

A radiographer was returning a 32 curie Iridium<sup>192</sup> source after a source exchange. In the course of preparing the source changer for shipment, the radiographer moved the source from a shielded position in the source changer to an exposing position. He did not make a radiation survey prior to shipping the package. The exposed source was discovered upon receipt at the source manufacturer's facility after the source had been transported on two airplanes and through three airports.

The maximum estimated dose equivalents to airport handlers were: Airport A — 10.4rem; Airport B — 26.0rem; Airport C — 134.4rem. Estimated maximum dose equivalents to passengers could have been 10.0rem on the first plane and 6.8rem on the second plane.

The principal cause of the incident was the failure to properly package the source for shipment and the failure to make a radiation survey prior to shipping the package.

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GAYLORD, MICHIGAN 49735

517-732-8059

## ACCIDENT

### (ALARA)

#### Case H

A radiographer was using a 14 curie Iridium<sup>192</sup> source to perform radiography on a construction platform approximately one half mile offshore. The radiographer failed to connect the source guide tube to the exposure device. Upon exposure, the source went over the side of the platform. Due to the weight of the driving cable and the ocean currents, the entire drive cable with the source assembly attached sank to the bottom in forty feet of water.

In an attempt to retrieve the source, a specially designed radiation detector for use at that depth was built. Using this detector and with special communication equipment, police divers attempted to locate the source assembly and drive cable. However, due to poor visibility, this was not successful.

The next approach was to lower a grab attached to a crane and attempt to grapple the drive cable. This worked on the first try. The source was brought to the platform and placed into a shielded position. The maximum dose equivalent received by any individual was 20mrem.

Although this incident did not involve any radiation overexposures, the source retrieval required five days of intensive work by a large number of people at considerable cost.

These case histories highlight the consequences of failing to make adequate surveys and failure to observe proper safety procedures especially when an emergency is recognized. We hope that these summaries have been instructive. We recommend that they be reviewed periodically as a reminder of the importance of observing the proper safety procedures.

CONTROL NO. 897275

SEP 24 1996

Terry L. Wilkins  
Radiation Safety Officer  
Mid American Inspection  
Services, Inc.  
1206 Effie Road  
Gaylor, MI 49735

Dear Mr. Wilkins:

Enclosed is Amendment No. 10 renewing your NRC Material License No. 21-26060-01 in accordance with your request.

Please review the enclosed document carefully and be sure that you understand all conditions. If there are any errors or questions, please notify the U.S. Nuclear Regulatory Commission, Region III office at (630) 829-9887 so that we can provide appropriate corrections and answers.

As discussed during our telephone conference on August 21, 1996, it is our understanding that certain radiographic equipment listed on your license which does not meet the performance requirements in Section 34.20 is in storage pending disposal or transfer to an authorized recipient. If you wish to remove these items from your NRC license, you may submit the documentation which describes the transfer/disposal as additional information to Control No. 397275 and we will amend your license accordingly.

Please be advised that your license expires at the end of the day, in the month, and year stated in the license. Unless your license has been terminated, you must conduct your program involving byproduct materials in accordance with the conditions of your NRC license, representations made in your license application, and NRC regulations. In particular, note that you must:

1. Operate in accordance with NRC regulations 10 CFR Part 19, "Notices, Instructions and Reports to Workers; Inspections," 10 CFR Part 20, "Standards for Protection Against Radiation," and other applicable regulations.
2. Notify NRC, in writing, within 30 days:
  - a. When the Radiation Safety Officer permanently discontinues performance of duties under the license or has a name change; or
  - b. When the licensee's mailing address changes (no fee is required if the location of byproduct material remains the same).

397275

3. In accordance with 10 CFR 30.36(b) and/or license condition, notify NRC, promptly, in writing, and request termination of the license when you decide to terminate all activities involving materials authorized under the license.
4. Request and obtain a license amendment before you:
  - a. Change Radiation Safety Officers;
  - b. Order byproduct material in excess of the amount, or radionuclide, or form different than authorized on the license;
  - c. Add or change the areas of use or address or addresses of use identified in the license application or on the license; or
  - d. Change ownership of your organization.
5. Submit a complete renewal application with proper fee or termination request at least 30 days before the expiration date of your license. You will receive a reminder notice approximately 90 days before the expiration date. Possession of byproduct material after your license expires is a violation of NRC regulations. A license will not normally be renewed, except on a case-by-case basis, in instances where licensed material has never been possessed or used.

In addition, please note that NRC Form 313 requires the applicant, by his/her signature, to verify that the applicant understands that all statements contained in the application are true and correct to the best of the applicant's knowledge. The signatory for the application should be the licensee or certifying official rather than a consultant.

You will be periodically inspected by NRC. Failure to conduct your program in accordance with NRC regulations, license conditions, and representations made in your license application and supplemental correspondence with NRC will result in enforcement action against you. This could include issuance of a notice of violation, or imposition of a civil penalty, or an order suspending, modifying or revoking your license as specified in the General Policy and Procedures for NRC Enforcement Actions. Since serious consequences to employees and the public can result from failure to comply with NRC requirements,

T. Wilkins

-3-

prompt and vigorous enforcement action will be taken when dealing with licensees who do not achieve the necessary meticulous attention to detail and the high standard of compliance which NRC expects of its licensees.

Sincerely,

Original Signed By  
Debbie A. Piskura  
Nuclear Materials Licensing Branch

License No. 21-26060-01  
Docket No. 030-31160

Enclosure: Amendment No. 10

DOCUMENT NAME: M:\03031160.CL6

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OFFICE	DNMS/RIII								
NAME	DAPiskura:brt								
DATE	09/20/96								

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JUL 25 1994

Mid American Inspection Services, Inc.  
ATTN: Terry L. Wilkins  
Radiation Safety Officer  
650 Alpine Road  
Gaylord, MI 49735

License No. 21-26060-01  
Control No. 397275

Dear Mr. Wilkins:

SUBJECT: LICENSE RENEWAL APPLICATION

This is to acknowledge receipt of your application for renewal of the material(s) license identified above. Your application is deemed timely filed, and accordingly, the license will not expire until final action has been taken by this office.

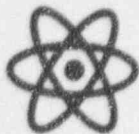
Any correspondence regarding the renewal application should reference the control number specified and your license number.

Sincerely,

Original Signed By  
Marianne Meenan, Chief  
Nuclear Materials Support Section

RIII

Meenan/bt  
07/ /94



# MID AMERICAN INSPECTION SERVICES, INC.

NDE Division  
1206 Effie Road, PO Box 1427  
Gaylord, Michigan 49735  
(517) 732-8059 • Fax (517) 732-0019

September 6, 1996

United States  
Nuclear Regulatory Commission  
Region III  
Nuclear Licensing Section  
801 Warrenville Road  
Lisle, Illinois 60532-4351

**SUBJECT: CONTROL NUMBER 397275 - LICENSE NUMBER 21-26060-01  
LICENSE RENEWAL - MID AMERICAN INSPECTION SERVICES, INC.**

Attn: Mrs. Piskura;

Enclosed please find the items we discussed in our phone conversation and also the notice for additional information, we received from your office.

Our response will address each issue in the order they were requested.

If you should need any additional information, please contact our office at your convenience.

Mid American Inspection Services, Inc.

Terry L. Wilkins  
President/RSO

TLW

RECEIVED  
SEP 10 1996  
REGION III

SEP 10 1996



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Gaylord, Michigan 49735  
(517) 732-8059 • Fax (517) 732-0019

September 6, 1996

## ITEM 1

Terry Wilkins has worked in the "Radiography Field" since 1977 in various job capacities. During the course of his employment with various companies he has been a "RSM" (Radiation Safety Monitor), under the direction of the "Radiation Safety Officer."

Job functions involved Leak Testing of exposure devices, Personnel Audits and Training. Calibrations of Survey Meters, And Dosimeter Pencils, Source Transfers, and Instruction in Emergency Source Recovery.

## FACILITY LOCATION CALIBRATIONS

Survey Meter Calibrations Will be performed at:

1206 Effie Road  
Gaylord, Michigan

Calibrations will be performed in the same area as the "Storage Vault" is located.

See Sketch

Approximately  
40'

78'

↖  
Rear  
Door

Storage  
Unit



Meter Calibrations  
with Tape Place  
in this Area of Facility

↖  
Block divider  
Wall

↖  
Door

Front of Building

Office

Office

↖  
Entrance  
Door



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## ITEM 2

A Trainee shall not be allowed to use Radiographic Equipment with a "Radiographic Source," until such a time they have completed all "Required Training listed in Mid American Inspection Services, Inc. Training Program."

## ITEM 3

- A. High Radiation areas are defined as an area an individual could receive in excess of 100 millirem in any continuous hour.

At no time while the source is in the exposed position (unless source recovery is in progress) is any one allowed to work in a "HIGH RADIATION AREA."

- B. While Radiography is being performed, a restricted area will be posted and constant surveillance by the "Radiographer and/or Radiographers Assistant, at all times."
- C. If an individual enters a restricted area, "Stop Radiographic Operations Immediately."

Explain what you are doing and point out the boundaries of the restricted area, if they still refuse to cooperate contact site supervisor or RSO. Do not continue Radiographic Operation until the individual(s) understand and agree to honor restricted area boundaries.



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- D. Shall be in Accordance with **"Section I, page 16 of the 'Operating and Emergency Procedures Manual.'"**

Exposure devices at temporary job site will be stored in designated **"Lock up Area"**, no exposure device will be considered stored by chaining to a fence, post, etc.

## ITEM 4

Radiographers, Radiographer Assistants and Trainee's are responsible for proper storage for their film badges and dosimetry. These areas may be at their home, motel or any area receiving minimal background radiation.

## ITEM 5

Source Retrieval Procedures are covered in in **"Section VI, page 5, Section 10.6 of License Application."**

- A. The RSO will perform all Source recovery Activity, only Radiographers that have received training in "Source Recovery" and practiced with dummy sources could assist with recovery. Other individuals would be used in posting or monitoring the area.





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- B. Terry Wilkins has received hands on training in source recovery using dummy source's.

Terry Wilkins wrote the recovery procedures for this license through practice and mock up situations.

Terry Wilkins has performed (2) live source recoveries using recovery procedure (1) Source disconnect in guide tube outside exposure device. Both recoveries were successful with minimal radiation received during retrieval.

Terry Wilkins has also assisted in (2) other live source recoveries in a monitoring capacity.

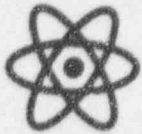
Robert Story has received mock up training by Terry Wilkins on recovery procedures.

Robert Story has performed mock up recoveries using (6ft. long retrieval tongs).

Robert Story has also participated in source retrievals in a monitoring capacity.

### ITEM 6

Section I of the Operating and Emergency Procedures Manual states a daily check list for exposure devices, on page 27 a statement to employees: That if there is any defects to equipment, Radiographic Operation will be discontinued immediately, and notify RSO.



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September 6, 1996

## ITEM 7

**Quarterly Inspections & Inventory:** Performed in Accordance with the Quarterly Inspection and Inventory Form. All maintenance and operation of exposure device will be instructed and performed in Accordance with each device by Manufacturer Specifications.

**ENCLOSED: ( FOR YOUR REVIEW)**

**PROJECTOR OPERATION & MAINTENANCE - AMERSHAM-660B**

**OPERATION MANUAL - INDUSTRIAL NUCLEAR COMPANY - IR-100**

**MID AMERICAN INSPECTION SERVICES - RADIOGRAPHIC EQUIPMENT  
QUARTERLY INSPECTION AND INVENTORY RECORD**

## ITEM 8

Enclosed please find a copy of the operations manual for the RA-500, Alarming Ratemeter we are presently using.

Also enclosed is a copy of a Rate Alarm Calibration Certificate, we will continue to use out side vendors to perform "Alarm Ratemeter Calibrations." With all alarming ratemeters in use requiring at least on a yearly basis.

## 5. PROJECTOR OPERATION

### Model 660

The Ameritest™ 660 projector has become the world-wide 'Industry standard' for on-site gamma radiography. It is easily portable, small, light in weight, but well shielded and self contained.

It is normally used with an Iridium-192 source for radiographic inspection of steel and light alloy sections.

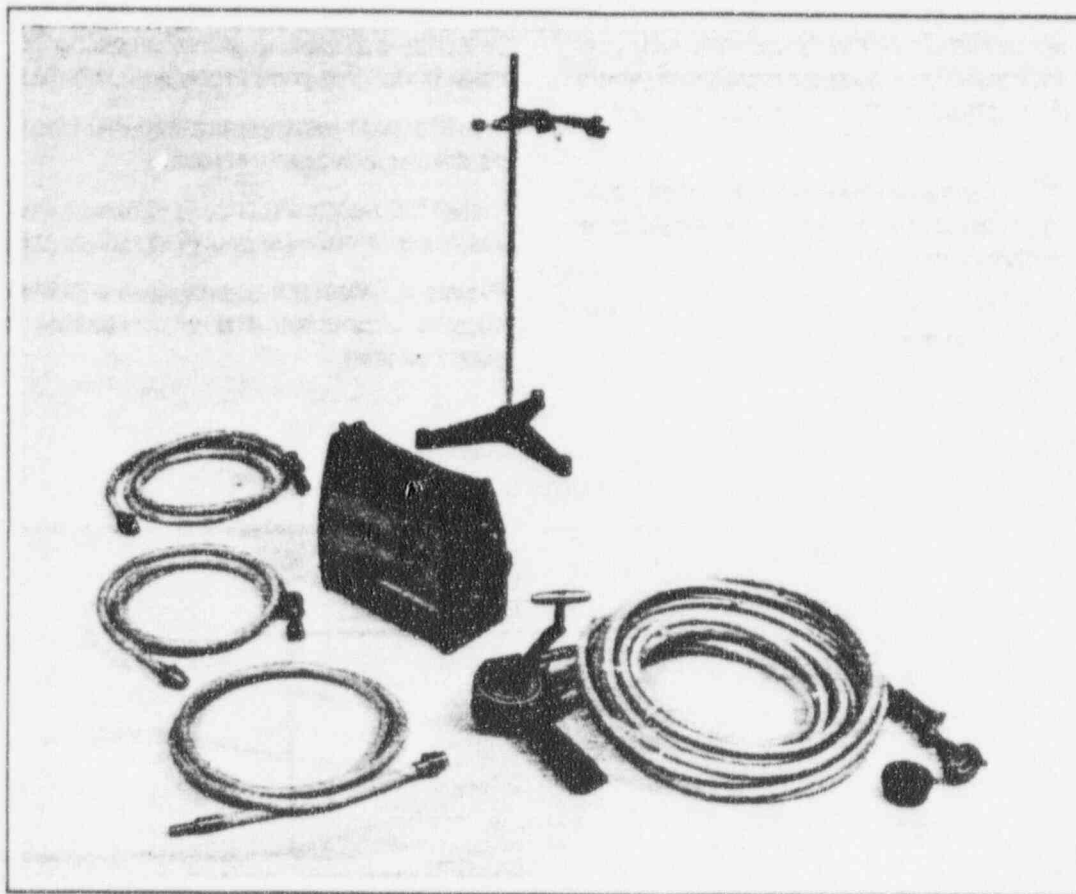
The durable steel case contains a radiation shield of depleted uranium.

