

DL-031296-05



7523 Whitepine Road
Richmond Virginia 23237
PH (804) 271-5447
FAX (804) 271-7692

March 12, 1996

Mr. Hector Bermudez
Nuclear Materials Licensing Section
U.S. Nuclear Regulatory Commission
Region II
101 Marietta Street, N.W., Suite 2900
Atlanta, Georgia 30323-0199

RE: Amendment Request of Materials
License No. 45-27519-01

Dear Mr. Bermudez:

This letter is in reference to a requested amendment to Western Stress, Inc.'s radioactive materials license No. 45-27519-01.

Included in this amendment request are organizational changes, owning company changes, corporate office relocation, changes in sealed sources, exposure devices, source changers, and subsequent revision to Western Stress's Radiation Safety Manual.

At the time of purchase Western Stress respectfully request that its radioactive materials license be amended as follows:

1. Western Stress is in the process of being purchased by Analytic Stress Relieving, Inc. The corporate office will be relocated from 111 North 16th Street, La Porte, Texas 77571, to 117 Board Road, Lafayette, Louisiana 70508, and the new telephone number is (318) 237-8790. This will become the corporate office of record for Western Stress, A Division of Analytic Stress Relieving, Inc. and is currently the corporate office of Analytic Stress Relieving, Inc. Western Stress's branch offices will retain the name of Western Stress and become a division of Analytic Stress Relieving, Inc.

The corporate radiation safety files will continue to be maintained in the Richmond, Virginia office of Western Stress. All previous references to Western Stress, Inc. in the License and Radiation Safety Manual shall be referred to as Western Stress, A Division of Analytic Stress Relieving, Inc.

2. I am not accepting a position with Analytic Stress Relieving, Inc. at the time of the sell of Western Stress, Inc.'s assets my employment will be terminated.



U. S. Nuclear Regulatory Commission
Page 2,

Western Stress's management is increasing the responsibilities of Mr. Raymond M. Martin, District Radiation Safety Officer to include the responsibilities of Corporate Radiation Safety Officer.

Correspondence previously addressed to me at the Richmond, Virginia office should be addressed to Mr. Raymond M. Martin at the same location.

Mr. Martin's resume is enclosed for your review.

3. Western Stress no longer utilizes or stores the Amersham Model 90003 source assemblies, Model 920 exposure devices or Model 850 source changers for Ir-192 radiographic operations.

All references to these models should be deleted from our license. A copy of the exposure device and source assemblies disposition invoice from Amersham is enclosed for your review.

Our license's reference to the Amersham Source Changer Model 650 should be modified to read Amersham 650L. Reference to the Amersham Model 660A Exposure Device should be deleted from our license.

Western Stress's Co-60 Amersham Model 680 and drive control cables are retrofitted to the 680A compliance requirement.

A copy of the retrofit invoice from Amersham is enclosed for your review.

4. Western Stress's Radiation Safety Manual has been modified to reflect the changes in the radiographic equipment requirements. The revision also includes references to pregnant woman/unborn fetus, and miscellaneous form changes and, or additions.

I have enclosed two copies of the updated Radiation Safety Manual and emergency response telephone list for your records. Also, I am enclosing a check in the amount of \$700.00 for the amendment.



U.S. Nuclear Regulatory Commission
Page 3.

Western Stress values a safe work environment for our employees and the general public. We look forward to working with you to assure our Radiation Safety Program meets all Federal Guidelines. If you have any inquiries concerning this amendment request or require additional information, please call our Richmond, Virginia office at (804) 271-5447, a 24-hour network.

Respectfully Submitted,
WESTERN STRESS, Inc.

James G. Speese
Corporate Radiation Safety Officer

Enclosures

- cc. Ryotaro Mogi - President/CEO
Western stress, Inc.
- Patrick Gauthier - President
Analytic Stress Relieving, Inc.
- Raymond M. Martin - District RSO
Western Stress, Inc.
- File

PLEASE REMIT TO:
AMERSHAM CORPORATION
 P.O. BOX 95498
 CHICAGO, IL 60694-5498

INVOICE

INVOICE	PAGE
16403	
DATE	
1/22/96	

SOLD TO
 WESTERN STRES
 7523 WHITEPINE ROAD
 RICHMOND VA 23237

SHIP TO
 WESTERN STRESS
 7523 WHITEPINE ROAD
 RICHMOND VA 23237

CUST. NO.	SHIP VIA	SALES ORDER NO.	PURCHASE ORDER NUMBER	TERMS		
1-1943400		0063545		NET 30 DAY		
ITEM NUMBER	DESCRIPTION	QUANTITY SHIPPED	QUANTITY BACK ORDERED	UNIT PRICE	AMOUNT	
TSN80003	*BILLING-WALLING GRP ARRV* *THANK YOU FOR YOUR ORDER AMERSHAM APPRECIATES YOUR BUSINESS** DISPOSITION FEE FOR CUST. PROP 920 GRP. SN: 39, 40, 41, 43, 44, 45, 46, 48, 49, 50, 52, 53 CUST. PROP. MODEL 920 GRP DISPOSITION FEE FOR CUST. PROP IR192 MODEL 90003 APPROX 1 CI SN: 1280, 1288, 1299, 1289, 1311, 1242, SN: 1262, 1303, 1305, 1287	12	057710	224.000	2,688.00	
CP920 TSN80003		12			NO CHARGE NO CHARGE	
TOTAL WEIGHT	NET SALES AMOUNT	TRADE DISCOUNT	MISCELLANEOUS CHGS	TAXES	TERMS DISCOUNT	AMOUNT DUE
	2,688.00					2,688.00

INVOICE

DATE	3-12-96
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PLEASE REMIT TO

AMERSHAM CORPORATION
 P.O. BOX 95498
 CHICAGO, IL 60694-5498

SENT TO

WESTERN STRESS
 7523 WHITE PINE ROAD
 RICHMOND VA. 23237

SHIP TO

HOLD FOR LICENSE AMENDMENT

CUST NO	SALES ORDER NO.	PURCHASE ORDER NUMBER	TERMS
58500	C063544	057710	
ITEM NUMBER	DESCRIPTION	QUANTITY SHIPPED	QUANTITY BACK ORDERED
TSNR1680	RETROPIT 680 SN# 338	1 ea.	0
CP680A	680A, SN# A 338	1 ea.	0
TSNR1000	RETROPIT OF 664 CONTROL ASSMY	1 ea.	0
CP664	REBL ASSMY	0	0
CPC060	COBALT SOURCE MODEL A424-14 SN# 216	0	0
NOTE: SHIPPING TO BE APPLIED AT TIME OF SHIPMENT.			
88* SHIPPING CHARGES WILL BE ADDED AT TIME OF SHIPMENT.			
NET SALES AMOUNT		3180.00	
TOTAL WEIGHT		3180.00	
MISCELLANEOUS CHGS.		** FRT TO BE ADDED AT TIME TO SHIPMENT	
TRADE DISCOUNT			
TAXES			
AMOUNT DUE		\$3180.00	

Amersham QSA AP-1794489

FOR FURTHER INFORMATION:
 800-827-1764 X 404
 AMERSHAM CORPORATION
 2038 SO CLEARBROOK DRIVE
 ARLINGTON HEIGHTS, IL 60007-4682
 FAX# (708) 583 8000

PLEASE CHECKS WE RE PRODUCED IN COMPLIANCE WITH THE REQUIREMENTS OF THE FAIR LABOR STANDARDS ACT OF 1938 AS AME NEEDED

Western
Stress,

A Division of Analytic Stress Relieving, Inc.

RADIATION SAFETY BULLETIN

Corporate Health Physics

EMERGENCY RESPONSE TELEPHONE NUMBERS

Revised March 11, 1996

The following is a list of emergency response telephone numbers for Radiographical Safety Supervisory Personnel. This document shall be posted in every NDE truck/rig, on all equipment room doors and distributed to all radiological personnel.

In the case of an emergency, always refer to Section 12 of your Radiation Safety Manual for the appropriate emergency procedure.

Always attempt to contact your District Radiation Safety Officer first. Radiation Safety Supervisory Personnel are on 24 hour call. If you believe that you have a problem, DO NOT hesitate to call for assistance.

Raymond Martin - Radiation Safety Officer
Richmond/Corporate

Office Telephone.....804/271-5447
Home Telephone.....804/530-1952
Pager.....800/719-3702

Leo Clark - Radiation Safety Officer
Pennsauken

Office Telephone.....609/665-0717
Home Telephone.....609/939-3606
Pager.....609/725-0660

RADIATION SAFETY BULLETIN

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Raymond Martin - Radiation Safety Officer
Richmond Corporate

Home Telephone.....814 271-8447
Home Teletype.....814 271-1952
Mobile.....214 214-3712

Bob Clark - Radiation Safety Officer
Richmond

Home Telephone.....814 271-1711
Home Teletype.....814 271-1711
Mobile.....214 214-3712

RAYMOND M. MARTIN
17813 WILLOWYNDE ROAD
(804) 530-1952

JOB OBJECTIVE

To provide my employer and clients with seventeen years of experience, knowledge, and proven efficiency in as safe a working environment my extensive training can provide.