One end plate houses a drive cable connector with a lock to prevent unauthorized use. The other end plate houses a source guide tube connector.

Model 660 projectors may be used with suitable iridium-192 sources up to 120 Curies (Model 660 & 660A), 140 Curies (Model 660B) or with ytterbium-169 or thulium-170 sources, (see table on page 5.14).

A range of drive cable control units, guide tubes, collimators, service replacement spares and accessories is available for these projectors.

Figure 5.1



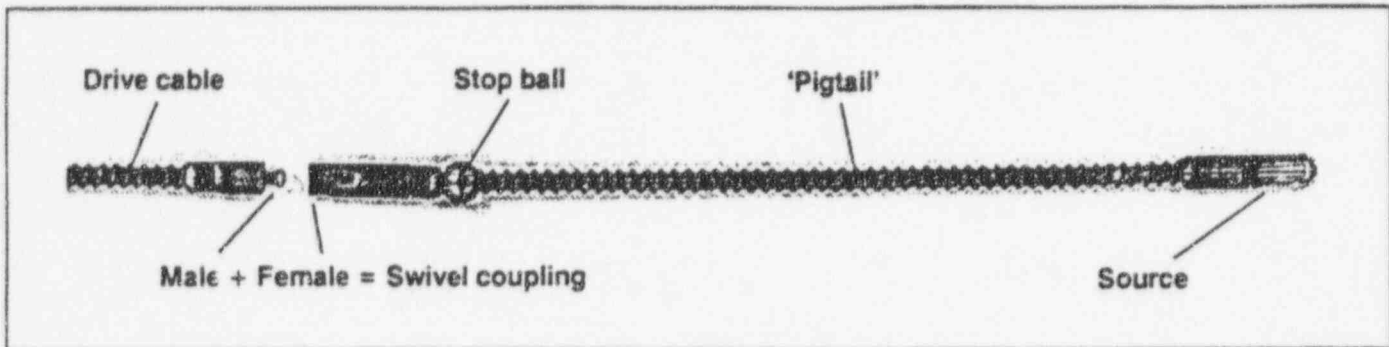
## 5.1 Operational features

- (a) **Source assembly:** A sealed radioactive source capsule is swaged to one end of a short flexible steel 'pigtail'. At the other end of the 'pigtail' are swaged a stop ball used to secure the pigtail in the projector and the female portion of the cable connection. (see Figure 5.2)

Note that the source connector is designed so that the source cannot be exposed unless the source assembly is properly coupled to the drive cable.

The 'available length' of drive cable **must exceed** the total length of the guide tube(s) so that the source can be projected to the source stop.

Figure 5.2



*The source itself must not be touched under any circumstances* and may be approached only when it is safely shielded in the projector or source changer.

- (b) **Projector:** The source is shown in the stored position in the 'S' tube at the center of the shield of a source projector. (Figure 5.3)

A drive cable control unit is shown with its drive cable coupled to the source pigtail.

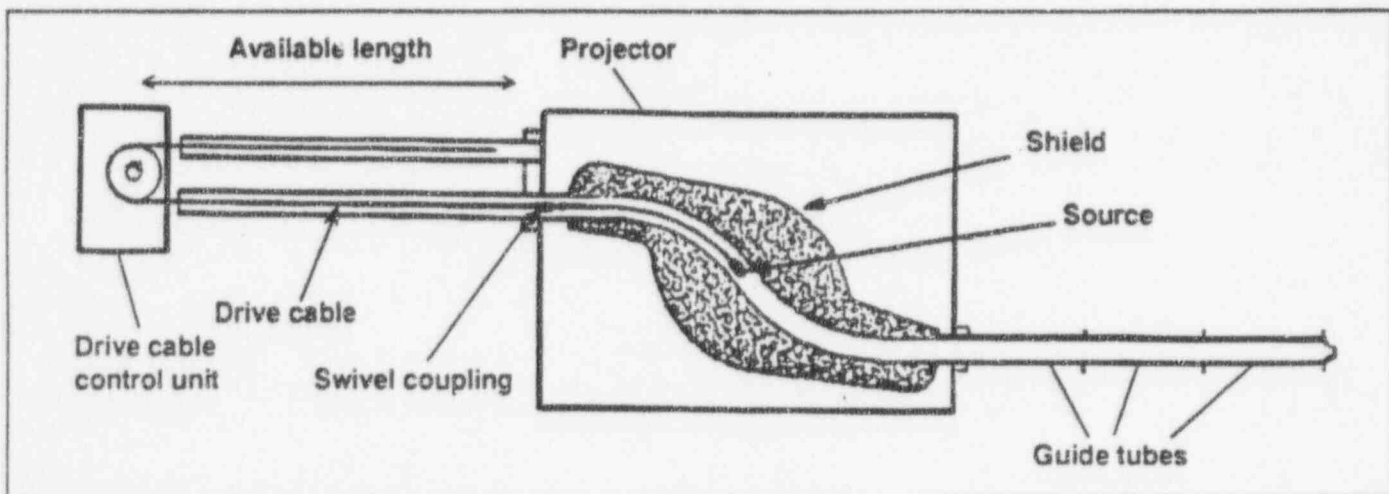
Compact depleted uranium shielding is used in the projector to give good protection with minimum weight.

The 'S' tube minimizes radiation from the exit port when the source is properly stored.

A lead filled shipping plug is screwed into the exit port and this is removed only during radiography operations.

The source must not be projected until the equipment is properly connected and all personnel have left the restricted area.

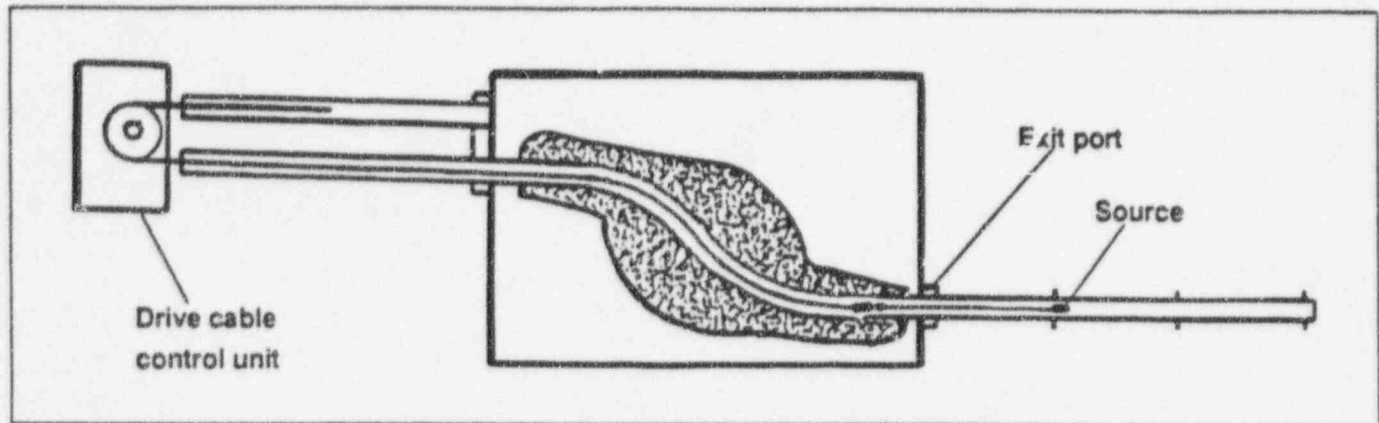
Figure 5.3



- (c) **Transit:** Rotating the crank of the drive cable control unit in the 'EXPOSE' direction (counter-clockwise) moves the source out of the storage position in the projector and into the guide tubes. (Figure 5.4)

The maximum operating distance is achieved when the drive cable housings and the guide tubes are laid out in a straight line.

Figure 5.4



The radioactive source is under positive mechanical control using the drive cable control system.

Control units fitted with an odometer give an approximate indication of the source position, but is no substitute for proper use of a survey meter.

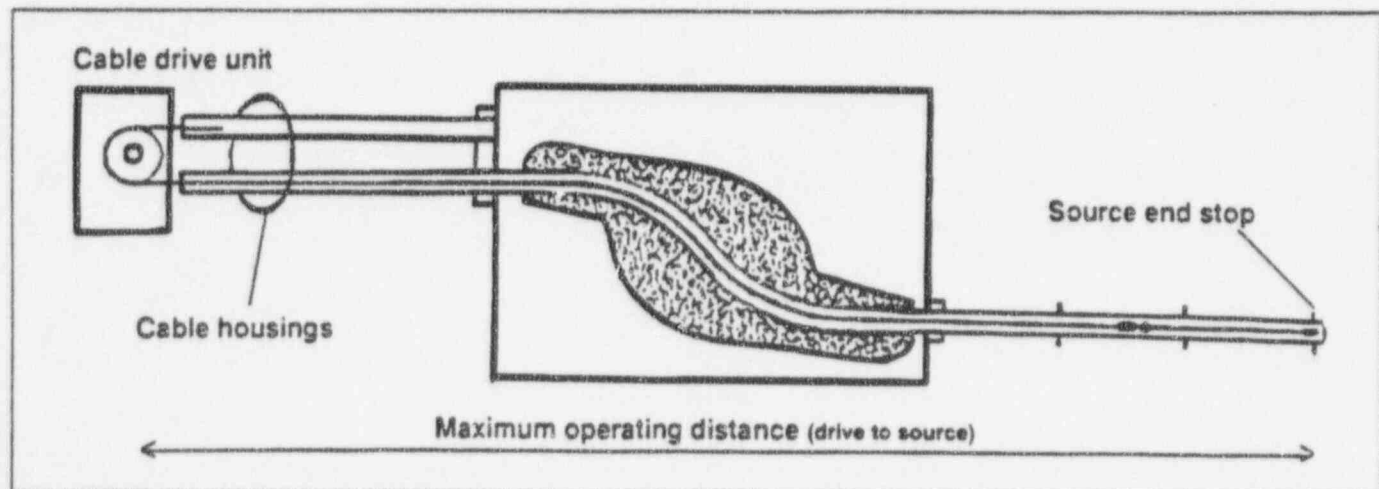
- (d) **Exposure:** When the source reaches the end stop at the radiographic focal position, an odometer will indicate (in feet and inches) the approximate distance travelled by the source. (Figure 5.5)

To return the source to the projector the crank is rotated in the 'RETRACT' direction (clockwise).

The drive cable cannot be disconnected from the source assembly unless the source assembly is properly stored in the projector.

**The systems are designed for safe and reliable operation *provided* that they are properly used and maintained.**

Figure 5.5





## 5.2 Daily inspection

Daily inspection is essential at the start of each shift to ensure that the equipment is in proper operating condition. Inspections should be recorded in the log book.

**Cables:** Inspect drive cable housings for cuts, dents and broken fittings. Ensure that the 'available length' of drive cable is **greater** than the total length of guide tube(s). (If necessary crank the cable out and compare it with the assembled guide tubes, but keep the cable clean and ensure that no dirt is carried back into the crank mechanism).

**Guide tubes:** Inspect source guide tubes for obstructions, cuts, dents and heat damage.

**Radiation:** Survey for excessive radiation levels around the projector.

**Projector:** Inspect projector for damage to lock, couplings and fittings.

**Drive controls:** Inspect the drive cable control unit for damage to drive cables or loose components.

**Connector:** Check for wear in the drive cable connector using the NO GO gauge. (Figure 5.6)

Without using excessive force, check the following four positions:

- (i) The ball connector on the end of the cable must **NOT GO** into the hole.
- (ii) The ball connector shank must **NOT GO** into the smaller of the two notches in the gauge side.
- (iii) The gauge must **NOT GO** into the female slot in the source connector.
- (iv) Assemble the male and female parts of the connector and check that the larger notch in the side of the gauge will **NOT GO** in the gap shown.

Replace components that fail any of these tests, because failure indicates significant wear that could allow safety features of the design to be defeated.

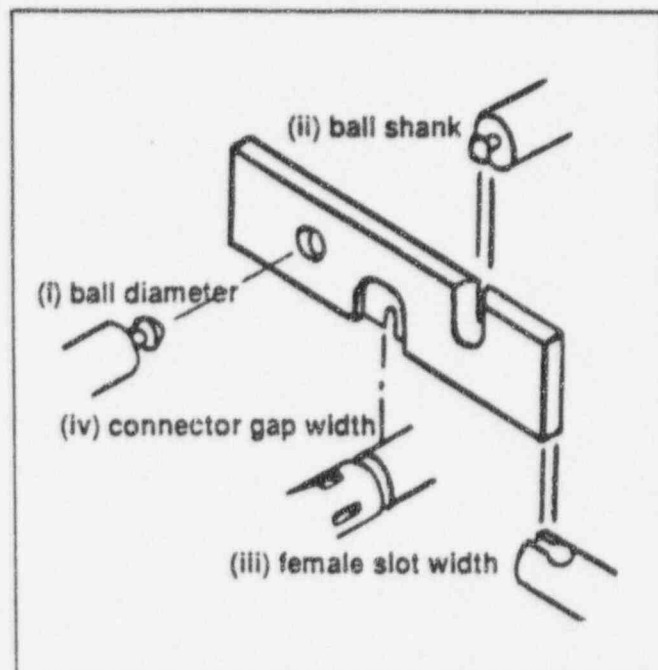
Contact Amersham for advice on disposal of the source if the connector fails test (iii).

**Movements:** During the first exposure of the shift, check the operation of the selector ring, lock assembly and control crank for freedom of movement. If operation is difficult, retract the source and survey the equipment to ensure that the source returns to the stored position.

**DEFECTIVE EQUIPMENT MUST BE REPAIRED OR REPLACED BEFORE USE**

**DO NOT COMPROMISE ON SAFETY**

Figure 5.6 NO GO gauge (TAN 550)



## 5.3 Site safety precautions

**Instruments:** The radiographer and his assistant must at all times wear a film badge or TLD. US regulations also require that a pocket dosimeter be worn.

The radiographer must also have a survey meter capable of measuring in the range 2mR/h (USA) or 2μSv/h (0.2mR/h) and up to at least 10mSv/h (1 R/h). [Section 3.3]

An audible "chirper" pocket alarm is also recommended (may be required in some countries).

**Restricted Area:** Radiography must be performed only in a restricted area which is marked with the appropriate radiation signs and secured against unauthorized entrance. [see Section 3.2]

**Distance:** Since the source emits high levels of radiation it is good practice to operate the system from as great a distance as possible.