WORK EXPERIENCE

WESTERN STRESS, INC., Richmond, VA.

08/10/93 - PRESENT

During employment my responsibilities progressed as follows:

Level II NDE Technician	08/10/93 - 03/18/94
Level II NDE Technician, Assistant RSO, NDE Supervisor	03/18/94 - 02/27/95
Level II NDE Technician, District RSO, and NDE Supervisor	02/27/95 - Present

OLD DOMINION FABRICATORS, Chester, VA.

09/77 - 1992

I started employment as an Assistant Radiographer and progressed to a Radiographer, Lead Radiographer, NDE Supervisor, Quality Control Manager, and Radiation Safety Officer. I was appointed Level III Radiographic, Magnetic Particle, and Liquid Penetrant Inspector.

I was responsible for the complete NDE and Inspection operations. Other responsibilities included, but not limited to:

- Supervising and scheduling of an eight member inspection department with an annual budget of approximately \$500,000 including the purchasing of equipment.
- The training and examination of all NDE and Inspection Level I and Level II personnel for certification.
- Responsible for the proper use and maintenance of X-Ray and Gamma Ray equipment, including the exchange of Iridium 192 sources from shipping containers to the exposure devices and return of depleted source(s).
- Leak testing of exposure devices. Survey meters, dosimeters, and rate alarm calibrations, film badge exchange and all associated documentations.

EDUCATION

High school diploma, graduation date 1976, Meadowbrook High School

TRAINING

(1994) 26DE Plus Digital Ultrasonic thickness measurement training seminar (16 hours)	Panametrics Richmond, VA
--	-----------------------------

(1993) Ultrasonic Testing Level I (40 hours)	Panametrics Waltham, MA
--	-------------------------

TRAINING (CONT.)

(1982) Magnetic Particle Testing Level II course
(21 hours)

The Old Dominion Section of the American
Society for Nondestructive Testing, Richmond, VA.

(1981) Industrial Radiography Level II course
(40 hours)

The Old Dominion Section of the American
Society for Nondestructive Testing, Richmond, VA.

(1980) Introduction to UT, ET, & AET
(15 hours)

The Old Dominion Section of the American
Society for Nondestructive Testing, Richmond, VA.

(1979) Industrial Radiography Safety
(10 hours)

The Old Dominion Section of the American Society
for Nondestructive Testing and J. Sargeant Reynolds
Community College Richmond, VA.

(1979) Basic Methods of Nondestructive Testing
(27 hours)

The Old Dominion Section of the American Society
for Nondestructive Testing and J. Sargeant Reynolds
Community College, Richmond, VA.

(1978) Radiographic Testing (PI-4-6)
Magnetic Particle Testing (PI-4-3)
Liquid Penetrant Testing (PI-4-2)

General Dynamics - Programmed instruction
for Nondestructive Testing

(1978) Industrial Radiography Radiation Safety
(40 hours)

F. L. Clifford Associates Niantic CN
Richmond, VA

As indicated in the above training summary, I have completed an excess of 221 hours of formal training in nondestructive testing of which more than 100 hours have been related to industrial radiography and radiation safety.

I would like to continue advancing in the field that I have been trained and am qualified for.

REFERENCES AVAILABLE UPON REQUEST

RAYMOND M. MARTIN
17813 WILLOWYNDE ROAD
(804) 530-1952

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- Leak testing of exposure devices. Survey meters, dosimeters, and rate alarm calibrations, film badge exchange and all associated documentations.

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(1993) Ultrasonic Testing Level I (40 hour)	Panametrix, Waltham, MA
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(21 hours)

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Society for Nondestructive Testing, Richmond, VA.

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(40 hours)

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The Old Dominion Section of the American
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Magnetic Particle Testing (PI-4-3)
Liquid Penetrant Testing (PI-4-2)

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LEASE HELMIT TO

AMERSHAM CORPORATION
P.O. BOX 95498
CHICAGO, IL 60694-5498

INVOICE

16403	
DATE	
1/22/96	

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WESTERN STRESS
7523 WHITEPINE ROAD

SHIP TO

WESTERN STRESS
7523 WHITEPINE ROAD

L RICHMOND

VA 23237

VA 23237

CUST. NO.	SHIP VIA	SALES ORDER NO.	PURCHASE ORDER NUMBER	TERMS	
1-1943400		C063545		NET 30 DAY	
ITEM NUMBER	DESCRIPTION	QUANTITY SHIPPED	QUANTITY BACK ORDERED	UNIT PRICE	AMOUNT
SNB0003	*BILLING-WALLING GRP ARRY* *THANK YOU FOR YOUR ORDER AMERSHAM APPRECIATES YOUR BUSINESS*** DISPOSITION FEE FOR CUST. PROP EA 920 GRP. SN: 39, 40, 41, 43, 44, 45, 46, 48, 49, 50, 52, 53 CUST. PROP. MODEL 920 GRP DISPOSITION FEE FOR CUST. PROP EA IR192 MODEL 90003 APPROX 1 CI SN: 1280, 1288, 1299, 1289, 1311, 1242, SN: 1262, 1303, 1305, 1287	12		224.000	2,688.00
P920 SNB0003		10			NO CHARGE NO CHARGE
TOTAL WEIGHT	NET SALES AMOUNT	TRADE DISCOUNT	MISCELLANEOUS CHGS	TERMS DISCOUNT	AMOUNT DUE
	2,688.00				2,688.00

FOR FURTHER INFORMATION 800-822-1784 X 408
 AMERSHAM CORPORATION
 2638 SO CLEARBROOK DRIVE
 ARLINGTON HEIGHTS, IL 60006-4008
 FAX (708) 963-9004

THESE GOODS WERE PRODUCED IN COMPLIANCE WITH THE REQUIREMENTS OF
 THE FAIR LABOR STANDARDS ACT OF 1938 AS AMENDED

Amersham QSA AR-12W4658

REMITTANCE COPY

INVOICE
 DATE
 3-12-96

SEE REMIT TO:
AMERSHAM CORPORATION
 P.O. BOX 95498
 CHICAGO, IL 60694-5498

SOLD TO
 WESTERN STRESS
 7523 WHITE PINE ROAD
 RICHMOND VA. 23237

SHIPP TO
 HOLD FOR LICENSE AMENDMENT

TOTAL P.02

CUST NO	ITEM NUMBER	DESCRIPTION	SHP VA	SALES ORDER NO.	PURCHASE ORDER NUMBER	TERMS	QUANTITY SHIPPED	QUANTITY BACK ORDERED	UNIT PRICE	AMOUNT	AMOUNT DUE		
												UNIT	
58500		HOLD FOR LICENSE AMENDMENT		C063544	057710								
TSNRT680		RETROFIT 680 SN# 338					1 ea.		2650.00	2650.00			
CP680A		680A. SN# A 338					0						
TSNRT000		RETROFIT OF 604 CONTROL ASSMY					1 ea.		530.00	530.00			
CP664		REEL ASSMY					0						
CPC060		COBALT SOURCE MODEL A424-14 SN# 2164					0						
NOTE: SHIPPING TO BE APPLIED AT TIME OF SHIPMENT. 88* SHIPPING CHARGES WILL BE ADDED AT TIME OF SHIPMENT.													
TOTAL WEIGHT		NET SALES AMOUNT		TRADE DISCOUNT		MISCELLANEOUS CHGS.		TAXES		TERMS DISCOUNT		AMOUNT DUE	
		3180.00										\$3180.00	

Amersham QSA INC. 1794500

FOR FURTHER INFORMATION: 800-885-1764 EXT 200
 AMERSHAM CORPORATION
 2030 SO CLAIRBROOK DRIVE
 ARLINGTON HEIGHTS, IL 60005-4802
 FAX: (708) 883 8804

IF THESE GOODS WERE PRODUCED IN COMPLIANCE WITH THE REQUIREMENTS OF THE FEDERAL MOTOR STANDARDS ACT OF 1980 AS AMENDED.

RADIATION SAFETY BULLETIN

EMERGENCY RESPONSE TELEPHONE NUMBERS

Revised March 11, 1996

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Raymond Martin - Radiation Safety Officer
Richmond/Corporate

Office Telephone.....804/271-5447
Home Telephone.....804/530-1952
Pager.....800/719-3702

Leo Clark - Radiation Safety Officer
Pennsauken

Office Telephone.....609/665-0700
Home Telephone.....609/939-3606
Pager.....609/725-0660

RADIATION SAFETY BULLETIN

Corporate Health Physics

EMERGENCY RESPONSE TELEPHONE NUMBERS

Revised March 11, 1996

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Raymond Martin - Radiation Safety Officer
Raymond Martin

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WESTERN STRESS
A DIVISION OF
ANALYTIC STRESS RELIEVING, INC.