**Shielding:** If possible, situate the radiographic exposure area in a room with suitably thick walls, floor, ceiling and doors. [see Section 3.5]



**Surveillance:** Radiography systems must be operated only by a qualified radiographer or his assistant (under direct supervision). The radiographer must be physically present and able to control the restricted area entrance.

**Locking:** Keep the source projector locked while assembling the system.

When an automatic drive control unit is used (model 957), remove the key from the power switch between each radiographic exposure to avoid any inadvertent exposure of the source. Store the key in a secured location.

#### 5.4 Source guide tube layout

**Source guide tubes:** Position and secure the source stop of the terminating source guide tube at the radiographic focal position using the tripod stand and swivel clamps or some other secure and suitable means.

Ensure that the source **end stop** is in place on the terminating guide tube.

Use a collimator to limit the beam in unwanted directions.

Determine where the source projector will be positioned and lay out the source guide tube as straight as possible, with no bend radius less than about half a meter (20 inches) to avoid restricting the source movements.

Make sure that the tubes do not contact any heated surface  $>60^{\circ}\text{C}$  ( $140^{\circ}\text{F}$ ).

Avoid any risk of crushing by falling objects, vehicles or doorways.

Connect the signal wire to the source stop switch if the model 957 automatic drive control is used.

Do not connect the source guide tube to the projector at this stage.

#### WARNING

Ensure that the 'available length' of drive cable is greater than the total length of guide tubing (Section 5.2)

If the drive cable is shorter than the guide tubing:

- (I) The source can *not* be projected all the way to the end stop of the terminating guide tube and correctly placed for the exposure.
- (II) The source may *not* reach a collimator; therefore, restricted area dose rates may be much too high.
- (III) The drive cable may be cranked right off the drive wheel of old units which were not fitted with a safety retaining spring. This would have to be treated as an EMERGENCY [see Section 3.4].

#### 5.5 Drive cable connection

**Cable layout:** Lay out the control cables with no bend radii less than about 1 m.

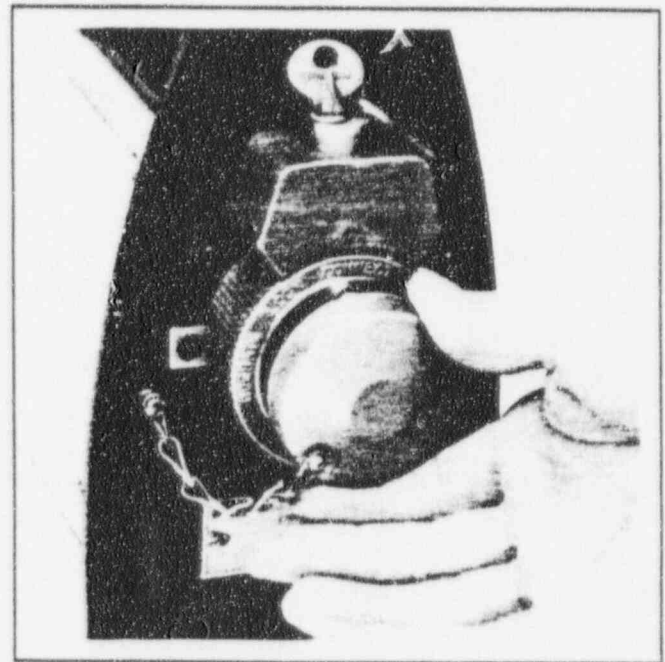
Avoid any risk of crushing by falling objects, moving vehicles or closing doors etc.

The drive cable control unit should be placed as far away from the source focal position as possible (preferably behind shielding).

**Cable connection:** Connect the drive cable to the source projector as shown in fig. 5.7.

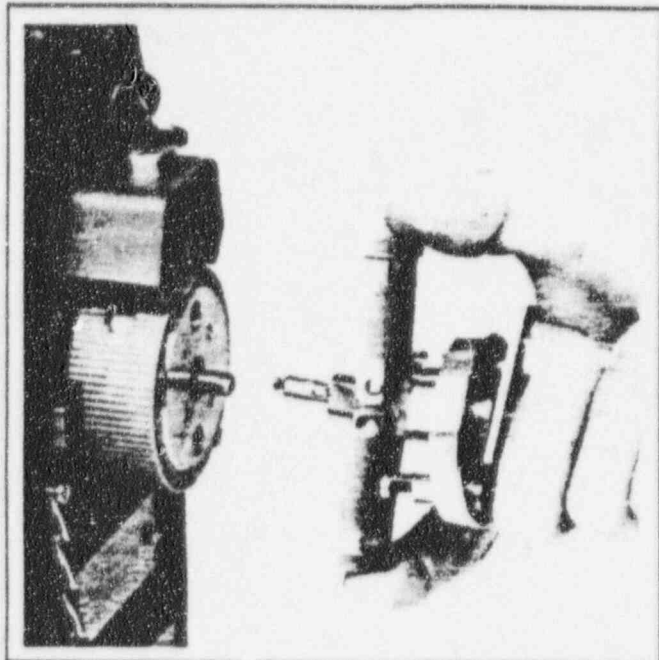
- (a) Unlock with the key and turn the selector ring from LOCK to CONNECT. The storage cover will disengage from the projector.

Figure 5.7(a)



- (b) Slide the control cable collar back and open the jaws to expose the male portion of the swivel coupling (ie. the ball-end on the drive cable).

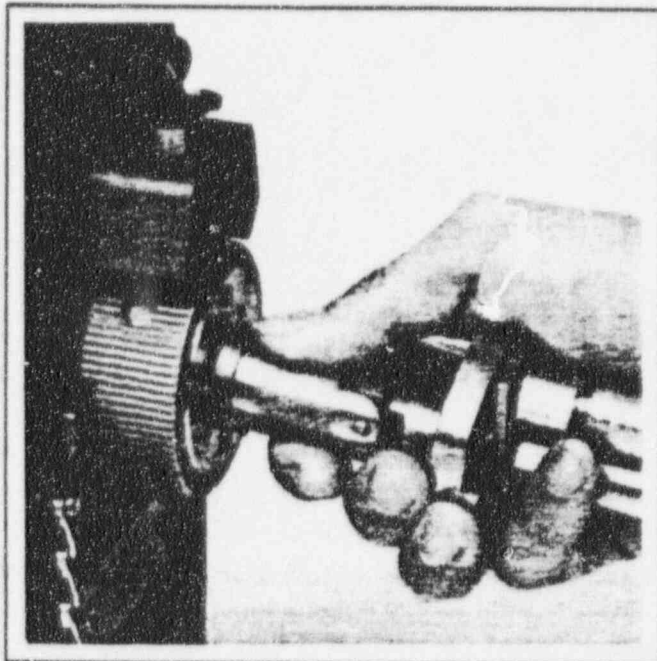
Figure 5.7(b)



- (d) Release the locking pin and check that the connection is secure.

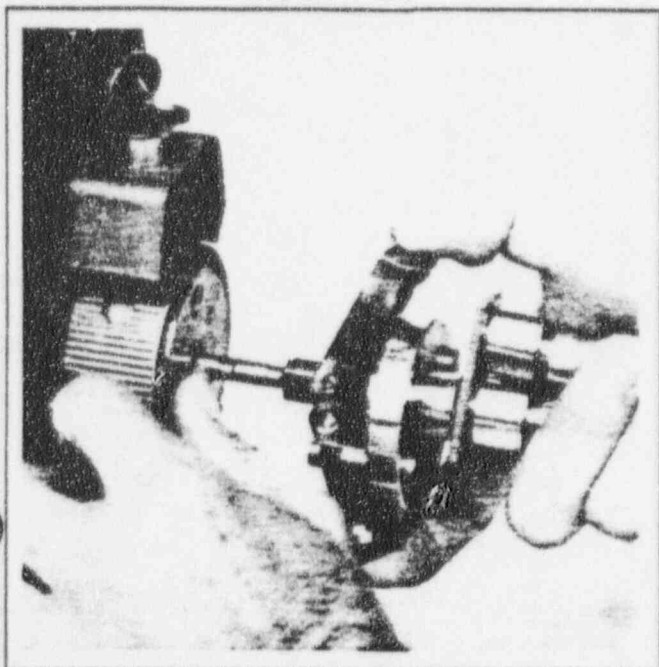
Close the jaws of the control cable connector over the swivel coupling.

Figure 5.7(d)



- (c) Press back the spring-loaded locking pin with a thumb nail and engage the male and female portions of the swivel coupling.

Figure 5.7(c)

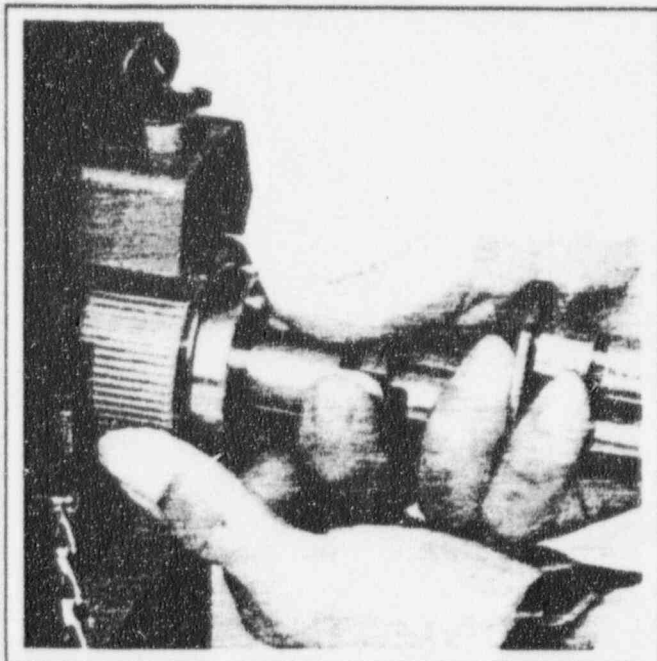


- (e) Slide the control collar over the connector jaws.

#### Note

The drive cable connector, when properly installed with the selector ring in the CONNECT position, displaces anti-rotation lugs which allows the selector ring to be rotated to the LOCK position and when required, through to the OPERATE position.

Figure 5.7(e)



- (f) Push and hold the control cable collar flush against the projector connector and rotate the selector ring from CONNECT to LOCK.

Do not rotate past LOCK.

The drive cable connector is now locked into the projector.

Figure 5.7(f)



- (g) Keep the projector in the LOCK position until ready to start the exposure.

## 5.6 Radiographic exposure

**Guide tubes:** Remove the shipping plug from the projector and connect the source guide tube(s).

**Projector survey:** Check the operation of the survey meter by reading the radiation level at the surface of the projector. It should read no more than 2Sv/h (200mR/h) except for the area just in front of the exit port when the shipping plug is removed.

Note the readings for verification of the source return after exposure.

**Checks:** Verify that the guide tube and drive cable are correctly connected.

Ensure that no unauthorized personnel are inside the Restricted Area or Exposure Room and that signs are posted and warnings are in operation.

### NOTE:

If the control is fitted with a lock it will be necessary to unlock the control and apply a forward motion to the control handle, as if exposing the source, until a resistance is felt. Release the control handle and proceed with the next step.

### CAUTION:

Do not apply excess force to the control handle in the exposed direction as this could cause the source assembly to move forward out of the stored position when the lock slide is released.

**Unlock:** Use the key to unlock the projector lock and rotate the selector ring to the OPERATE position. Ensure there is no tension force in either direction on the drive cable. Push the slide bar (green marking) laterally from left to right (as seen behind the projector) until the slide bar (red marking) fully appears on the right side of the selector ring and you feel or hear the sleeve snap into slide. When the green marking is visible the source assembly is locked into the safety-stored position within the projector; when the red marking is visible the source assembly is free to be projected from/to the projector. The source is now free to move.

Return to the drive control unit.

If an odometer is fitted, adjust the reset knob to read zero.

**Project:** Rapidly rotate the crank in the 'EXPOSE' direction (counter-clockwise) to move the source out of the projector to the radiographic focal position.

The hand crank will stop turning when the source reaches its stop. Do not use excessive force.

The odometer (if fitted) will indicate the approximate total distance travelled. (about 2.1 m (7ft) for each guide tube section).

Set the brake to **ON** to prevent movement of the source during the exposure.

Calculate the exposure time from the moment when the source reaches the stop.

**Survey:** Survey meter readings observed during the projection operation should increase rapidly from background to a high level as the source emerges from the projector. Then readings should fall as the source moves out to the focal point, fall sharply as the source enters a collimator (if used) and remain steady throughout the exposure.

Actual survey meter readings will depend on the source activity, distance, collimators and shielding.

The sequence of changes should be observed and the readings noted.

During source retractions the sequence will reverse.

During exposure, use the survey meter to check the boundary dose rate, but spend as little time as possible in the restricted area to minimize personal exposure.

**Retract:** At the end of the required exposure time, set the brake to **OFF** and rapidly turn the crank in the 'RETRACT' (clockwise) direction until the crank



no longer moves. You should hear the slide bar "click" back into its original position and observe the green marking on the slide bar.

Apply a slight amount of forward pressure on the crank handle as if to expose the source to ensure that the positive locking mechanism has actuated. Allow the crank handle to return to a neutral position, thereby relieving any tension (force) on drive cable which would cause source movement when unlocking the camera. At this point the source cannot be moved out of the stored position.

In the unlikely event the locking slide moves toward the lock position before the source is fully stored in the projector, turn the hand crank in the "RETRACT" (clockwise) direction until the crank stops turning. (The lock slide is designed to lock on the stop ball, not the drive cable). Do not use excessive force. The source will be in the projector but not in the fully shielded position. Approach the projector, from the rear, with a survey meter. The meter will read approximately 40 mR/hr at the rear plate of the projector when a 100 Ci source is in use.

#### CAUTION:

Remain clear of the front of the projector to minimize personal exposure. Reset the lock slide to the open position. Return to the control and turn the hand crank in the retract (clockwise) direction and store the source in the normal manner.

The odometer (if supplied) should read approximately zero when the source assembly has returned to the projector.

The survey meter should indicate a continually increasing radiation level as the source retracts, then drop to background when the source is stored in the projector.

**Check survey:** Approach the projector with the survey meter—observe the green marking on the slide bar and survey it on all sides. The meter should indicate the same radiation level as observed before the exposure. Note particularly the exit port reading.

Survey the entire source guide tube with the survey meter. If the meter shows a sharp increase, the source is exposed or incompletely shielded.

If the source is still exposed, attempt to store it properly by cranking the source a short distance toward the source stop and retracting it, repeating if necessary.

If the source can not be fully retracted after several attempts, treat the situation as an **EMERGENCY**. [see Section 3.4]

**Lock projector:** When the source is properly stored in the projector, rotate the selector ring from the **OPERATE** position to the **LOCK** position and secure it with the projector lock. Remove and secure key.

#### WARNING

If after several attempts to return the source, the selector ring cannot be rotated to the lock position (do not use excessive force) or the lock slide is not actuated, one must suspect an accident in which the source could have become disconnected or stuck outside the projector, giving rise to a very high radiation field.

Treat the situation as an **EMERGENCY** (see Section 3.4).

### 5.7 Dismantling equipment

**Guide tubes:** Unscrew the source guide tube sections. Place the plastic caps on the tubes to exclude dirt. Screw the shipping plug into the projector guide tube connector.

**Drive control unit:** Unlock the projector and then rotate the selector ring from **LOCK** to **CONNECT**. The safety control connector will partially disengage.

Disengage the drive control unit from the projector by reversing the sequence of actions described in section 5.5.

Replace and hold the storage cover on the projector connector and rotate the selector ring to the **LOCK** position.

Remove the key and push in the lock to secure the projector.

Check the entire circumference of the projector with the survey meter to ensure the source is properly secured.

**Storage:** Lock the equipment safely and securely in a clean dry storage area where it cannot be tampered with or removed by unauthorized personnel.

A radioactive warning notice must be posted on the door.

### 5.8 Maintenance requirements

Projectors and associated equipment must be maintained regularly by trained and qualified personnel to ensure consistent and safe operation. (10CFR 34.28(b))

Maintenance procedures described in Section 5.9 must be performed at 3 month intervals.

Equipment should be completely serviced after it has been subjected to severe conditions (eg. Immersed in water or mud, in a sand storm, dropped, etc). Per Section 5.10

Amersham has service facilities for this work in the USA at Burlington, MA, at Houston, TX and at Baton Rouge, LA and in the UK at Harwell, Oxon.

Alternatively, Amersham's service engineers can service these units at the operator's premises.

## 5.9 Quarterly maintenance

- (a) Clean, inspect and maintain the drive cable assembly [see Section 6.3].
- (b) Clean and inspect the source guide tubes (see Section 6.6).
- (c) Clean and inspect the projector for wear or obvious damage. Report any defect which might affect safe operation and **withdraw it from service** until repairs can be effected.
- (d) See that the radioisotope warning labels are secure and legible. Do not cover with any other labels.
- (e) Check that the source outlet shipping plug is in place and that the screw and nut turn freely, but are not loose.
- (f) Check for wear in the cable connector using the NO GO gauge. There are four NO GO tests — ball diameter; ball shank; slot width; and connector gap width.  
  
Replace components that fail any of these tests [see Section 5.2].
- (g) Check that the selector ring and lock mechanism operate freely. If operation is faulty, contact Amersham to arrange for servicing, or see Section 5.10.

## 5.10 Complete service

Equipment which is used under good conditions should only require complete service annually.

In addition to the schedule of operations listed in Section 5.9 the connector and the lock mechanism must be stripped for maintenance.

This service requires removal of the source, which is potentially a dangerous operation, together with work on components which are critical to safety.

**This service must be done only by persons specifically trained and qualified for this work.**

**Amersham will service these units at one of their laboratories or in the field on request.**

Alternatively, trained and qualified persons who wish to do this work should use the following procedure:

- (a) Use the NO GO (TAN 550) gauge to check for wear in the female slot width of the source coupling. [see Section 5.2]

The gauge thickness should NOT GO in the slot. The source fails the test if the gauge can enter the slot; in which case contact Amersham for advice on disposal of the source.

Use the gauge also to check the drive cable male coupling: Check the ball diameter and shank. Couple the cable to the source and check the connector gap width.

In each case the gauge must NOT GO.

Proceed with (b) if the source coupling passes the tests.

- (b) Transfer the source out of the projector and into a source changer for safe storage. [see Section 7]

This transfer must be carried out in a restricted area by licensed and properly trained personnel.

**Use a survey meter to ensure that the source is properly transferred.**

Remove the source identity plate from the projector and fasten it with wire onto the source changer.

The source must be replaced by a **test connector (jumper)** (found inside the cover) so that when the drive cable is returned to the projector storage position the drive cable control can be removed from the projector.

- (c) After removal of Source Assembly, carry out a wipe test on the inside of the 'S' tube to check for uranium contamination. Uranium is slightly radioactive, so the wipe test swab should be sent to Amersham in a sealed plastic container to be checked for low level radioactive contamination.

The presence of uranium indicates wear through of the 'S' tube. It is recommended the projector be taken out of service. Contact Amersham for recommendations.

Clean the tube with a swab soaked in 1:1:1 trichloroethane solvent (observe the solvent manufacturers recommended precautions).

- (d) Cover Plate Removal

1. Remove the Danger Tag (secured with rivets) from the bottom of the rear plate.
2. Remove the rear plate by unscrewing the six phillips head screws securing it to the exposure device body.

- (e) Refer to figure 5.8 and dismantle the selector assembly, taking care not to lose the spring loaded parts.

Remove the lock (2) from the lock retainer (3) by undoing screw (4) and turning the key through 90 degrees.

- (f) Remove 4 screws securing the front end plate.

Remove the guide tube connector nut (17) and retaining ring (18).

- (g) Clean all parts with trichloroethane and inspect for wear. Replace as necessary.

When ordering spare parts, quote the **serial number of the projector** as well as the component number to ensure correct replacement.

- (h) Lightly grease the inside surfaces of the selector ring (10) and the lock retainer (3) using type MIL-G-23827 B grease (in Repair Kit, Fig. 5.8)

Note that other types of grease may form tars when exposed to radiation.

Lubricate the lock barrel (2) with 2 drops of light oil.

Attach the lock assembly to the mounting plate with two socket screws (1).

All screws should be treated with vibratite.

#### NOTE:

All screws were treated with "vibratite" coating when assembled new. If screw and coating is in good condition they can be reused.

If new screws are required they must be treated with vibratite per Vibratites instructions.

- (i) Begin the Selector Asm. reassembly by lightly coating the components with type MIL-6-23827 B grease. See Fig. 5.8.

Hold rear end plate horizontally, face up and the lock in the 12 o'clock position. (NOTE: The face plate may be held carefully in a vise or other fixture so as to free both hands for this assembly procedure).

Insert the 5/8 diameter of the selector body (6) into the mating hole in the center of the rear plate. The narrow end of the slot opening is to be at the 3 o'clock position.

Locate the locking slide (7) and return spring (8) into mating slot of selector body.

Place the selector ring (10), with the word "CONNECT" at the 12 o'clock position, over the selector body. Push the locking slide so the selector ring will clear and rest the selector ring on the top surface of the selector body.

Insert springs (14) into holes at the top and bottom of the selector body. Place the anti-rotation lugs (13) over the springs.

Place the sleeve (12), with the large diameter facing down, on the center of the locking slide. Place the spring (11) over the sleeve.

Install the selector ring retainer (9) into the selector ring. Ensure that the three non-threaded holes line up under the word "CONNECT". See Fig. 5.8. Depress the selector ring retainer into the selector ring until its top is flush with the top of the selector ring.

- (j) While holding the assembly firmly against the end plates turn it over to expose the back side. Install the four socket head screws (15) and the lock washers (16) to secure the connector assembly to the rear plate.

Insert the "U-Tool" into the top and bottom holes of the selector assembly. Rotate the selector ring toward the "OPERATE" position.

Push the locking slide until the sleeve snaps into place.

- (k) While still in the "OPERATE" position, wind out a short length of the drive cable and pass it through the front of the selector assembly. Couple the cable to the test jumper connector and withdraw it into the selector assembly.

Pull on the cable and confirm that the locking slide snaps shut to lock the connector in the safe position. Push in the locking slide and repeat to assure smooth operation. If smooth operation is not attained, disassemble the selector assembly and thoroughly inspect components for rough edges, burrs, etc. which could cause jamming or irregular selector assembly action. Replace parts as necessary. Re-lubricate the components and reassemble the selector assembly.

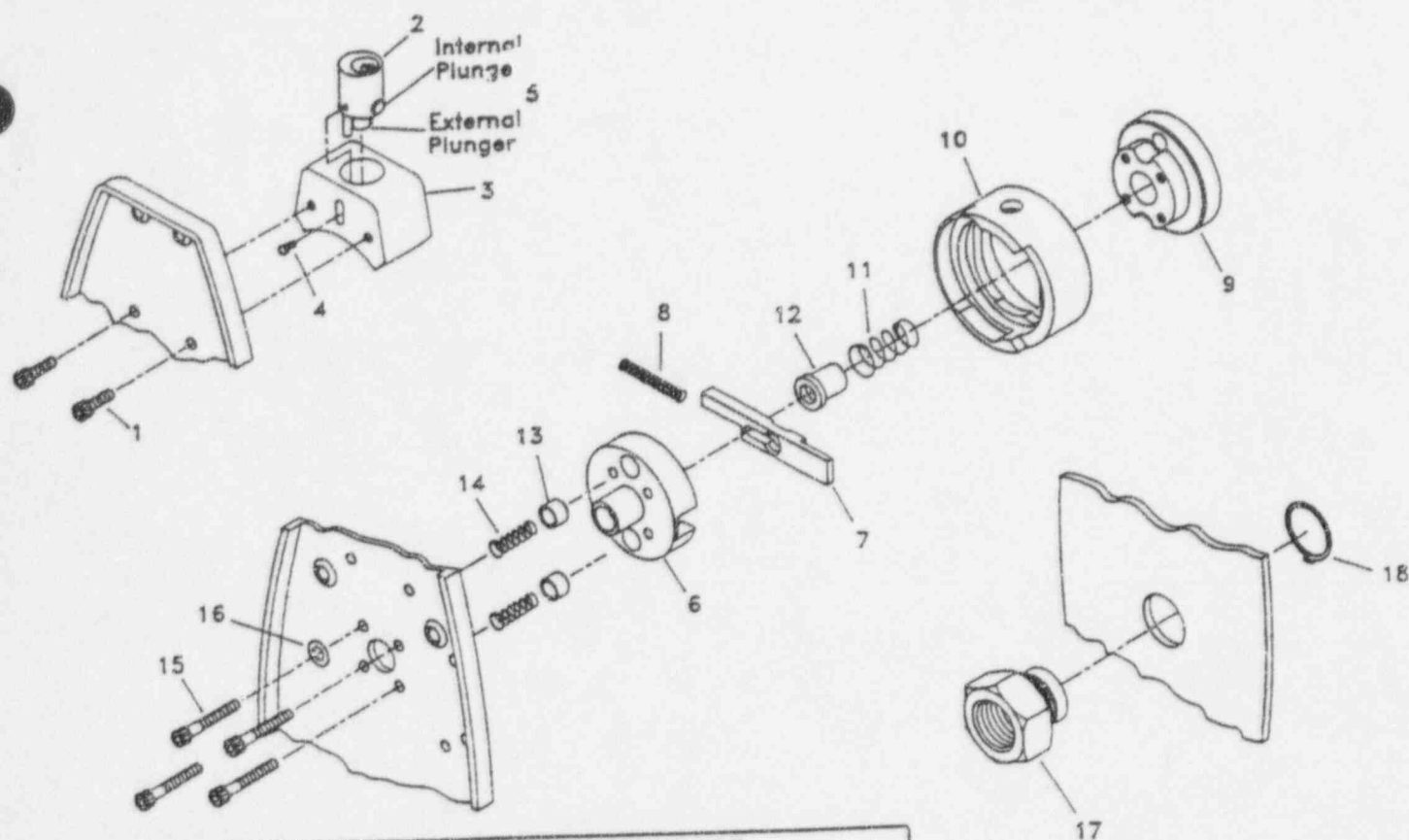
Run through the normal operations of the lock and selector assembly (1).

- (l) Use the **misconnect test to check simultaneously all the operating tolerances of the projector and of the cable drive unit normally used with it:**

Turn the selector ring to CONNECT, then uncouple the cable and attempt to recouple the connector without engaging the male-female connection, but simply touching them together in line.



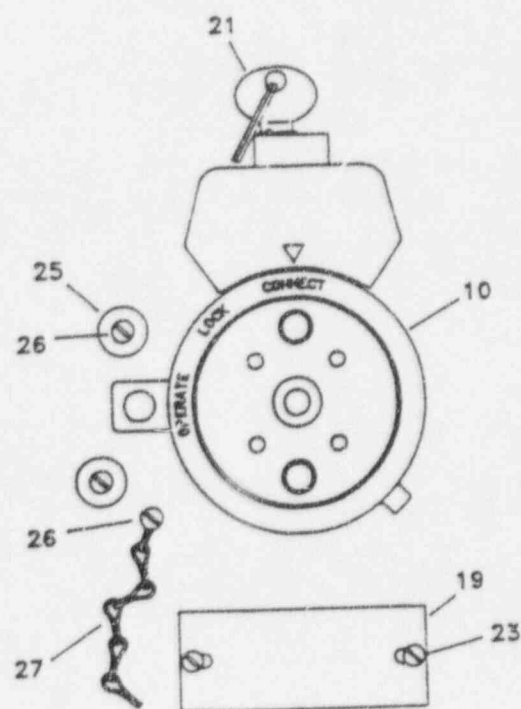
Figure 5.8 Projector assembly diagram—Models 660A and 660B



AMERTEST™ 660 GAMMA RAY PROJECTOR

660 Repair Kit  
Code Kit-002  
Qty in Kit

Ref #	Cat Code	Part # U.S.A.	Qty	Description	
1	TMN1		2	10-32x5/8" Socket Head Screw	4
2	TSN66011	66001-11	1	Lock	
3	TSN66012	66001-12	1	Lock Retainer	
4			1	Screw (Supplied with Item 2)	
5			1	Internal Plunger	
6	TSN85712	85701-2	1	Selector Body	
7	TSN85714	85701-4	1	Locking Slide	
8	TSN0321		1	Compression Spring (LC-022C-7)	2
9	TSN85715	85701-5	1	Selector Ring Retainer	
10	TSN85713	85701-3	1	Selector Ring	
11	TSN0541		1	Compression Spring (LC-045H-5)	1
12	TSN85716	85701-6	1	Sleeve	
13	TSN66006	66001-6	2	Anti-Rotation Lugs	
14	TSN0267		2	Compression Spring (LC-026D-7)	2
15	TMN1		4	Socket Head Screws	
				10-32x1 1/4" (st. steel)	4
				Lock Washers, #10	4
16	TMN1		4	Lock Washers, #10	
17	TSN53311	53301-11	1	Guide Tube Connector Nut	
18	TMN1		1	Retaining Ring 5160-98	1
19	TSN002	LBL-010	1	Source Identification Plate	
20			8	1/4-20x3/4" Flat Head Phillips	8
21	TSN003	66001-811	1	Key	
22	TSN66020	66001-20	1	Jumper Connector (Not Shown)	
23			2	BHMS 4-40x3/16"	4
24			8	10-32x5/8" Flat Head Phillips	4
25		RUB-007	2	Protective Bumper BH-2082	
26			3	6-32x5/8" Binder Head Phillips	3
27			1	Braided Cable	1
			1	#30 Drill Bit	1
			12	1/8" S.S. Pop Rivets	12
			1	#4 Scott Drive Screws 5/6"	2
				Grease	
				Check List	
				660 Operations/Maint. Manual	
				U-Tool	
				Cover (Selector) (Not Shown)	
				Label (Control Certification)	
	TSN66039	66001-39	1		
		66010-1			



A gap of at least 0.53mm (0.021in) should be visible between the drive cable collar and the selector ring and it should be impossible to rotate the ring. Do not use excessive force. See Fig. 5.9.