RADIATION SAFETY MANUAL

1ST EDITION
REV. #0

ISSUED: March 11, 1996

Western Stress A Division of Analytic Stress Relieving, Inc. HEAT TREATING & INSPECTION	MANUAL NO.:	TITLE: RADIATION SAFETY MANUAL		
	SECTION: TABLE OF CONTENTS	TITLE: TABLE OF CONTENTS		
	REVISION NO.: 0	BY: J. Speese	DATE: 03/11/96	PAGE: 1 of 1

RADIATION SAFETY MANUAL

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<u>SECTION</u>	<u>TITLE</u>
1	Administrative Organization and Responsibilities
2	Description of Storage Facilities
3	Radioactive Material Security
4	Radiation Monitoring Equipment
5	Radiation Surveys
6	Posting and Labeling Requirements
7	Transportation of Radioactive Materials
8	Inventory, Inspection and Maintenance
9	Leak Test Instructions
10	Notification Requirements
11	Documentation and Record Retention
12	Emergency Procedures
13	Quality Assurance Program for Shipping Containers
14	Internal Audit and Inspection Program
15	Qualification of Personnel
16	Radiation Safety Training Program
17	Equipment Handling Procedures

Western Stress A Division of Analytic Stress Relieving, Inc. HEAT TREATING & INSPECTION	MANUAL NO.:	TITLE: RADIATION SAFETY MANUAL		
	SECTION: 1.0	TITLE: ADMINISTRATION ORGANIZATION AND RESPONSIBILITIES		
	REVISION NO.: 0	BY: J. Speese	DATE: 03/11/96	PAGE: 1 of 8

SECTION I

ADMINISTRATIVE ORGANIZATION AND RESPONSIBILITIES

Western Stress	MANUAL NO.:	TITLE: RADIATION SAFETY MANUAL		
	SECTION: 1.0	TITLE: ADMINISTRATION ORGANIZATION AND RESPONSIBILITIES		
A Division of Analytic Stress Relieving, Inc.	REVISION NO.: 0	BY: J. Speese	DATE: 03/11/96	PAGE: 2 of 8
HEAT TREATING & INSPECTION				

1.0 STATEMENT OF POLICY

1.1 The purpose of this manual is to delineate responsibility for the establishment and execution of an orderly system for the control, use, storage and transport of radiation producing equipment and radioactive materials.

1.2 Western Stress maintains a Corporate policy of "Safety First" in the work place. Safety Procedures and practices have been developed to assure the safety of Western Stress personnel, and, additionally, the health and welfare of client personnel and the general public. Strict adherence to safety procedures is the responsibility of every Western Stress employee and shall be considered our first priority.

In keeping with this concept, Western Stress shall, under the authority of this document, institute an ALARA (as low as reasonably achievable) policy. Whereby every reasonable effort shall be made to keep the radiation exposure to Western Stress personnel as low as possible and, as a first priority, to preclude any endangerment to the health and welfare of the general public.

1.3 The Radiation Safety Program, as presented in this document, shall assure compliance with the requirements of the United States Nuclear Regulatory Commission as presented in the Code of Federal Regulations, and the regulatory requirements of the various agreement states. Additionally, this document shall provide for compliance with the requirements of the United States Department of Transportation as presented in the Code of Federal Regulations, Title 49, Parts 100-177.

1.4 Establishment and execution of the Radiation Safety Program shall be the responsibility of the Corporate Radiation Safety Director. The Corporate Radiation Safety Officer may delegate certain duties in the Radiation Safety program to other qualified technical personnel or to consultants. However, ultimate responsibility for the radiation safety program shall be retained by the Corporate Radiation Safety Officer.

1.5 The Radiation Safety Program shall be monitored to assure that it has been properly established and that radiological functions and radiographic operations are being correctly performed.

Western Stress A Division of Analytic Stress Relieving, Inc. HEAT TREATING & INSPECTION	MANUAL NO.:	TITLE: RADIATION SAFETY MANUAL		
	SECTION: 1.0	TITLE: ADMINISTRATION ORGANIZATION AND RESPONSIBILITIES		
	REVISION NO.: 0	BY: J. Speese	DATE: 03/11/96	PAGE: 3 of 8

1.6 The personnel responsible for performing radiation safety functions shall have sufficient organizational freedom and authority to identify safety problems or areas of non-conformance, to initiate or provide corrective action and to verify subsequent conformance.

1.7 District radiation safety personnel shall report directly to the Corporate Radiation Safety Officer. The Corporate Radiation Safety Officer shall report directly to the President.

1.8 Irrespective of the organizational structure, individuals with the responsibility for assuring the effective execution of the radiation safety program, or any part thereof, at any location where activities are being performed under the authority of this document, shall have direct access to such levels of management as may be necessary to effect unimpaired performance of the radiation safety function.

2.0 RADIATION SAFETY PROGRAM

2.1 The radiation safety program shall provide control over all functions involving the possession, use, storage and transport of radiation producing equipment and radioactive materials in order to assure compliance with the applicable regulatory requirements.

2.2 The program shall be executed in accordance with written safety procedures.

2.3 The program shall provide for the training and qualification of all personnel involved with radiological or radiographic operations conducted under the authority of this document to assure proficient performance of their assigned responsibilities.

3.0 PROGRAM CONTROL

3.1 The radiation safety program shall be revised as necessary to assure that the program be kept current with the latest revisions of the applicable regulatory requirements.

Western Stress A Division of Analytic Stress Relieving, Inc. HEAT TREATING & INSPECTION	MANUAL NO.:	TITLE: RADIATION SAFETY MANUAL		
	SECTION: 1.0	TITLE: ADMINISTRATION ORGANIZATION AND RESPONSIBILITIES		
	REVISION NO.: 0	BY: J. Speese	DATE: 03/11/96	PAGE: 4 of 8

3.2 A system of internal audits and inspections shall be implemented to monitor the proper execution of the radiation safety program.

3.3 This system of audits and inspections shall extend to include the periodic surveillance of radiographic services procured by Western Stress from subcontractors, vendors or brokers, etc., for compliance with the radiation safety requirements of the applicable regulatory agencies.

3.4 Western Stress shall maintain a system whereby corrective action or disposition shall be made on any item which is not in conformance with the radiation safety program.

3.5 The corrective action system shall provide for a written report of the discrepancy, the corrective action to be taken, the time frame within which the discrepancy will be corrected and a system of follow-up to assure that corrective action has been taken.

4.0 DISTRIBUTION

A copy of this manual will be assigned to each Western Stress employee involved in the handling and use of radiation producing equipment. Any lack of understanding or questions concerning these procedures or the applicable regulations should be referred immediately to the District Radiation Safety Officer.

5.0 RESPONSIBILITIES

5.1 Corporate Radiation Safety Officer -

The Corporate Radiation Safety Officer shall have ultimate responsibility for the establishment and execution of the Radiation Safety Program especially with respect to the following:

Western Stress A Division of Analytic Stress Relieving, Inc. HEAT TREATING & INSPECTION	MANUAL NO.:	TITLE: RADIATION SAFETY MANUAL		
	SECTION: 1.0	TITLE: ADMINISTRATION ORGANIZATION AND RESPONSIBILITIES		
	REVISION NO.: 0	BY: J. Speese	DATE: 03/11/96	PAGE: 5 of 8

- 5.1.1 Act as liaison to the various regulatory agencies.
- 5.1.2 Maintain a program of periodic review and implementation of any necessary revisions to procedures and programs affecting the radiation safety function.
- 5.1.3 Establish and control the radiation safety educational programs outlined in this document.
- 5.1.4 Establish, control and review a system of internal audits.
- 5.1.5 Be responsible for assuring that corrective action has been instituted in any areas of noncompliance.
- 5.1.6 Establish record keeping systems such that compliance with the various regulatory agencies is maintained.
- 5.1.7 Be exclusively responsible for authorizing program changes and issuing new requirements.
- 5.1.8 Assume control and institute corrective action in emergency situations.
- 5.1.9 Perform periodic audits on district and field operations to assure compliance with radiological safety requirements.
- 5.1.10 Be vested with total authority over the radiological safety program including immediate suspension or termination of personnel for deliberate negligence or violations of safety procedures.

5.2 District Radiation Safety Officer -

The District Radiation Safety Officer shall report directly to the Corporate Radiation Safety Officer and will be responsible for the daily operations of the radiation safety program at the district level, including the following:

- 5.2.1 Supervision of all radiographers, assistants and other personnel in matters pertaining to safety.

Western Stress A Division of Analytic Stress Relieving, Inc. HEAT TREATING & INSPECTION	MANUAL NO.	TITLE: RADIATION SAFETY MANUAL		
	SECTION: 1.0	TITLE: ADMINISTRATION ORGANIZATION AND RESPONSIBILITIES		
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- 5.2.2 Maintain personnel monitoring program, including the issuing of personnel monitoring equipment, ensuring the timely exchange of monitoring equipment and the maintenance of dosimetry records.
- 5.2.3 Maintain female radiographer, and/or radiographers assistant pregnancy statement, notification, and declaration records.
- 5.2.4 Leak test sample acquisition on sealed sources, transfer of samples for analysis and maintenance of leak test records.
- 5.2.5 Assure that source exchange operations are conducted by qualified personnel or supervise the exchange operation.
- 5.2.6 Maintain control of licensed by-product material procurement, transfer and disposal.
- 5.2.7 Conduct safety meetings and periodic training sessions for personnel involved with the radiation program.
- 5.2.8 Perform or supervise the performance of periodic surveys of the storage facility.
- 5.2.9 Perform unannounced quarterly field inspections on radiographers and assistants.
- 5.2.10 Perform required quarterly inventory, inspection and maintenance of equipment.
- 5.2.11 Ensure that all procedures are followed on a daily basis and that all records, as required by this document, are maintained. (Site survey reports, utilization, dosimeter reports, etc.)
- 5.2.12 Immediately notify the Corporate Safety Officer of any emergency situation, excessive exposure to radiation program personnel, or ANY exposure to the general public.
- 5.2.13 Implement any changes or revisions to procedures as directed by the Corporate Radiation Safety Officer.

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5.2.14 Examine and determine competency of radiography personnel.

5.2.15 Maintenance of all records required by the Radiation Safety Program:

- * Personnel records
- * Safety meetings
- * Utilization records
- * Field inspection reports
- * Receipt and disposal records
- * Dosimetry records
- * Leak test records
- * Survey meter calibration certificates
- * Storage area surveys
- * Camera survey reports
- * Termination notices

5.3 District Assistant Radiation Safety Officer -

The Assistant Radiation Safety Officer is directly responsible to the District Radiation Safety Officer and will assume his duties in his absence. He shall have the following responsibilities:

5.3.1 Perform duties as assigned by the District Radiation Safety Officer or Corporate Radiation Safety Officer.

5.3.2 Maintain records of reports, surveys, etc. as directed by the District Radiation Safety Officer.

5.3.3 Maintain close contact with the job sites for inspection and supervision for compliance with the Radiation Safety Program.

5.3.4 Assist the District Radiation Safety Officer in training, examining and qualifying radiographers and assistant radiographers.

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5.4 Radiographers -

A Radiographer shall carry out the day to day radiographic operations and shall have met, as a minimum, the requirements outlined in the regulations. A radiographer's duties shall include the following:

- 5.4.1 Shall be responsible for complying with all procedures outlined in this document when conducting radiographic operations.
- 5.4.2 Shall be responsible for any radiation producing devices assigned to him.
- 5.4.3 Shall be responsible for having all the required safety equipment present before commencing radiographic operations.
- 5.4.4 Shall be responsible for maintaining all required job site records and documentation.

5.5 Assistant Radiographer -

The Assistant Radiographer is an individual that is undergoing on-the-job training in order to acquire sufficient experience to be qualified as a radiographer. He shall have met, as a minimum, the requirements of the applicable regulations for assistant radiographers. His duties shall include the following:

- 5.5.1 Shall be responsible for understanding all of the safety procedures of this document.
- 5.5.2 Shall only conduct radiographic operations under the direct supervision of a qualified radiographer.

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SECTION II

DESCRIPTION OF STORAGE FACILITY AND USE AREAS

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1.0 PERMANENT STORAGE FACILITIES:

1.1 Western Stress conducts industrial radiographic operations from district facilities at various locations throughout the United States. The following district offices maintain permanent radioactive materials storage facilities:

1.1.1 Western Stress (NRC jurisdiction)
Div. of Analytic Stress Relieving, Inc.
7523 Whitepine Road
Richmond, Virginia 23237
Phone: (804) 271-5447
Resident District R.S.O.: Mike Martin

Description of Storage Vault: See Attachment I of this section "Radioactive Materials Storage Vault Construction Specifications".

1.1.2 Western Stress (NRC jurisdiction)
Div. of Analytic Stress Relieving, Inc.
1602 Hylton Road
Pennsauken, New Jersey 08110
Phone: (609) 665-0700
Resident District R.S.O.: Leo Clark

Description of Storage Vault: See Attachment I of this section "Radioactive Materials Storage Vault Construction Specifications".

2.0 STORAGE AREA:

2.1 Exposure Levels:

Storage vaults shall be surveyed in accordance with Section 5 of this manual whenever storage activity increases. Exposure levels on the exterior surfaces shall not exceed 2 mR/H or 100 mRem in seven consecutive days.

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2.2 Posting of Storage Vault:

The storage room shall be posted on all sides with "Caution - Radioactive Materials" signs, one of which will be posted on the exterior surface of the access door. Additionally, one sign will be affixed to the cover of the interior storage box.

2.3 Security:

The storage vault and interior storage box shall be kept locked at all times except when materials are being removed from or placed in storage. The District Radiation Safety Officer shall control key distribution for storage vault access. No individual, other than Radiation Safety personnel and qualified radiographers, shall be issued keys. **THIS IS A RESTRICTED ACCESS SECURITY AREA.**

2.4 In case of emergencies (fire, explosion, storm damage, etc.) one set of storage vault access keys will be provided to the District General Manager for use by emergency personnel, if necessary.

2.5 No access to the storage vault is permitted to ANY individual that is not equipped with personal dosimetry.

3.0 USE AREAS:

3.1 Radioactive material use, under the authority of this license, shall be at Western Stress facilities or at temporary job site locations.

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ATTACHMENT I

RADIOACTIVE MATERIALS STORAGE VAULT
CONSTRUCTION SPECIFICATIONS

METHOD:

Standard plank and beam architectural construction technique.

DIMENSIONS:

Exterior dimensions to be 8'-0" wide. 10'-0" long, 8'-0" high. Access door to be a minimum 3'-0" wide. Place door for convenient access with respect to surrounding area.

MATERIAL:

Door:

Exterior grade, steel, pre-hung with dead bolt lock set.

Studs, sole plates, top plates:

2" x 4" yellow pine or equivalent

Joists:

2" x 6" yellow pine or equivalent

Walls & Roof:

Interior and exterior surfaces to be sub-sheathed with 3/8" Struc. 1, C-C ext. grade plywood and over-sheathed with 5/8" Gypsum Board. Interior and exterior seams in Gypsum board must be offset.

NOTE:

Gypsum density should be 2.31 - 2.33 gm/cm³, DO NOT utilize fiber wall board.

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ADDITIONAL:

1. Structure shall not be free floating, sole plates shall be anchored to concrete slab.
2. A steel storage box shall be installed inside the main storage vault to provide containment for smaller exposure devices.
3. Due to the structural integrity required to support the mass of the Gypsum sheathing, center-line on studs and joists shall not exceed 16" c/c.

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SECTION III

RADIOACTIVE MATERIALS SECURITY

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1.0 GENERAL REQUIREMENTS:

1.1 All by-product material and radiation producing equipment shall be maintained under security conditions (lock and key) at all times, unless under the direct surveillance of a qualified radiographer or other authorized individual.

2.0 PERMANENT STORAGE:

2.1 The permanent storage facility location(s) is/are designated in Section 2 of this document with regard to the applicable regulatory area. No other permanent storage site(s) is/are authorized under this license.

2.2 A permanent storage facility is defined as a Western Stress location which is normally equipped to provide radiography services and which meets all of the following criteria.

2.2.1 A fixed or non-selfpropelled structure on the exterior of which are placed signs for the purpose of advertising and the solicitation of business.

2.2.2 The installation of telephone service.

2.2.3 The active solicitation of business at multiple locations other than the facility site.

2.3 The storage facility shall be kept locked at all times. Only authorized personnel shall have access to the storage facilities.

2.4 The District Radiation Safety Officer will control key distribution for storage access.

2.5 Absolutely no access to storage facilities will be allowed to personnel not equipped with personnel dosimetry.

2.6 Removal of by-product material from storage shall be by authorized personnel only.

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2.7 In case of emergencies (fire, explosion, storm damage, etc.) one set of storage vault access keys will be provided to the District General Manager for use by emergency personnel, if necessary.

2.8 A utilization record, Attachment I of this section, shall be completed each time by-product material is removed from or returned to storage. This record shall be maintained at the storage facility and shall contain, as a minimum, the following information:

- * date and time of removal;
- * serial number of device;
- * serial number of source;
- * location of use;
- * date and time of return;
- * name of authorized individual removing device.

3.0 TEMPORARY FIELD STORAGE:

3.1 Radioactive materials used under this license at temporary job sites shall be maintained under security conditions at all times.

3.2 The following are approved security conditions under which radioactive materials may be maintained at temporary job sites.