If the selector ring can be rotated, this indicates unacceptable wear, distortion, or damage in the connector, lock mechanism or drive cable connector which must be corrected before using the equipment again.

- (m) Secure the rear end plate to the exposure device and handle using the six attaching phillips head screws and replace the protective plate over the bottom two rear plate screws using pop rivets (.125" diameter x .294" long).

- (n) Lightly grease the guide tube connector nut hub with MIL-G-23827B lubricant.

Reassemble to the front mounting plate, ensuring that the retaining ring is seated in the inner slot.

Secure the mounting plate to the projector.

Inspect the shipping plug, making sure that the lead insert is present.

- (o) Run through the normal operating sequence several times, using the test connector or a dummy source assembly (non-radioactive), to ensure smooth operation.
- (p) Check that the fixed labels are in good condition.
- (q) Transfer the source from the source changer back to the projector as described in Section 7.

Use a survey meter to check that radiation levels do not exceed 2mSv/h, (200mR/h) at any point on the surface.

Replace the source identity plate back on to the projector.

### WARNING

Some operators use the misconnect test on the fully assembled projector complete with its radioactive source. If this is done, proper safety precautions must be carefully observed:-

The source exit port must be *closed by the shipping plug* securely screwed in place.

When the cable connector is presented to the projector (without coupling the cable to the source) care must be taken to ensure that the selector ring is *NOT turned past the LOCK position*.

If the ring can be turned at all, the equipment is faulty.

This procedure has the advantage of testing all the connector components and selector mechanism simultaneously, but *risks losing control of the source* if the components are worn or damaged and the selector ring is rotated *past LOCK*.

### NOTE:

It is recommended that the key used for the 660 lock be inspected for excessive wear every 6 months.

# Operation Manual



MAY 1996

## Model IR100 Portable Gamma Ray Exposure System

### Warning

Do NOT unpack, assemble, operate, disassemble, or carry this device unless properly utilizing the required/appropriate radiation monitoring instrumentation.

# Table of Contents

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## Description

General	1
Exposure Device	1
Source Tube Assembly	1
Control Assembly	1
Principles of Operation	2
Specifications	2
Manufacturer-Supplied Equipment and Recommended Accessories	2

---

## Recommended Safety Precautions

General	3
Radiation Measuring Instruments	3
Working Distance	3
Exposure Time	3
Shielding	3
Hand-Carrying	3
Shipping	3
Quality Assurance	3
Damage	3

---

## Unpacking/Warranty

Unpacking	4
Warranty	4

---

## Preparation for Use

Attaching Source Tube Assembly	4
Attaching control Assembly	4

---

## Operation

---

## Disassembly

---

## Maintenance

General	6
Control Cable	6
Source Tube	6
Cleaning and Lubrication	6
Source Replacement	6

---

## Service Memo

Cleaning and Lubrication	7
Lock Assembly Overhaul	7

DRAWINGS	8
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DRAWINGS	9
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# Description

## General

The Model IR100 Portable Exposure System is an improved isotope handling unit developed to provide safe storage and accurate remote positioning of industrial radiographic sources.

Designed for use with Iridium 192 sources, the System IR100 features maximum operator protection, together with unusual flexibility of application. In use, the equipment positions the radioactive source at the end of a long, flexible tube, where its 360° (panoramic) radiation pattern may be used to full advantage, either for multiple specimen work, or for circumferential exposure techniques. Positive mechanical control of the source is maintained at all times.

Sources can be safely replaced or exchanged in the field using the Models IR-50 and other Approved Source Changer.

## Exposure Device

- 1.2.1 **SOURCE ASSEMBLY** - 100 curies of Iridium 192 are sealed inside a stainless steel capsule. The capsule is swaged onto a short length of cable. A special fitting at the end of this Source Cable serves to connect the Source Assembly to a Drive Cable.
- 1.2.2 **EXPOSURE DEVICE** - A stainless steel housing containing 32 pounds (nominal) of depleted uranium ( $U^{238}$ ) shielding. A curved passage through the depleted uranium allows the passage and storage of the source assembly.
- 1.2.3 **CONTROL CABLE CONNECTOR** - A special connector on the end of the Control Cable for attaching the Control Cable Assembly to the Exposure Device.
- 1.2.4 **DUST CAP** - A protective cover which threads into the Camera Lock Body for storage.
- 1.2.5 **DUST CAP STORAGE PLUG HOLDER** - A threaded receptacle in the handle which conveniently holds the Dust Cap during operation, when the cap is not in the Camera Lock Body.
- 1.2.6 **SAFETY LATCH PLATE**  
A blade that is used to capture or release the source assembly. It is located on top of the Lock Body. Up indicates capture, down indicates released.
- 1.2.7 **SOURCE TUBE CONNECTOR** - A built-in connector on the end of the Exposure Device for attaching the Source Tube.
- 1.2.8 **SAFETY PLUG** - A threaded plug which screws into the Source Tube Connector to seal the passage and prevent movement of the Source during transit.
- 1.2.9 **SAFETY PLUG HOLDER** - Located in the handle.

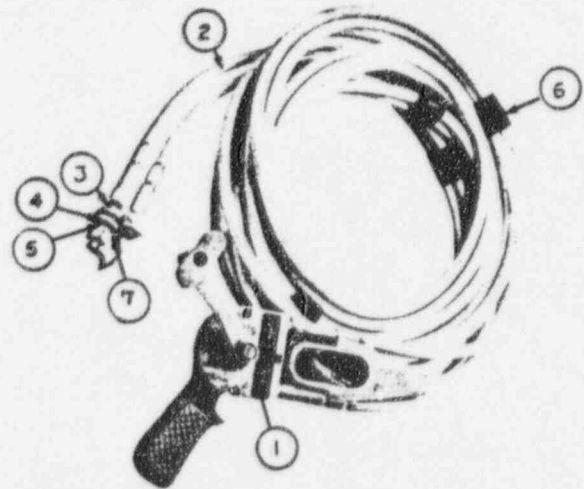
DOUBLE CHECK ALL PARTS OF DEVICE AND ACCESSORIES.

## Source Tube Assembly

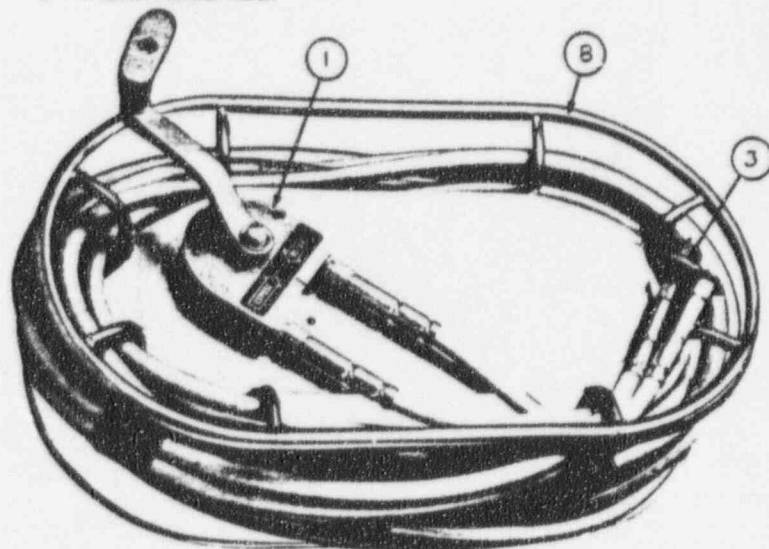
- 1.3.1 **SOURCE TUBE** - A flexible yellow vinyl covered metallic hose consisting of one, two, or three 7-foot sections through which the Source is moved by the Drive Cable.

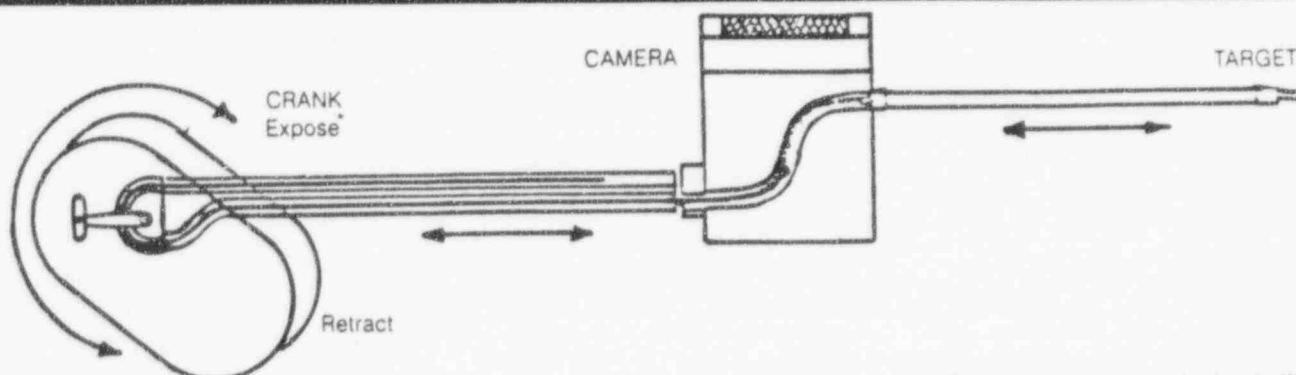
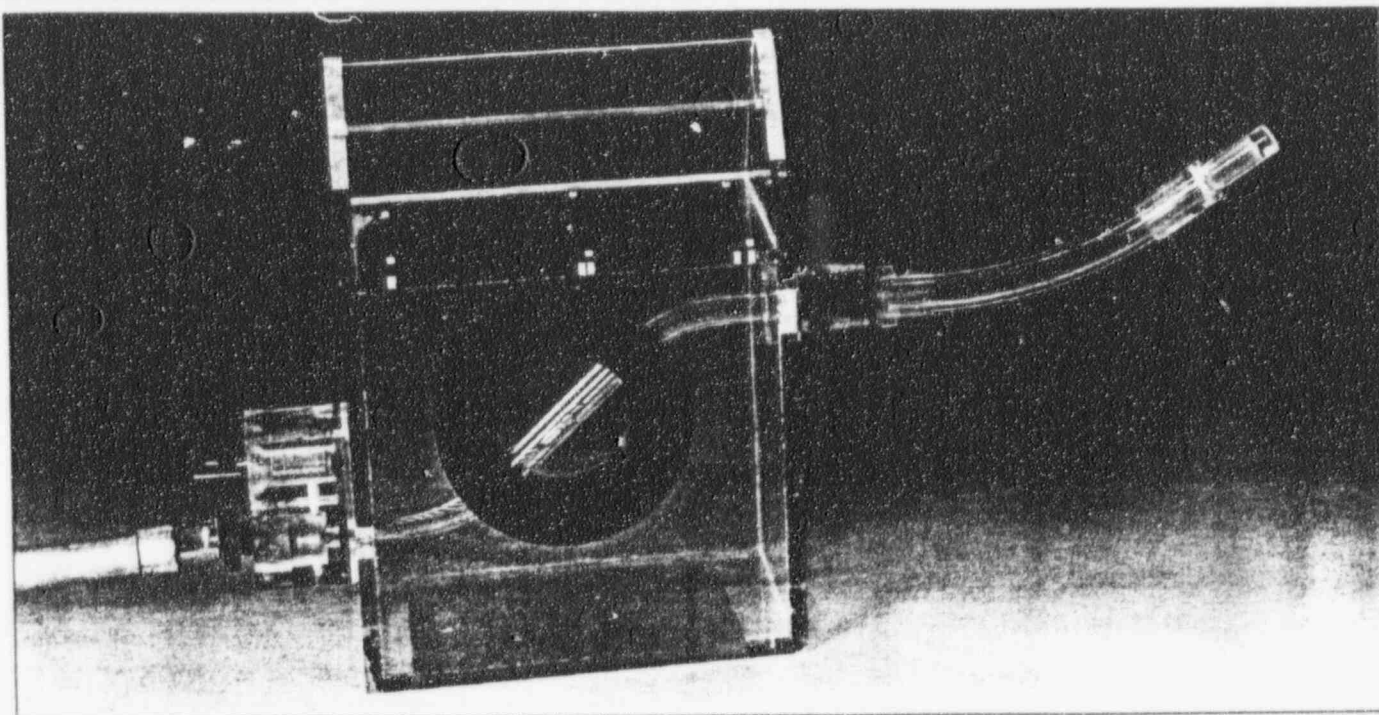
## Control Assembly

- 1.4.1 **CONTROL UNIT** - A unit consisting of a Hand Crank assembly, provided with a Cable Reel or Pistol Grip.
- 1.4.2 **HAND CRANK** - A hand-operated crank on the Cable Reel or Pistol Grip which permits the operator to move the Source from the Source Shield to its exposure position and back again.
- 1.4.3 **TWO DRIVE CABLE HOUSINGS** - House the flexible Drive Cable which mechanically positions the Source.



1. CRANK ASSEMBLY
2. DRIVE CABLE ASSEMBLY
3. DRIVE ASSEMBLY CONNECTOR
4. DRIVE CABLE
5. SOURCE CONNECTOR
6. RETAINERS
7. CAP
8. REEL ASSEMBLY





### Principles of Operation

The Hand Crank moves the Drive Cable through the Drive Cable Housings. The Drive Cable connected to the encapsulated radioactive Source Pigtail Assembly, pushes the Source from its storage position in the Exposure Device

through the Source Tube for exposure and retracts the encapsulated radioactive Source Pigtail Assembly into the storage position.

### Specifications

#### 1.6.1 SOURCE DATA

- (A) Isotope: Iridium 192.
- (B) Maximum Storage Strength: 120 curies.
- (C) System Meets all N.R.C., I.A.E.A. and A.N.S.I. requirements.

#### 1.6.2 SIZE AND WEIGHT

- (A) Exposure Device: 10-7/8 x 4-1/4 x 9-1/4 inches.
- Camera weight, 53 pounds (nominal).

#### 1.6.3 OPERATING SPECIFICATIONS

- (A) Maximum distance, Exposure Device Control Unit: 25 feet.
- (B) Distance, Source Shield to exposure position: 7, 14, or 21 feet.

### Manufacturer Supplied Equipment and Accessorys

#### 1.7.1 EQUIPMENT SUPPLIED

- (A) Exposure Device.
- (B) Three 7-foot Source Tube sections.
- (C) Control Unit complete with Control Cable.