3.2.1 Locked in the source storage cabinet inside the field unit.

3.2.2 Maintained under the direct surveillance of a qualified radiographer or other authorized individual.

3.2.3 Secured against physical removal; for example, chained to a reasonably immovable object. However, securing against removal in an open area that is accessible to personnel not equipped with dosimetry, unless under the direct surveillance of an authorized individual such that nonmonitored personnel will not be exposed to radiation levels in excess of 2 mR/H is absolutely not permitted.

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3.3 When radiographic field units are required to remain away from the permanent storage facility overnight, and radioactive materials are not left in storage at the job site, the following procedures shall be followed.

3.3.1 The radioactive exposure device shall be locked inside the transport compartment inside the field unit.

3.3.2 The door to the field unit shall be locked and posted with a sign bearing the standard radiation symbol and the words "CAUTION - RADIOACTIVE MATERIALS".

3.3.3 The exterior surfaces of the vehicle shall be surveyed to ascertain that no radiation levels in excess of 2 mR/H are present at any exterior surface.

3.3.4 The ignition and the doors of the vehicle shall be locked and the radiographer in charge shall retain the keys.

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HEAT TREATING & INSPECTION

SECTION III ATTACHMENT I

RADIOACTIVE MATERIAL UTILIZATION LOG

Check Out Date	Time	Camera Type & Serial #	Source Serial #	Survey Meter#	Location Description	Check In Date	Time	Radiographer
				1 _____				
				2 _____				
				1 _____				
				2 _____				
				1 _____				
				2 _____				
				1 _____				
				2 _____				
				1 _____				
				2 _____				
				1 _____				
				2 _____				
				1 _____				
				2 _____				
				1 _____				
				2 _____				
				1 _____				
				2 _____				

WRITE LEGIBLY - FILL OUT COMPLETELY

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SECTION IV
RADIATION MONITORING EQUIPMENT

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1.0 SCOPE

- 1.1 This section is intended to outline the requirements for the use, maintenance and calibration of radiation detection and monitoring equipment.
- 1.2 In keeping with Western Stress' safety and ALARA policies, properly calibrated radiation detection and monitoring equipment shall be used at all times when radioactive materials are removed from storage, transported, or utilized, such that radiation exposure to personnel be kept to minimum possible levels. Additionally, the use of radiation detection equipment and the use of survey procedures shall be integrated so as to preclude any exposure to the general public or other non-monitored personnel.

2.0 THERMOLUMINESCENT DOSIMETERS (TLD'S)

- 2.1 Permanent or "hard copy" records of personnel radiation exposure shall be maintained through the use of thermoluminescent dosimetry and the exposure reports provided by the authorized dosimetry supplier.
 - 2.2.1 Dosimetry suppliers shall be NBS/NVLAP accredited.
- 2.2 A TLD will be assigned by name and number to each employee involved with radiographic operations.
- 2.3 The TLD shall be worn at all times when handling, transporting or working with by-product material.
- 2.4 The TLD will be worn on the forward trunk position of the body somewhere between the belt and collar line.
- 2.5 Under no circumstances will an employee wear another individual's TLD.
- 2.6 TLD's will be exchanged on a monthly schedule. At the end of the control period, TLD's will be returned to the District Radiation Safety Officer for exchange. The District Radiation Safety Officer will be responsible for the timely exchange of TLD's and the return of "used" units to the dosimetry supplier for processing.

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2.7 Thermoluminescent dosimetry and processing services will be supplied by the R.S. Landauer Jr. Co. or other NBS/NVLAP accredited facility.

3.0 POCKET DOSIMETERS

- 3.1 In addition to a TLD, all personnel involved with radiographic operations shall wear a direct reading pocket dosimeter at all times when handling, transporting or working with by-product material.
- 3.2 Two direct reading pocket dosimeters with a range of 0-200 millirem shall be worn, the second unit providing contingency readings in the case of a malfunction of one of the units.
- 3.3 Pocket dosimeters shall be worn on the forward trunk portion of the body somewhere between the belt and collar line.
- 3.4 Pocket dosimeters shall be calibrated annually by an authorized calibration facility. Dosimeters must be within ± 30 percent of true value. Dosimeters failing to meet the accuracy tolerance requirements will be removed from service.
- 3.5 Pocket dosimeters shall be zeroed at the beginning of each day or shift and the reading recorded at the beginning and end of each day (or shift) on the Daily Radiation Report form, Attachment I of this Section.
- 3.6 A pocket dosimeter may be re-zeroed during the day, however, the previous reading must be recorded and the total of the readings for the day (or shift) must be indicated on the daily dosimeter report.
- 3.7 Should a pocket dosimeter become discharged beyond readable scale, then that individual shall cease operations, or in the case of multiple employees at one site, remove himself to an unrestricted area and submit his TLD to the District Radiation Safety Officer for immediate processing. This individual will not re-enter a restricted area until the TLD reading is provided by the processing facility and the results indicate that his exposure, combined with previous exposure, is not in excess of allowable limits.

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3.8 Dosimeters and dosimeter charges manufactured by the following companies are approved for use under this procedure:

- * Dosimeter Corporation of America
- * Victoreen Co.
- * Landsverk Co.
- * Stephens Co.

3.9 Dosimeters shall be checked for calibration accuracy by the following firms or by the manufacturer.

- * W.H. Henken Industries, Inc.
Arlington, Texas
License No. 5-967
- * Industrial Radiography Maintenance & Supply Co.
Amelia, Louisiana
License No. LA4342-L01

4.0 DOSIMETER CHARGER OPERATING PROCEDURE

Dosimeters shall be charged (zeroed) as required by paragraph 3.5 in accordance with the following procedures.

- 4.1 Remove dust cap from electrode end of dosimeter.
- 4.2 Insert electrode end of dosimeter into contact socket of charger.
- 4.3 Press dosimeter down firmly into socket and look through eyepiece at the scale and hairline.
- 4.4 Turn adjusting knob to position the hairline at zero.
- 4.5 Remove dosimeter from charging socket and, while pointing it at a light source, look through the eyepiece to determine if the hairline is set exactly at zero.
- 4.6 If the hairline has moved from zero, the above steps should be repeated until the hairline is positioned at zero.

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5.0 SURVEY INSTRUMENTS

- 5.1 Calibrated, operable survey instruments shall be utilized at all times when handling, transporting or working with by-product material.
- 5.2 Survey instruments shall have a range capable of measuring radiation intensities from 2-1000 mR/H.
- 5.2.1 The following survey instruments are approved for use under these procedures:
- * G.E. Smith Model GS1000A, GS2000A;
 - * Ludum Measurements Model 6, Model 14C Counter with Beta/Gamma and Scintillation Probes (Health Physics Personnel);
 - * Bicron, Inc. Model Radiographer;
 - * Eberline Model E-130G.
 - * NDS Products ND2000
- 5.3 Survey instruments shall be calibrated at intervals not to exceed 90 days or after any repair procedure.
- 5.4 Survey instruments shall be calibrated at two points on each scale with neither point being the minimum or maximum possible reading on that scale. (Two points approximating 25% and 75% on each scale is acceptable). Actual reading must be within +/- 20% of the reference standard.
- 5.5 Calibrations shall be performed at a radiation energy level approximating those energy levels to be detected.
- 5.6 Certificates of calibration shall be filed in the District Radiation Records. Calibration stickers, showing calibration and due dates, affixed to the instrument by the calibrating facility shall be considered evidence of current calibration status in field use.
- 5.7 Survey instruments shall be calibrated by the following firms or by the manufacturer.
- * W.H. Henken Industries, Inc.
Arlington, Texas
License No. 5-967

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* Industrial Radiography Co.
Amelia, Louisiana
License No. LA4342-LO1

6.0 SURVEY INSTRUMENT OPERATION

- 6.1 Each field unit shall be equipped with a minimum of two calibrated, operable survey instruments.
- 6.2 If one of the instruments becomes inoperable during radiographic operations, work may continue providing at least one meter remains operational.
- 6.3 Should both instruments become inoperable, operations must cease immediately. Operations may not resume until at least one of the instruments has been repaired or replaced.
- 6.4 The following steps shall be taken to assure the proper operations of survey instruments. These steps shall be taken prior to leaving the storage facility.
- 6.4.1 Check calibration sticker attached to instrument to determine that instrument is within calibration. Additionally, determine that the instrument will remain within calibration for the duration of the assignment or that replacement instruments can be provided prior to the expiration of the calibration period.
- 6.4.2 Check the instrument for obvious physical damage, broken meter, missing controls, etc.
- 6.4.3 Turn instrument control to the "battery check" position. Check meter reading to determine that the battery strength is within acceptable range. If the battery strength is not within acceptable limits, then, batteries should be replaced prior to utilizing instrument.
- 6.4.4 Set instrument control to the 10X setting and hold instrument in proximity to the exposure device to determine that an actual indication of radiation intensities can be obtained.

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6.4.5 If positive responses are obtained from requirements 6.4.2 - 6.4.4 then it can be assumed that the instrument is in an operable condition. If a negative response is obtained from any of these requirements, the instrument shall not be utilized and the District Radiation Safety Officer contacted for a replacement.

6.4.6 Should it be suspected, at any time during operations, that a survey instrument is not functioning properly, it should be removed from service and the District Radiation Safety Officer notified as soon as possible.

6.5 Methods and occasions for conducting surveys are outlined in Section 5 of this document.

7.0 ALARMING RATEMETERS

7.1 In addition to a TLD and two direct reading pocket dosimeters all personnel involved with radiographic operations shall wear a 500 mR/h alarming ratemeter at all times when handling, transporting or working with by-product material. The alarming ratemeter is designed to emit a high pitched alarm if the radiation intensity in the area exceeds 500 milliRoentgens per hour. These devices ARE NOT intended to be used as a replacement for properly conducting surveys with a calibrated survey instrument. Alarming ratemeters are designed as a 'fail safe' back-up instrument to warn individuals in the event that other instrumentation fails.

7.2 The alarming ratemeter shall be worn on the side or forward trunk portion of the body between the belt and collar line. The serial number of the ratemeter and the date of calibration shall be listed on the Daily Radiation Report form. Results of the battery and alarm operations checks shall be noted on the Daily Equipment Inspection form.

7.3 Alarming ratemeters shall be calibrated annually by an authorized calibration facility. Alarming ratemeters must be within ± 20 percent of the primary alarming rate of 500 mR/h. Devices failing to meet the accuracy tolerance requirements shall be removed from service and repaired.

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7.3.1 The calibration sticker affixed to the case of the ratemeter by the calibration facility shall be considered field evidence of calibration.

7.3.2 The calibration certificates issued by the calibration facility shall be maintained on file at the district radiation safety office. Certificates of calibration shall be available for inspection by the NRC or appropriate regulatory agency.

7.3.3 Alarming ratemeters shall be checked at the beginning of each day, or period of use, to determine the unit is within calibration. Additionally, it shall be determined that the unit will remain in calibration for the duration of the assignment or that replacement units can be provided prior to the expiration of the calibration period.

7.4 Alarming ratemeters shall be checked for alarm and battery operational levels at the beginning of each day, or period of use, by triggering the recessed test switch on the face of the unit. The red LED will light and the alarm should sound if the battery levels are satisfactory. The batteries shall be replaced any time the battery monitoring LED indicates that remaining battery strength is below operational minimum. Batteries are replaced by removing the four screws on the back of the unit and lifting off the back panel. The screws are not 'locked' to the back panel; exercise caution so as not to misplace the screws. With the back panel removed during battery replacement, be certain not to touch any of the circuitry or the potentiometer at the base of the battery compartment. After battery replacement is completed the rate meter shall be retested to verify proper battery, alarm and operational status.

7.5 Alarming ratemeters shall be checked for operational status at the beginning of each day or period of use by holding the unit, with the off on switch in the 'on' position, next to the ear in a low noise level location. If the unit is operating, a low pitched motorboating (hum) will be heard.

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7.6 Periodically the ratemeter should be tested by placing it in a radiation area calculated to be in excess of 500 mR/h. **DO NOT WEAR THE UNIT INTO THE HIGH RADIATION AREA**, place the unit in the area prior to exposing the source of radiation. **DO NOT** attempt to test all of the units at a single location at the same time. A sufficient number of the ratemeters shall be withheld to allow for the safe return of the source of radiation to the shielded position and then be tested in a second sequence.

7.7 As with other battery powered instrumentation, the batteries should be removed if the ratemeter is to be placed in storage for prolonged periods of time to prevent damage to the battery compartment. After removal from storage, each device shall be fully tested and checked for calibration prior to being placed into service.

7.8 Ratemeters shall be calibrated by the following firms or by the manufacturer:

- * W.H. Henken Industries, Inc.
Arlington, Texas
License No. 5-967

- * Industrial Radiography Co.
Amelia, Louisiana
License No. LA4342-101

8.0 STORAGE OF PERSONNEL MONITORING EQUIPMENT

8.1 Personnel monitoring equipment utilized by Western Stress', radiological safety program is not affected by normal atmospheric conditions during storage when not in use, however, atmospheric extremes should be avoided. For Example: It is not wise to store TLD's in the heat generated by the sun on vehicle dashboards.

8.2 Care should be taken to assure that thermoluminescent dosimeters (TLD's) are stored in a radiation free area when not in use.

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8.3 When battery operated instrumentation (survey meters, dosimeter chargers, etc.) are stored for prolonged periods, the batteries should be removed from these devices in order to prevent damage to internal circuitry. Fresh batteries should be installed when these devices are returned to service.

8.4 When survey instruments are removed from storage, they shall be checked to determine that the device is still within calibration frequency. Additionally, the operational checks required by Paragraph 6.4 of this section shall be performed prior to returning the instrument to service.

HEAT TREATING & INSPECTION

DAILY RADIATION REPORT

Operator _____ Date _____

Location of Job _____

PERSONNEL INFORMATION

Radiographer _____	Assistant _____
TLD Badge# _____	TLD Badge # _____
Dosimeter # 1. _____ 2. _____	Dosimeter # 1. _____ 2. _____
Rate Alarm _____ Cal. _____	Rate Alarm _____ Cal. _____
Dosimeter Readings Start _____ Finish _____	Dosimeter Readings Start _____ Finish _____

EQUIPMENT INFORMATION

Camera Serial # _____	Source Serial # _____	Number Of Curies _____
Survey Meter Type _____	Meter Serial # _____	Date of Calibration _____
Survey Meter Type _____	Meter Serial # _____	Date of Calibration _____

SURVEYS

Camera Checkout _____ mR hr @ 6"	Vehicle Prior to Departure _____ mR hr @ surface
Lockout _____ mR hr @ 6"	Prior to Return _____ mR hr @ surface
Check In _____ mR hr @ 6"	

RESULTS OF PHYSICAL SURVEYS

_____ mR hr @ _____ Feet

Source

_____ mR hr @ _____ Feet

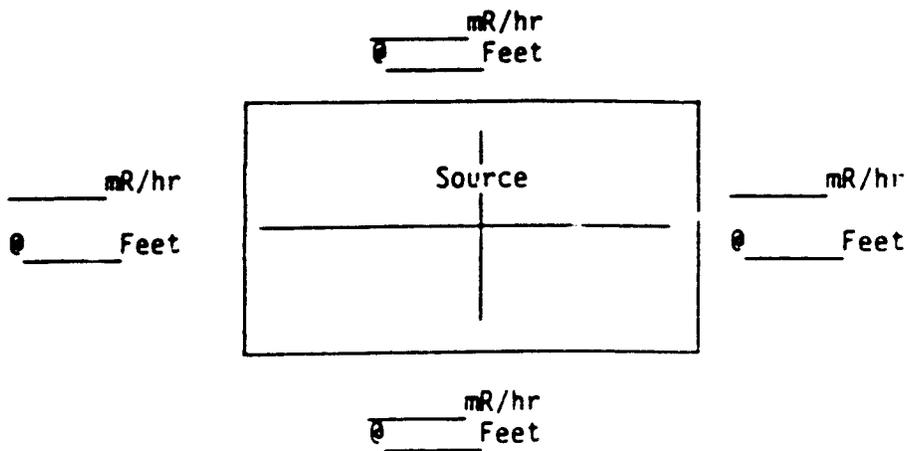
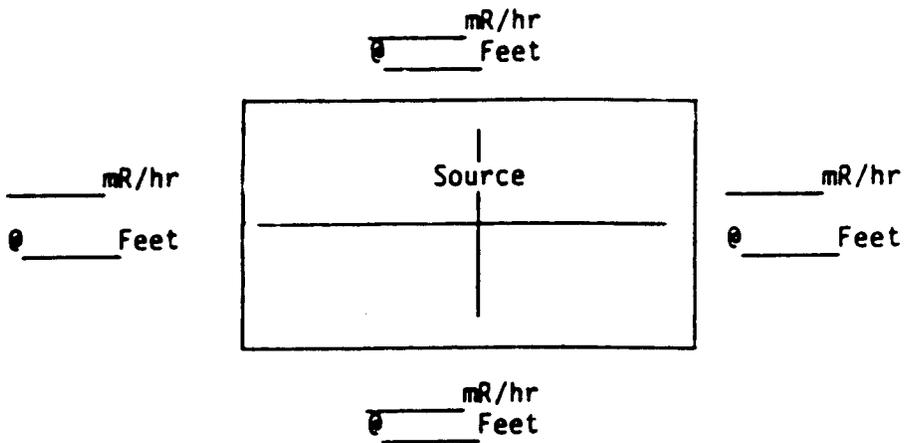
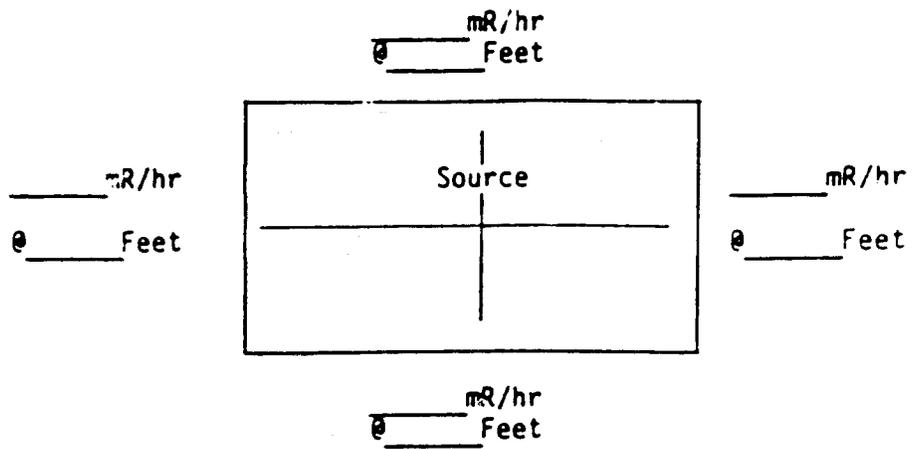
_____ mR hr @ _____ Feet