#### 1.7.2 RECOMMENDED ACCESSORY EQUIPMENT

- (A) Iridium 192 Sources (see separate list).
- (B) Survey Meter (I.N.C. Model 2 or 4); Ranges: 0-10, 0-100, 0-1000 mr/hr.
- (C) Dosimeter Range: 0-200 mr/hr.
- (D) Dosimeter Charger (available on I.N.C. meters).
- (E) Exposure Calculator.
- (F) Source Collimator.
- (G) Source Stand



# Recommended Safety Precautions

## General

Industrial Nuclear Exposure Devices are designed to afford the operator maximum protection from radiation. However, precautions consistent with accepted isotope handling practices must be observed at all times.

## Radiation Measuring Instruments

The use of radiation measuring instruments is mandatory; any handling of exposure devices shall be monitored by proper radiation detectors. The following are required:

### 2.2.1 SURVEY METERS

### 2.2.2 FILM BADGES OR TLD's (most regulatory agencies allow either)

### 2.2.3 POCKET DOSIMETERS (required by most regulatory agencies)

### 2.2.4 ALARMING RATE METERS (required in the U.S. and soon to be required in Canada)

## Working Distance

Every precaution should be taken to insure adequate distance between the exposed source and areas accessible to personnel. Surrounding areas should be surveyed - any areas in which readings are excessive should be restricted and posted. (See Code of Federal Regulation, Title 10CFR Part 20, Agreement States regulations, or Canadian AEC regulations; as applicable.) Personnel operating equipment should always work at the maximum possible distance from the source to avoid unnecessary or excessive exposure. (The exposure rate varies inversely with the square of the distance from the source.)

## Exposure Time

Maximum radiation doses have been specified by the N.R.C. (See Code of Federal Regulations, Title 10, N.R.C., Part 20, agreement states regulations, or Canadian regulations.) Maximum doses, however, should be avoided wherever possible.

## Shielding

Wherever possible, the Control Unit and operating personnel should be positioned behind a shield. Shielding materials commonly used to absorb or reduce radiation are concrete, iron, steel, and lead. Tungsten collimators may also be used to absorb or reduce radiation.

## Hand-Carrying

Hand-carrying should be limited to operations where absolutely necessary. Unnecessary personnel exposures can result from hand-carrying the unit close to the body or legs for periods of more than one-half hour per person per week. Anyone carrying the unit should wear a dosimeter or film badge on the part of the body nearest to the source.

## Shipping

Each person authorized by specific license, issued by a cognizant regulatory agency to receive, possess, use, or transfer licensed materials, must conform to all applicable regulations.

## Quality Assurance

Pursuant to 10CFR71, a licensee must establish, maintain, and execute a Quality Assurance Program for his shipping activities.

## Damage

2.9.1 If damage occurs to the equipment while the source is in "Expose" position:

- (A) Secure the restricted area to a 2 mr/hr. boundary.
- (B) Follow your company's operating and emergency procedure instructions.

2.9.2 If damage occurs to the equipment while the source is in "Safe" position:

- (A) **Do not** use any damaged equipment until it has been properly repaired and tested.
- (B) All camera repairs must be made by the manufacturer.
- (C) Ship the loaded camera in its shipping container; ensuring that the source is in the "safe" position, with the safety plug and the dust cap in place; and, that the source reading does not exceed 200 mr/hr. Use the proper labeling in accordance with the requirements of 49CFR.

## Warning

Tampering with or altering of this device is prohibited and will void its warranty.

It is strongly recommended that only INC manufactured and/or approved accessories (control cables, etc.) be used with the IR100 exposure device in order to minimize the possibility of safety-related problems.

# Unpacking/Warranty

## Warning

Do NOT unpack, assemble, operate, disassemble or carry this device unless properly utilizing the required/ appropriate radiation monitoring instrumentation. Read Section 2, "Recommended Safety Precautions," thoroughly before proceeding.

## Unpacking

The model IR100 Portable Exposure System is shipped in a metal drum; with the controls and accessories shipped in a cardboard container. Inspect all shipping containers for any external signs of damage. Open containers and remove the contents.

Remove from cardboard container:

- (A) Control Unit with attached Control Cable.
- (B) Three 7-foot Source Tube sections.

Remove from metal drum:

- (C) Exposure Device.

Examine all items for damage. Check all items against packing list.

## Warranty

Industrial Nuclear Company uses reasonable precautions to insure that all merchandise is free from defects and is accurate to specifications and warrants only that its merchandise is free from defects in materials and workmanship. Industrial Nuclear Company's warranty on the materials and workmanship, employed in its equipment, extends for a period of 12 months from the date of shipment for the IR-100, and for a period of 1 month from the date of shipment for the control and source tube assemblies; but there is no warranty if such equipment is not operated and maintained in accordance with the instructions provided by Industrial Nuclear Company. Industrial Nuclear Company's liability, under the aforesaid warranty, is limited to replacing or repairing, at its own plant, such of the above defects as are reported within the applicable warranty period.

# Preparation for Use

## Warning

Do NOT assemble this device unless properly utilizing the required radiation monitoring instruments. Read Section 2, "Recommended Safety Precautions," thoroughly before proceeding.

## Attaching Source Tube Assembly

- (A) Locate Exposure Device at desired distance (7, 14, or 21 feet) from specimens to be radiographed.
- (B) Remove Safety Plug from front of Exposure Device by cutting the seal wire and unscrewing plug from the Source Tube Connector. Discard seal wire. Insert plug in handle.
- (C) Remove covering from the ends of Source Tube sections to be used, and unroll tubes to full length. Attach one section of Source Tube to Source Tube Connector. Add second or third Source Tube sections as desired, ADDING SECTION WITH ATTACHED TIP LAST. Maximum permissible length is 21 feet.
- (D) Never Operate the Exposure Device with more than three Source Tube sections attached. Do not operate if cable or tubes are damaged.

## Caution

Lay out Source Tube sections as straight as possible, avoiding point supports. A bend radius less than 20 inches may restrict movement of the Drive Cable.

## Attaching Control Assembly

- (A) Place Control Cable Connector End near Exposure Device.
- (B) Unreel Control Cable from Control Unit, forming cable in long loop returning crank to Exposure Device. Remove Dust Cap from Connector.
- (C) Remove Dust Cap from Lock Body and screw it in the handle.
- (D) Rotate Cable Drive Crank (expose) to reveal Drive Cable Connector.
- (E) Connect Drive Cable to Source Pigtail.
- (F) Rotate Cable Drive Crank (retract) to permit threaded connection of Drive Cable Housing to screw into Lock Body.

## Caution

Lay out Control Cable as straight as possible, avoiding point supports. A bend radius less than 3 feet may restrict movement of the Drive Cable.

# Operation

- (A) Turn the Hand Crank (retract) to release lock.
- (B) Rotate lock key on Exposure Device 90° clockwise.

**Note:** Failure to connect Drive Cable to the Source Pigtail Assembly will prevent unlocking of the device. Key cannot be removed except when Device is locked

- (C) Move Crank Assembly away from camera to the proper operating location.
- (D) Return to the device and depress the safety latch.
- (E) Turn the Hand Crank (expose) to move the Source Assembly out of the Exposure Device toward the target.

**Note:** The device is designed so that when the source is returned to the fully shielded position the safety latch will "pop-up", securing the source. The safety latch must be manually reset (depressed) prior to each crank-out of the Source Assembly. All surveys required by the applicable regulatory agency regulations to verify that the source is properly shielded must be performed at the appropriate times.

- (F) Turn the Hand Crank in the retract direction to return the Source Assembly from the target to the Exposure Device.

## Caution

Never operate the Exposure Device with more than three Source Tube sections totaling 21' attached. Do not operate if cable or tubes are damaged.

This Device is designed to prevent accidental removal of the Source without proper connection of the Drive Cable. Verification of the connection must be performed (be retracting the Source Pigtail Assembly) before the Device can be unlocked. As a safety measure, a latching action occurs whenever the Source Assembly is fully retracted. The safety latch must be manually reset (depressed) prior to each crank-out of the Source Pigtail Assembly.

**Note:** The device is designed so that it can only be locked when the Source Pigtail Assembly is in the safe position in the device. Once locked, the unlocking procedure, as previously described, must be followed.

- (G) After source has been retracted to the secured position, apply forward (exposed direction) pressure on the crank assembly handle to ensure the source is secured (captured). Do not lock with Key (counter-clockwise) until source is in the fully retraced captured (shielded) position.

# Lock Assembly

It is imperative that all components of the lock assembly be kept clean. No amount of dirt can be regarded as negligible. Dirt-clogged cables, tubes and connectors impede drive cable movement and cause excessive wear. Such impedence can result in a HAZARDOUS loss of source control.

**Note:** A dirty or "STICKING" crank or drive cable assembly can prevent the safety latch from remaining in the operate position.

## Caution

In the unlikely event the safety loach pops up prior to the source assembly being captured in the safe position, simply depress the safety latch and resume cranking the source assembly into the safe position. **DO NOT**, under any circumstances, lock the device with the key until the source is captured in the safe position. If the above described condition persists and/or the safety latch cannot be depressed, **DO NOT** force the latch. Stop all attempts to correct the situation and call INC for assistance.

# Disassembly

## Caution

DO NOT begin disassembly until the source assembly has been completely retracted into the Exposure Device, and the required surveys of the device and source tube(s) have been completed.

(A) Secure lock.

**Note:** Key cannot be removed except when Device is locked.

(B) Remove Source Guide Tube(s) from Exposure Device.

- (C) Replace Safety Plug. THIS SEQUENCE IS RECOMMENDED AS AN ADDITIONAL SAFEGUARD TO PREVENT ACCIDENTAL SOURCE REMOVAL.
- (D) Disconnect Drive Cable Housing from camera.
- (E) Disconnect Drive Cable from Source Pigtail.
- (F) Replace dust cap on camera.
- (G) Replace cap on Drive Cable Housing.

# Maintenance

## General

It is imperative that all components be kept clean. No amount of dirt can be regarded as negligible. Dirt-clogged Cables, Tubes, and Connectors impede Drive Cable movement and cause excessive wear. Such impedence can result in a hazardous loss of Source control.

### Control Cable Assembly

Inspect Control Cable regularly for signs of damage. Avoid twisting or bending excessively. Recoil Control Cable carefully for storage. Avoid all contact with dirty surfaces - do not drag Cable around. Replace Control Cable Cap when not in use.

## Source Tube

Inspect Source Tube regularly for signs of damage. Avoid twisting or bending excessively. Recoil Source Tube carefully for storage. Avoid all contact with dirty surfaces - do not drag tube around. Replace plastic caps on Source Tube section connectors when not in use.

### Cleaning and Lubrication

See Service Memo (Section 8), "Cleaning and Lubrication of Control Cables, Drive Cables, Drive Unit, and Source Tubes".

### Source Replacement

Renewal Sources are available from industrial Nuclear for replacement in the field. For instructions, see Source Changer Operation Manual.

It is recommended that when a source is to be replaced that the IR-100 be returned to INC for inspection and maintenance of the lock assembly.

# Service Memo

## Cleaning and Lubrication

### 8.1.1 DRIVE CABLE AND CRANK ASSEMBLY

#### (A) Cleaning and Lubrication

- (1) Crank Drive Cable into a clean container of solvent and agitate for a few minutes. Inspect Cable for wear and kinks. Thoroughly drain and dry.
- (2) Disassemble Crank Assembly and clean with solvent. Inspect for bearing wear, housing wear, rust, and damaged gear teeth.
- (3) Lightly coat drive gear with grease and reassemble unit.

### 8.1.2 LOCK ASSEMBLY

#### (A) Cleaning

- (1) Cleaning may be accomplished by a flushing action. Solvent may be poured around the indicator and will flow through the mechanism and bottom drain.
- (2) Lubrication is not required.

## Lock Assembly Overhaul

**Note:** Do NOT Attempt any disassembly of the Lock Assembly until it has been verified that the Source Pigtail has been removed from the Exposure Device.

### 8.2.1 LOCK ASSEMBLY

- (A) Remove Drive Cable Receiver (retainer).
  - (1) With a small Allen Wrench remove the set screws in the Lock Body.
  - (2) Remove the retainer, spring, and slide receiver.
- (B) Remove Lock Cylinder and Indicator Plate.
  - (1) With an Allen wrench remove the screw under the Lock Cylinder.
  - (2) With a long Allen wrench remove the Allen screw in the Lock Body.

**Note:** This screw is inside the housing, under the lock cylinder and is accessible only from below. The screw (item 10 next page) must first be removed.

- (3) The safety latch plate is spring-loaded. Hold down lightly and with the key in the lock slightly rotated, remove the Lock Cylinder Assembly.
- (4) Remove the safety latch spring, and pin.

- (C) Clean all parts except the Lock with solvent.
- (D) Inspect all components for excessive wear or damage.

### 8.2.2 ASSEMBLY

#### (A) Install latch, spring, and pin.

- (1) Place camera on right side to install pin, spring and safety latch plate in the Lock Body. Safety latch must be installed with color section visible. See locked position view.

#### (B) Install Lock Cylinder in body.

- (1) Lock cylinder must be installed in unlocked position with hole in bottom of cylinder down to align with Allen screw installed through bottom of lock body.
- (2) Lock cylinder must be properly inserted in Lock Body in order for cam to engage safety latch. Excessive insertion will misalign hole with Allen screw and may inhibit safety latch plate action.
- (3) Secure Lock cylinder with Allen screw.
- (4) Rotate Lock cylinder to "unlocked" position and test safety latch for smooth "up and down" travel.
- (5) Insert the slide receiver. Note that the pin projecting from the receiver slide must be aligned so as to enter the hole inside the Lock Body cavity beside the large center hole. Correct rotation may be verified by observing that the index mark on the face of the receiver is at the bottom.
- (6) Insert the large spring in the slide receiver.
- (7) Fully insert Drive Cable receiver/retainer into Lock Body cavity and rotate until retainer screw holes align with holes in sides of Lock Body. Insert Allen set screw in bottom of Lock Body to hold retainer.
- (8) To test for proper assembly:
  - (a) Depress safety latch and visually observe that the latch plate opening matches the hole through the slide receiver. This is the "operate" position.
  - (b) Push Drive Cable through camera and attach dummy pig tail to Drive Cable.

**Note:** Test dummy pig tail is extra long to prevent full dust cap installation.
  - (c) Pull Drive Cable with dummy pig tail back (retract) through camera. At this point, the safety latch should "pop-up" to the latched position. Test for proper action by depressing latch, push dummy pig tail out and return. With latch in "up" position and dummy pig tail trapped, rotate key to lock position. Pull cable back, rotate key to unlock. Finally, to verify



for proper assembly, depression of the safety latch to the "operate" position will permit removal of the pig tail through the outlet port of the camera.

- (d) Complete insertion of Allen screws described in (7) and lock side screws with special short screws.
- (e) Replace screw under the Lock Cylinder.