_____ mR hr @ _____ Feet

Record changes in physical surveys on back of form

Daily Equipment Inspection Performed Yes () No ()
Any Malfunctions Noted on Back of Sheet Yes () No ()

Signature of Radiographer _____



CALCULATIONS

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SECTION V
RADIATION SURVEYS

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1.0 SCOPE

- 1.1 This section is intended to outline the procedures for performing radiation surveys as required by the various referencing sections of this document.
- 1.2 All surveys shall be performed at times as required by the referencing section.
- 1.3 Unless otherwise indicated in these procedures, all survey results shall be recorded on the appropriate form(s). Survey results shall be recorded at the time the survey is taken. Survey results shall not be "remembered" for recording at a later time.
- 1.4 All radiation surveys shall be conducted utilizing an approved, calibrated and properly functioning survey instrument in accordance with the requirements of Section 4 paragraph 5, of this document.

2.0 SURVEY UPON RECEIPT OF RADIOACTIVE MATERIALS

- 2.1 Upon receipt of radioactive materials the outer surface of the transport container (over pack) shall be surveyed. If the radiation levels are in excess of 200 milliroetgens on any exterior surface or in excess of 10 milliroetgens at 1 meter (3.3 feet) from any exterior surface immediately notify the District Radiation Safety Officer. The District Radiation Safety Officer shall notify the Corporate Radiation Safety Director and the appropriate regulatory agency and the final delivering carrier will be notified by the Corporate office as applicable.
- 2.2 Upon removal of the radiation exposure device (or source changer) from the transport container, or, if the exposure device (or source changer) is utilized as the transport container (required certification as a Type B (u) shipping container) the following surveys shall be performed.
- 2.2.1 For radiographic exposure devices (or source changers) measuring less than 10 centimeters (4 inches) from the sealed source storage position to any exterior surface of the device (typically, devices containing Iridium Isotopes), the

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radiation level shall not exceed 50 milliroetgens per hour at 15 centimeters (6 inches) from any exterior surface.

For radiographic exposure devices (or source changers) measuring 10 centimeters (4 inches) or more from the sealed source storage position to any exterior surface of the device the radiation level shall not exceed 200 milliroetgens per hour at any exterior surface or 10 milliroetgens per hour at 1 meter (3.3 feet).

2.2.2 The results of the above surveys shall be recorded on the receipt/camera survey form, Attachment I of this Section, and filed in the source record.

2.3 If radioactive materials are received at company facilities during normal working hours, the survey requirements of 2.1 and 2.2.1 shall be met within 3 hours of receipt. If the radioactive materials are received at company facilities after normal working hours, the requirements of 2.1 and 2.2.1 shall be met no later than 18 hours after receipt.

3.0 SURVEY OF PERMANENT STORAGE AREA

3.1 Facilities designated as permanent storage areas (storage vaults) shall be surveyed to determine that the radiation level at the exterior surface does not exceed 2 milliroetgens per hour and that exposure to an individual could not exceed 100 mRem in any seven consecutive days.

3.2 Surveys of permanent storage areas shall be performed each time the total storage activity is increased.

3.3 Results of permanent storage area surveys shall be recorded on the "storage survey" form, Attachment II of this Section.

3.4 Should the radiation level at the exterior surface of the storage vault be in excess of 2 milliroetgens per hour, repositioning of the stored devices within the vault or additional shielding is required.

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4.0 SURVEY UPON REMOVAL OF RADIOACTIVE MATERIALS FROM STORAGE (CHECK OUT SURVEY)

- 4.1 Each time a radiographic exposure device is removed from the storage facility a survey of the device shall be performed.
- 4.2 Radiation levels shall be in accordance with Paragraph 2.2.1 of this Section.
- 4.3 Results of the above check out survey shall be recorded on the Daily Radiation Report form, Attachment III of this Section, at the time the survey is performed.
- 4.4 Radiographic exposure devices with radiation levels in excess of the allowable levels of Paragraph 2.2.1 shall not be removed from storage and the District Radiation Safety Officer shall be notified immediately.

5.0 VEHICLE SURVEY

- 5.1 When radiographic exposure devices (or source changers) are transported by company owned vehicles from a permanent storage facility to a temporary job site, the transporting vehicle shall be surveyed after the device has been loaded and prior to the vehicles departure from the storage facility.
- 5.2 After the radiation exposure device has been secured in the transport compartment, the exterior surface of the vehicle closest to that location shall be surveyed. The radiation level at that surface shall not exceed 2 milliroentgens per hour. The radiation level in the cab shall not exceed 1 milliroentgen per hour. If the radiation levels at either location exceed the above levels, additional shielding shall be added prior to transport.
- 5.3 After completion of the job, the above vehicle survey shall be repeated once the exposure device has been secured in the transport compartment and prior to leaving the job site.
- 5.4 The results of the above vehicle survey shall be recorded on the Daily Radiation Report form, Attachment III of this Section, at the time each survey is performed.

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6.0 SURVEY OF THE PERIMETER OF RESTRICTED AREAS

6.1 A restricted area is any area in which radiation levels are such that, if an individual were continuously present in the area, he would receive a radiation exposure in excess of 2 millirem in any one hour, or an exposure of 100 millirem in any seven consecutive days. These areas must be surveyed as follows.

6.1.1 After the area boundaries are calculated for the particular source activity being used such that the radiation levels at the perimeter will not be in excess of 2 millirem in any one hour, these boundaries must be surveyed to determine that actual exposure levels do not exceed 2 millirem in any one hour.

6.1.2 The results of the perimeter survey shall be recorded on the Daily Radiation Report, Attachment III of this Section, at the time the survey is performed.

6.1.3 The perimeter survey shall be repeated each time exposure technique or geometry changes, such that exposure levels at the perimeter are affected and perimeter boundaries adjusted accordingly.

7.0 SURVEY AFTER EACH EXPOSURE

7.1 After the completion of each exposure, and prior to approaching the exposure device, the area is to be surveyed to determine that the high exposure levels, anticipated while the source is in the guide tube, have been reduced to storage levels.

7.1.1 The survey conducted after each exposure need not be recorded, HOWEVER, this survey SHALL BE PERFORMED at the completion of each exposure.

7.1.2 Survey meters shall not be left with the exposure device, or in the case of longer exposures, with the control assembly. Survey meters shall be in the radiographer's or radiographer assistants' possession at all times during exposures.

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7.2 While monitoring post exposure radiation levels with a survey meter, approach the device from the forward 'quarter'. This approach will provide an early indication of a problem should the source be lodged in the exit port nipple area of the device. In this way the device will not act as a shield - providing a false indication of a 'safe' situation as with a rear approach.

After the initial approach, begin the survey in the area of the guide tube tip. Continue the survey along the guide tube to the exit port nipple and, after determining that no problem exists toward the forward end of the assembly, complete the survey by surveying the entire circumference of the exposure device.

7.3 If high exposure levels are obtained while approaching the device or upon surveying the device, this may indicate that the source has not been completely returned to its shielded storage position. **IN THIS CASE RETURN TO A SAFE DISTANCE AND REFER TO THE EMERGENCY PROCEDURE IN SECTION 12 OF THIS MANUAL.**

8.0 SURVEY AFTER FINAL EXPOSURE (LOCKOUT SURVEY)

8.1 After completion of the final exposure and prior to transporting the exposure device, a final (lockout) survey shall be conducted.

8.2 The final (lockout) survey shall be conducted in the same manner as the check out surveys of Paragraph 4.0 of this Section and exposure levels should approximate the check out survey results recorded on the Daily Radiation Report.

8.3 Results of the lockout survey shall be recorded on the Daily Radiation Report at the time that the survey is performed.