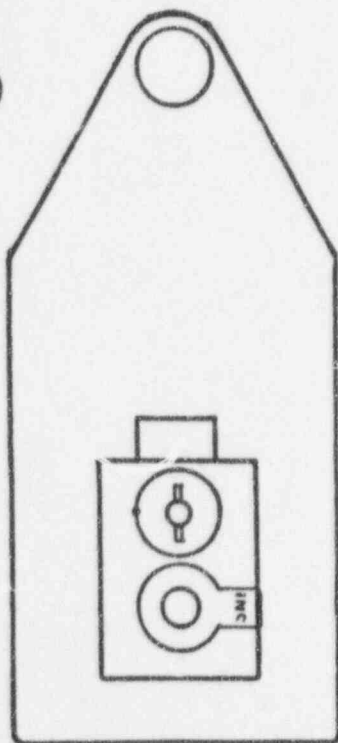
(C) Test complete system as follows:

- (1) Pull (retract) dummy pig tail.
- (2) Safety latch plate will "pop-up".
- (3) Push (expose) dummy pig tail. Dummy pig tail will not move out of camera.
- (4) Rotate key to lock position and remove. Dummy pig tail will not move out of camera. Safety latch plate cannot be depressed.

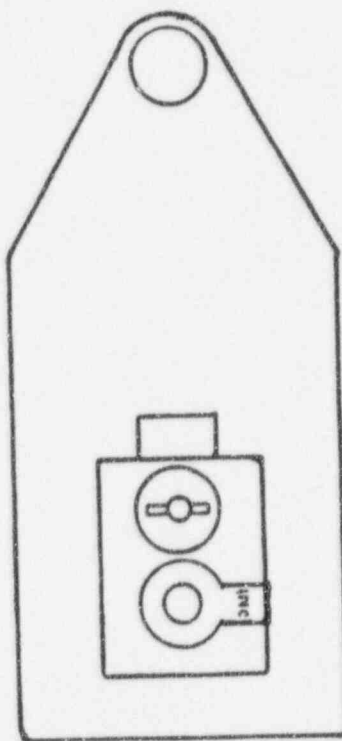
- (5) Insert key and attempt to rotate. (Do NOT force.) Key should not rotate to unlock position.
- (6) Pull (retract) dummy pig tail and rotate key to unlock position. Safety latch plate will depress slightly as key turns.
- (7) Release pull on dummy pig tail, key in unlock position. Indicator plate may now be manually depressed to "operate" position.
- (8) Rotate key to lock position. (Do NOT force.) Key should not rotate.
- (9) Remove dummy pig tail

**Note:** The lock must be in the "operate" mode to permit Source installation.

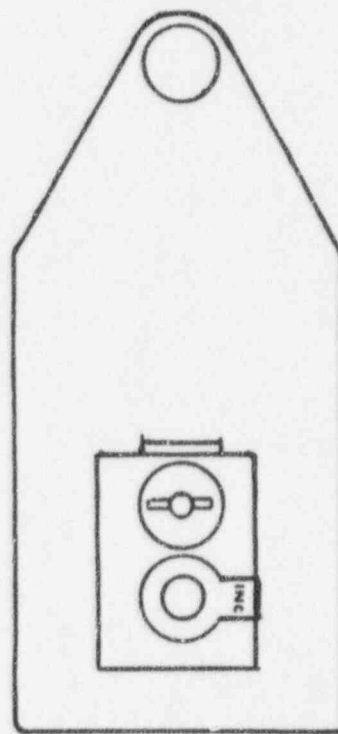
LOCKED  
POSITION



UNLOCKED  
POSITION

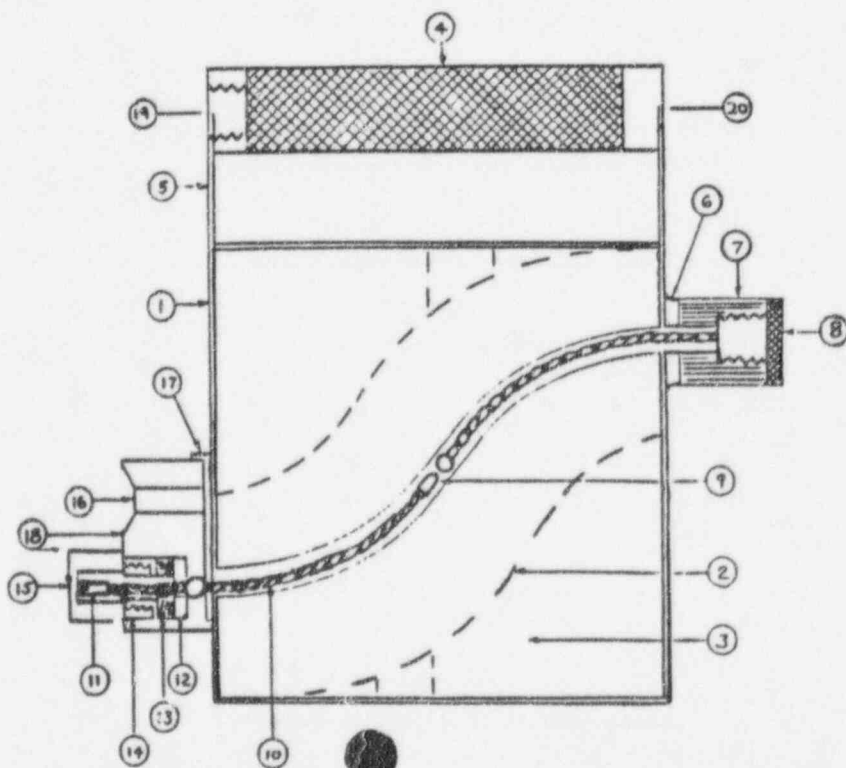
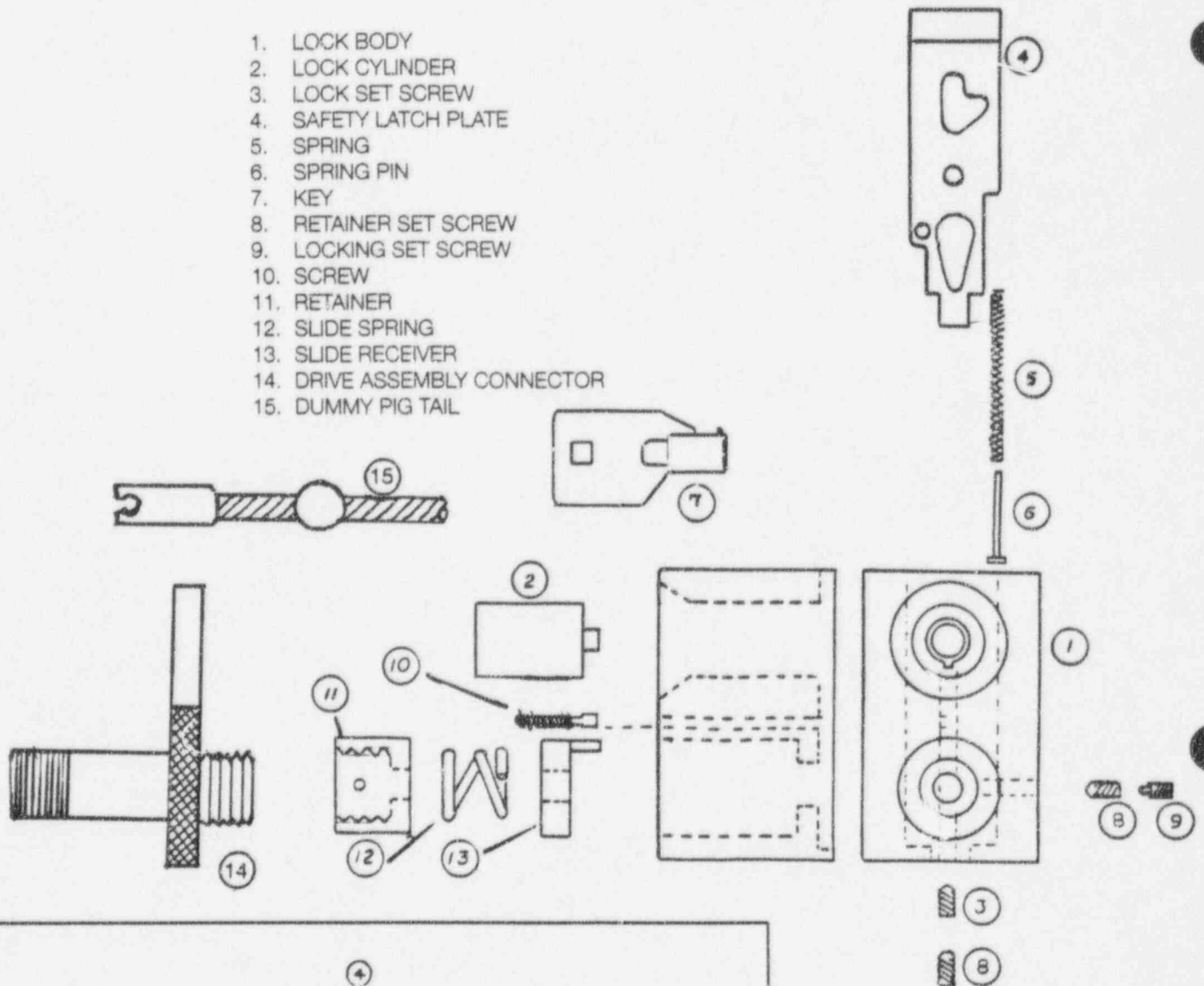


OPERATE  
POSITION





1. LOCK BODY
2. LOCK CYLINDER
3. LOCK SET SCREW
4. SAFETY LATCH PLATE
5. SPRING
6. SPRING PIN
7. KEY
8. RETAINER SET SCREW
9. LOCKING SET SCREW
10. SCREW
11. RETAINER
12. SLIDE SPRING
13. SLIDE RECEIVER
14. DRIVE ASSEMBLY CONNECTOR
15. DUMMY PIG TAIL



1. HOUSING
2. SHIELD
3. FOAM
4. HANDLE
5. HANDLE BRACKET
6. OUTLET FITTING
7. (SOURCE TUBE CONNECTOR)
8. SAFETY PLUG
9. 192-IR CAPSULE
10. PIGTAIL
11. PIGTAIL CONNECTOR
12. SLIDE RECEIVER
13. SLIDE SPRING
14. RETAINER
15. DUST CAP
16. LOCK CYLINDER
17. SAFETY LATCH
18. LOCK BODY
19. DUSTCAP STORAGE
20. SHIP PLUG STORAGE

# MID AMERICAN

## INSPECTION SERVICES • NDE DIVISION

1206 Effie Road - P.O. Box 1427

GAYLORD, MICHIGAN 49735

517-732-8059

### RADIOGRAPHIC EQUIPMENT QUARTERLY INSPECTION AND INVENTORY RECORD

Date of Inspection/QIR. \_\_\_\_\_

Signature of R.S.O. \_\_\_\_\_

#### REMOTE RADIOGRAPHIC EXPOSURE DEVICES

Radiographic Unit \_\_\_\_\_

Manufacturer \_\_\_\_\_

Model \_\_\_\_\_

Serial Number \_\_\_\_\_

Legend:

S-Satisfactory

U-Unsatisfactory

M-Missing

#### Condition Of Units:

Condition of Pigtail Connector \_\_\_\_\_

Condition of Lock &amp; Lock Housing \_\_\_\_\_

Radioactive Material Labels \_\_\_\_\_

Radioactive Material Assay Labels \_\_\_\_\_

Safety Plugs in Position \_\_\_\_\_

Condition of Handle \_\_\_\_\_

Identification of Unit \_\_\_\_\_

Identification Plate \_\_\_\_\_

List any unusual conditions \_\_\_\_\_

List any corrective measures \_\_\_\_\_

#### SOURCE TUBE

Length of Source Tube \_\_\_\_\_ Feet

Material of Source Tube \_\_\_\_\_

List any unusual conditions \_\_\_\_\_

List corrective measures \_\_\_\_\_

#### CONTROL CABLES

Length of Control Cables \_\_\_\_\_ Feet

Type of Lock Box Adapter \_\_\_\_\_

List any unusual conditions \_\_\_\_\_

List corrective measures \_\_\_\_\_

#### SURVEY OF EXPOSURE DEVICES

##### Maximum Survey Readings

Isotope Type \_\_\_\_\_

Activity Source \_\_\_\_\_

Source Serial No. \_\_\_\_\_

Surface \_\_\_\_\_ MR/Hr.

6" \_\_\_\_\_ MR/Hr.

1 Meter \_\_\_\_\_ MR/Hr.

# **NDS PRODUCTS**

## **RA~500 OPERATION MANUAL**

Manufacturer • Calibration • Repair  
Radiation Safety Instruments

P. O. BOX 1896  
PASADENA, TX 77501

111 ANDERSON  
PASADENA, TX 77506

Tel. (713) 475-2986 or (713) 475-8071

Fax (713) 477-6741

## USER CAUTION AND WARNINGS

THE EQUIPMENT HEREIN IS DESIGNED AND MANUFACTURED IN COMPLIANCE WITH ALL APPLICABLE SAFETY STANDARDS; NEVERTHELESS, CERTAIN HAZARDS ARE INHERENT IN THE USE OF ALL ELECTRONIC EQUIPMENT. ADEQUATE WARNINGS ARE INCLUDED IN THIS MANUAL AND ON THE PRODUCT ITSELF TO COVER HAZARDS THAT MAY BE ENCOUNTERED IN NORMAL USE AND SERVICING OF THIS EQUIPMENT. NO OTHER PROCEDURES ARE WARRANTED BY NDS PRODUCTS. IT SHALL BE THE OWNER'S OR USER'S RESPONSIBILITY TO ASSURE THAT THE PROCEDURES HEREIN ARE METICULOUSLY FOLLOWED, AND ESPECIALLY THAT THE WARNING AND CAUTIONARY NOTES ARE HEEDDED. FAILURE ON THE PART OF THE USER IN ANY WAY TO FOLLOW THE PRESCRIBED PROCEDURES SHALL ABSOLVE NDS PRODUCTS AND ITS AGENTS FROM ANY RESULTING LIABILITY.

## READ YOUR OPERATION MANUAL

## WARRANTY

NDS PRODUCTS WARRANTS THAT THE PRODUCTS COVERED HEREBY SHALL BE FREE FROM DEFECTS IN WORKMANSHIP AND MATERIALS FOR A PERIOD OF ONE YEAR FROM DATE OF NDS PRODUCTS SHIPMENT (GM TUBE IS WARRANTED BY MANUFACTURER FOR 90 DAYS). THE FOREGOING WARRANTY DOES NOT APPLY TO ANY PRODUCTS WHICH HAVE BEEN SUBJECT TO MISUSE (INCLUDING STATIC DISCHARGE), NEGLIGENCE, ACCIDENT, OR MODIFICATION. NDS PRODUCTS' SOLE OBLIGATION TO BUYER HEREUNDER FOR PRODUCTS FAILING TO MEET THE AFORESAID WARRANTY SHALL BE, AT NDS PRODUCTS' DISCRETION, TO REPAIR AND RECALIBRATE THE NON CONFORMING PRODUCT OR TO REPLACE THE NONCONFORMING PRODUCT WHERE WITHIN THE WARRANTY PERIOD: 1) THE BUYER HAS RETURNED THE NONCONFORMING PRODUCT TO NDS PRODUCTS, FREIGHT PREPAID, AND 2) NDS PRODUCTS HAS DETERMINED THAT THE PRODUCT IS NONCONFORMING AND THAT SUCH NONCONFORMITY IS NOT A RESULT OF IMPROPER USE, REPAIR, MODIFICATION OR OTHER MISUSE BY BUYER OR USER.

## WARRANTY (CONTINUED)

THE FOREGOING WARRANTY AND REMEDIES ARE EXCLUSIVE AND ARE MADE EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, EITHER IN FACT OR BY OPERATION OF LAW, STATUTORY OR OTHERWISE, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR USE. NDS PRODUCTS NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR IT ANY OTHER LIABILITY IN CONNECTION WITH THE SALE, OR USE OF ITS PRODUCTS, AND NDS PRODUCTS MAKES NO WARRANTY WHATSOEVER FOR PRODUCTS NOT MANUFACTURED BY NDS PRODUCTS. NDS PRODUCTS SHALL NOT BE LIABLE FOR DAMAGES DUE TO DELAYS IN DELIVERIES OR USE AND SHALL IN NO EVENT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND; WHETHER ARISING FROM CONTRACT, TORT, OR NEGLIGENCE, INCLUDING BUT NOT LIMITED TO, LOSS OF PROFITS, LOSS OF GOODWILL, OVERHEAD OR OTHER LIKE DAMAGES.

## DESCRIPTION

THE MODEL RA-500 IS A BELT WORN RATE ALARM WHICH PROVIDES AN IMMEDIATE AUDIBLE INDICATION IN RADIATION FIELDS IN EXCESS OF 500 mR/hr.

THE SIGNALS ARE HIGH PITCHED CHIRPS AT 450 mR/hr AND CHANGE TO A SOLID TONE AT 530 mR/hr. THE RA-500 MEETS 10 CFR 34.33 FOR PERSONNEL MONITORING.

FEATURES INCLUDE A RUGGED, TWO PIECE DIE-CAST ALUMINUM CASE, SYSTEM TEST INCLUDES BATTERY TEST (LED RED LIGHT ON GOOD BATTERY) AND ALARM TEST (AUDIBLE INDICATION), RECESSED CONTROLS PROVIDE LONG LIFE AND LESS DOWN TIME.

## OPERATION

SLIDE ON - OFF SELECTOR SWITCH TO ON POSITION. CHECK BATTERY AND ALARM TONE USE A PAPER CLIP OR EQUIVALENT AND PUSH WHERE INDICATED. THE RED LED BATTERY LIGHT WILL LIGHT IF THE BATTERY IS OK AND THE ALARM SHOULD SOUND. DO NOT USE IF EITHER TEST FAILS, REPLACE BATTERY IF INDICATED.

NOTE: IT IS RECOMMENDED THAT THE UNIT BE TESTED PERIODICALLY IN A RADIATION FIELD.

## SPECIFICATIONS

RADIATION DETECTED.....GAMMA & X-RAY 80 TO 1500 KeV.  
CONTROLS.....ON/OFF - BATTERY INDICATOR LED LIGHT -  
BATTERY AND AUDIO CHECK PUSH BUTTON SWITCH  
DETECTOR.....HALOGEN QUENCHED GM TUBE TYPE 716. AREAL DENSITY 90  
mg/cm SQUARED. EFF. LENGTH .25 IN. EFF. DIAMETER  
.19 IN. MATERIAL 446 SS.  
ALARM OUTPUT.....SOLID STATE AUDIO TONE TRANSDUCER. AT 450 mR/hr  
STARTS TO ACTIVATE - WILL EMIT A LOUD CRACKLING  
SOUND - AS THE FIELD INTENSIFIES THE ALARM  
BECOMES ONE SOLID TONE. ACCURACY + OR - 20%  
POWER.....9 VOLT (EVEREADY EN95 OR EQUIVALENT) COMES WITH EV22



BATTERY LIFE..... APPROX. 6 MONTHS IN NORMAL USE. BATTERY LIFE IS  
 SHORTENED WHEN ALARM IS ACTIVATED. FULL LOAD  
 CONSTANT ALARM OF 500 mR/hr - 50 HOURS OF  
 BATTERY LIFE USING EN95  
 DIMENSIONS..... 2.5 IN. WIDE X 4.25 IN. HIGH X 1.25 IN. THICK  
 EXPOSURE RATE LIMIT.....GREATER THAN 1000 R/hr  
 WEIGHT.....8 OUNCES WITH BATTERY  
 ENVIRONMENTAL EFFECTS..... -10 TO 50 DEG. C. RELATIVE HUMIDITY  
 0 TO 90 % OVER TEMPERATURE RANGE  
 WARM UP TIME.....NO WARM UP TIME REQUIRED  
 CALIBRATION..... SINGLE POTENTIOMETER LOCATED BESIDE BATTERY  
 EACH UNIT IS CALIBRATED AT FACTORY AND CERTIFIED  
 FOR ONE YEAR  
 ALARM OUT PUT.....100 db AT SIX INCHES

#### LIMITATION (SATURATION) \* CAUTION \*

IT IS A WELL KNOWN PHENOMENON THAT ALL GEIGER-MUELLER TUBE INSTRUMENTS SATURATE OR OVERLOAD AT SOME POINT (THIS MAY ALSO BE CALLED FLOODING OR JAMMING). THIS PARTICULAR MODEL WILL SATURATE WHEN IN A RADIATION FIELD IN EXCESS OF 1000 R/hr WHEN IT HAS BEEN PROPERLY MAINTAINED. IF THE RADIATION FIELD IS IN EXCESS OF 1000 R/hr, ONE OF TWO EVENTS WILL OCCUR: 1) THE INSTRUMENT WILL EMIT A CONTINUOUS ALARM TONE AND ONCE IT REACHES SATURATION, IT WILL STOP, OR 2) IF THE INSTRUMENT IS TURNED ON IN A FIELD IN EXCESS OF 1000 R/hr, THE INSTRUMENT WILL NOT REACT.

ALTHOUGH A 1000 R/hr FIELD IS EXTREMELY HIGH AND MAY NEVER BE ENCOUNTERED, PROPER RADIATION SAFETY PROCEDURES AND REGULATIONS SHOULD BE OBSERVED.

#### INSTRUMENT CALIBRATION

INSTALL A FRESH 9 VOLT BATTERY AND LEAVE THE BATTERY OUT OF THE BATTERY COMPARTMENT. LOOK INSIDE THE BATTERY COMPARTMENT AND YOU WILL SEE A SINGLE POTENTIOMETER WITH A BLUE THUMBWHEEL, THIS IS THE CALIBRATION POTENTIOMETER.

WHEN THE POWER SWITCH IS TURNED ON, A SINGLE CHIRP SHOULD BE HEARD. IF THE UNIT IS OPERATING PROPERLY, A LOW FREQUENCY ( ABOUT 400/MINUTE) MOTORBOATING SHOULD BE HEARD WHEN THE UNIT IS HELD CLOSE TO THE EAR IN A QUIET LOCATION.

THE INSTRUMENT IS CALIBRATED BY PLACING THE UNIT IN A 450 mR/hr Cs-137 RADIATION FIELD. IF NECESSARY ADJUST THE POTENTIOMETER UNTIL A CRACKLING CHIRP IS HEARD. MOVE THE UNIT TOWARD A RADIATION FIELD AND THE ALARM SHOULD BECOME A CONTINUOUS TONE.



## MAINTENANCE

WHEN THE INSTRUMENT IS ON, YOU WILL HEAR A CONTINUOUS, LOW FREQUENCY MOTORBOATING SOUND WHEN HELD NEAR THE EAR. IF THERE IS NO SOUND, CHANGE THE BATTERY BY UNSCREWING THE BACKPLATE AND REPLACING WITH A 9 VOLT BATTERY.

KEEP INSTRUMENT FREE OF DIRT AND MOISTURE.

KEEP INSTRUMENT DRY. IF IT SHOULD GET WET DO NOT USE UNTIL COMPLETELY DRY.

THE INSTRUMENT IS DESIGNED TO BE WORN ON THE BELT. THIS WILL REDUCE UNNECESSARY VIBRATIONS THAT MAY CAUSE DAMAGE.

REMEMBER: THE RA-500 IS A SAFETY DEVICE DESIGNED TO REDUCE YOUR OVEREXPOSURES. WITH PROPER CARE IT WILL GIVE YOU LONG AND DEPENDABLE SERVICE.

WARNING: THIS INSTRUMENT CONTAINS CMOS DEVICES. NO SERVICE SHOULD EVER BE ATTEMPTED BY OTHER THAN A COMPETENT TECHNICIAN THOROUGHLY FAMILIAR WITH THESE COMPONENTS. CURRENT LEAKAGE IN SOLDERING IRONS OR OTHER NON-GROUNDED TOOLS ALONG WITH STATIC ELECTRICITY CAN INSTANTLY DESTROY CMOS ICs. SINCE THIS UNIT HAS IC SOCKETS DO NOT ATTEMPT TO REMOVE OR REPLACE THE ICs WITHOUT OBSERVING ESD PRECAUTIONS.

## RATE ALARM CALIBRATION CERTIFICATE

NAME: Mid-American Inspection Service

P.O. Box 1427

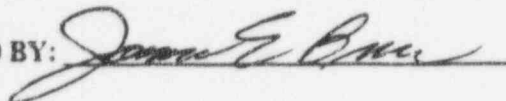
Gaylord, MI. 49735

CALIBRATION DATE: 05-17-96 CALIBRATION DUE DATE: 05-17-97

	<u>MODEL</u>	<u>SER. NO.</u>	<u>RADIATION FIELD</u>	<u>TRIP POINT</u>
1.	<u>RA-500</u>	<u>6012</u>	<u>400-600 MR</u>	<u>500 mR</u>
2.	<u>RA-500</u>	<u>6013</u>	<u>"</u>	<u>400 mR</u>
3.	<u>RA-500</u>	<u>6016</u>	<u>"</u>	<u>400 mR</u>
4.	<u>RA-500</u>	<u>6017</u>	<u>"</u>	<u>500 mR</u>
5.	<u>RA-500</u>	<u>9425</u>	<u>"</u>	<u>400 mR</u>
6.	<u>RA-500</u>	<u>11660</u>	<u>"</u>	<u>500 mR</u>
7.	<u>RA-500</u>	<u>11661</u>	<u>"</u>	<u>500 mR</u>
8.	<u>RA-500</u>	<u>13052</u>	<u>"</u>	<u>400 mR</u>
9.	<u>RA-500</u>	<u>13054</u>	<u>"</u>	<u>400 mR</u>
10.	<u>RA-500</u>	<u>13056</u>	<u>"</u>	<u>400 mR</u>

COMMENTS: Replaced switch in S/N 9425

THE ABOVE RATE ALARMS HAVE BEEN CALIBRATED IN ACCORDANCE WITH N.R.C.  
10CFR 34 USING 120 MILLICURIES OF CS-137.

CALIBRATED BY: 

## CONVERSATION RECORD

TIME 3:00 pm DATE 8/21/96

☐ VISIT ☒ CONFERENCE ☒ TELEPHONE☐ INCOMING  
☒ OUTGOING

NAME OF PERSON(S) CONTACTED OR IN CONTACT

Terry Wilkens, RSO

ORGANIZATION (OFFICE, DEPT. ETC.)

Mid American Insp

TELEPHONE NO.

517-732-8059

## SUBJECT

License No. 21-26060-01  
CN 397275

## SUMMARY

I spoke with Terry about the license renewal application and requested additional information/clarification on the items listed below. We also discussed the source/device combinations to be listed on the license. Terry explained that cameras listed in Condition 10.A., B., and C. are no longer used and are in storage awaiting disposal/transfer to Amersham. He requested to add Industrial Nuclear Ir-100 with the Ind. Nuclear 32 & 33 sources and IR-50 changer.

The following items needed additional information:

- ✓ 1. Describe training and experience for Terry in performing survey instrument calibrations. Also note the location within the facility where they will perform calibrations.
- ✓ 2. Please clarify certain statements in your outline for the 30 hour training you will provide to individuals qualifying to become assistant radiographers. This training should be limited to demonstration of the use of radiographic equipment. Individuals cannot actually use radiographic equipment (containing "live" sources) even under the supervision of a radiographer until they have qualified as radiographers' assistants.
- ✓ 3. Confirm that you will calculate the "high radiation area" posting distance rather than perform survey for the distance. Confirm that the job site will have constant surveillance. Describe steps that you will take if an individual enters the boundary. Describe the securing of cameras at temporary job sites. Note that it is not acceptable to the chain the camera to a post or fence.
- ✓ 4. Please designate your low background radiation area where film badges and pocket dosimeters are to be stored when not in use.
- ✓ 5. In your emergency procedures, you stated that the RSO may perform source retrieval operations under specific circumstances. In the event of a disconnection or loss of a radiography source, certain procedures must take place to recover the source. You need to submit your procedures for source recovery, considering the following:
  - a. At no time can an assistant radiographer be allowed to perform source recovery operations.

- b. Describe Terry's qualifications and experience with the source recovery operations. Radiography personnel must not attempt to perform source recovery or retrieval operations unless they have received specific training and actual practice in these operations using a "dummy" source. If you intend for Terry or Robert Story to perform source retrieval or recovery, please include a description of his training and practice with dummy sources.

An alternate procedure would be to secure the area, maintain surveillance, call the RSO who would arrange for properly trained representatives of the manufacturer or other authorized entity to safely recover the source.

- ✓ 6. Please verify that you will instruct all radiography personnel to immediately notify management of any malfunctions or defects found in radiography equipment.
- ✓ 7. Please submit your procedures for performing quarterly inspection and maintenance of equipment. This should include procedures for each device you wish to possess and use. If radiography personnel are assigned the task of performing the quarterly inspection and maintenance, your instructions your provide step-by-step procedures for each manufacturer's device.
- ✓ 8. In your application, you committed to provide radiographers and assistant radiographers with alarming ratemeters. Please note that the alarm ratemeter must have an audible alarm at a preset dose rate of 500 milliroentgens per hour. It must be checked for operability each day, prior to start of radiography operations. Section 34.33 (f) (4) requires that ratemeters be calibrated annually for proper response ( $\pm 20\%$ ). Please submit your procedures for their annual calibration.

---

ACTION REQUIRED

Respond in writing within 30 days to Control Number 397275.

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NAME OF PERSON DOCUMENTING CONVERSATION

D.A. Piskura

SIGNATURE

*D.A. Piskura*

DATE

| 8/21/96  
|

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ACTION TAKEN

/

SIGNATURE

TITLE

DATE