8.4 If the exposure levels obtained during the lockout survey are substantially higher (or lower) than the levels recorded during the check out survey **DO NOT TRANSPORT**, return to a safe distance (keeping perimeter boundaries posted) and refer to the emergency procedures in Section 12 of this manual.

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9.0 SURVEY UPON RETURN OF RADIOACTIVE MATERIALS TO STORAGE (CHECK IN SURVEY)

- 9.1 In situations where radiographic exposure devices are utilized at temporary job sites, a check in survey, in addition to the lock out survey, is required.
- 9.2 The check in survey will be performed after returning to the storage facility and prior to placing the exposure device(s) back into the storage vault.
- 9.3 The check in survey will be performed in the same manner as the check out survey in Paragraph 4.0 of this Section and the results recorded in the Daily Radiation Report.

10.0 SHIPPING OF RADIOACTIVE MATERIALS

- 10.1 Shipping of radioactive materials by common carrier shall be in accordance with the procedures in Section 7 of this manual and the department of transportation requirements outlined in Title 49 CFR and HM-181. Surveys shall be conducted and recorded on the appropriate transport documents as required by Section 7.

CAMERA SURVEY

Camera: _____ Serial # _____

Source Type: _____ Serial # _____

Activity: _____ Date Received: _____

SURVEY RESULTS

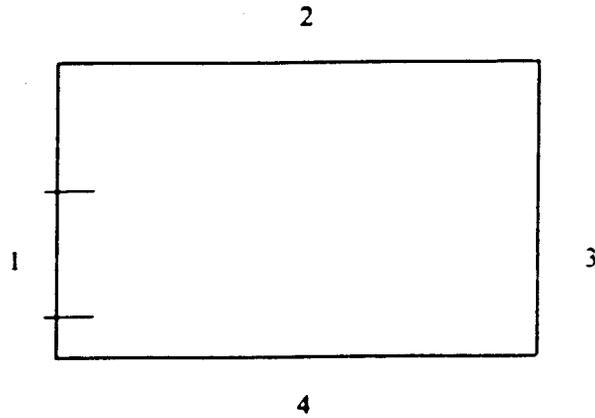
(in mR/H)

<u>Location</u>	<u>Reading @ 6"</u>	<u>Reading On Contact</u>	<u>Reading @ 1 Meter</u>
Front			
Back			
Left			
Right			

Survey Meter: _____ Serial # _____ Date Calibrated: _____

Survey Performed By: _____ Date: _____

STORAGE SURVEY



<u>Location:</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
<u>Reading (in Mr H)</u>	_____	_____	_____	_____

Survey Meter: _____ Serial # _____ Date Calibrated: _____

Survey Performed By: _____ Date: _____

HEAT TREATING & INSPECTION

DAILY RADIATION REPORT

Customer _____

Date _____

Location of Job _____

PERSONNEL INFORMATION

Radiographer _____

Assistant _____

TLD Badge# _____

TLD Badge # _____

Dosimeter # 1. _____ 2. _____

Dosimeter # 1. _____ 2. _____

Rate Alarm _____ Cal. _____

Rate Alarm _____ Cal. _____

Dosimeter Readings Start _____ Finish _____

Dosimeter Readings Start _____ Finish _____

EQUIPMENT INFORMATION

Camera Serial # _____

Source Serial # _____

Number Of Curies _____

Survey Meter Type _____

Meter Serial # _____

Date of Calibration _____

Survey Meter Type _____

Meter Serial # _____

Date of Calibration _____

SURVEYS

Camera

Checkout _____

mR/hr @ 6"

Vehicle

Prior to Departure _____ mR hr @ surface

Lockout _____

mR/hr @ 6"

Prior to Return _____ mR hr @ surface

Check In _____

mR/hr @ 6"

RESULTS OF PHYSICAL SURVEYS

_____ mR/hr @ _____ Feet

Source

_____ mR/hr @ _____ Feet

_____ mR hr @ _____ Feet

_____ mR hr @ _____ Feet

Record changes in physical surveys on back of form

Daily Equipment Inspection Performed Yes () No ()
Any Malfunctions Noted on Back of Sheet Yes () No ()

Signature of Radiographer _____

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SECTION VI

POSTING AND LABELING REQUIREMENTS

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1.0 SCOPE

- 1.1 This section is intended to outline the procedures and requirements for the posting and labeling of radiographic areas, equipment and vehicles.
- 1.2 All signs and labels will be of commercially available manufacture and design. Utilizing the standard three bladed radiation symbol and such additional information or instruction as are appropriate to minimize exposure to radiation.
- 1.3 All signs and labels shall be maintained in a clean, legible condition.
- 1.4 Signs and labels shall be checked during routine daily equipment checks.
- 1.5 Prior to signs and labels deteriorating to a point where they are no longer legible, the District Radiation Safety Officer should be notified for replacements.
- 1.6 Signs and labels bearing radiation symbols or warnings of the presence of radiation or radioactive materials are serious documents and, SHALL NOT be used as a decoration on personal equipment, clothing or vehicles.

2.0 LABELING OF RADIOACTIVE MATERIALS, EXPOSURE DEVICES AND SOURCE CHANGERS

- 2.1 All radiographic exposure devices and source changers shall be conspicuously labeled with the standard radiation symbol and the words "CAUTION" (or danger) radioactive materials.
- 2.2 All radiographic exposure devices and source changers shall have affixed to their exterior surface, in an obvious location, a label bearing the statement "CAUTION (or danger) RADIOACTIVE MATERIALS - DO NOT HANDLE - NOTIFY CIVIL AUTHORITIES IF FOUND".
- 2.3 All radiographic exposure devices and source changers shall have affixed to their exterior surface a label indicating the type of material contained in the device, the activity of the material contained in the device, the date at which the

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activity was determined and the serial number of the material (source) contained in the device.

3.0 LABELING OF TRANSPORT CONTAINERS AND OVER PACKS

3.1 The labeling, survey and transport document requirements for the utilization of radiographic exposure devices, source changers or over packs as transport (shipping) containers are outlined in Section 7 - "Transportation of Radioactive Materials" - of this manual.

4.0 POSTING OF STORAGE AREAS

4.1 Permanent storage facilities:

4.1.1 Rooms designated and utilized for the permanent storage of radioactive materials (storage vaults) shall have affixed to the exterior surface of the access door(s) a sign bearing the standard symbol and the words "CAUTION (or danger) RADIOACTIVE MATERIALS". Signs (and lettering) shall be of a sufficient size such that they can be read from a minimum distance of twenty (20) feet. If an additional container (such as a gang box, chest, etc.) is used inside the storage room for the placement of exposure devices, the container shall also have a sign, as required above, affixed to the cover or other access point.

4.2 Temporary storage facilities:

4.2.1 When it becomes necessary to store radioactive materials at temporary job sites, access to these areas must be posted with signs as in Paragraph 4.1.1 above.

Example: When exposure devices are stored in radiography field units when the device is not actually in use or for project durations longer than one day, where the field unit will not return to the permanent storage

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facility. In such a case, the door of the unit shall have the appropriate sign affixed to the exterior surface.

NOTE: When radioactive materials are stored at temporary locations, the requirements of Sect. 3, "Radioactive Material Security", shall be met in addition to the posting requirements above.

5.0 POSTING AND RESTRICTING RADIOGRAPHIC AREAS

5.1 The following procedures shall be utilized to ensure that all areas in which radiographic operations are being conducted are restricted and posted properly so as to minimize the possibility of accidental exposure to non-monitored personnel.

5.2 Restricted Area:

5.2.1 A restricted area is any area in which the radiation exposure to an individual would be greater than 2 millirems in any one hour or 100 millirems in any seven (7) consecutive days.

5.2.2 The perimeter of the restricted area shall be roped off with magenta (or black) and yellow "RAD" rope or ribbon.

5.2.3 The perimeter of the restricted area shall be posted with signs bearing the standard radiation symbol and the words "CAUTION (or DANGER) RADIATION AREA". The signs (and lettering) shall be of sufficient size such that they can be read from a minimum distance of twenty (20) feet. Signs shall be spaced along the perimeter such that the distance between any two signs does not exceed thirty (30) feet. At times, the use of signs in languages other than English may be necessary in addition to the standard warning signs.

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5.2.4 After perimeter boundaries have been established and signs properly posted, the radiation exposure level at the perimeter must be verified by survey, during the first exposure, in accordance with Section 5, Paragraph 6.1.1 of this manual and the perimeter boundaries adjusted as necessary.

5.2.5 The entire restricted area shall be maintained under direct visual surveillance at all times when the source is in the exposed position to prevent accidental entry by non-monitored individuals

5.3 Radiation Area:

5.3.1 A radiation area is any area in which the radiation exposure to an individual would be greater than 5 millirems in any one hour. In that the radiation area is contained within the boundaries of the posted restricted area, the radiation area need not be posted, nor, is the erection of perimeter boundaries required.

5.4 High Radiation Area:

5.4.1 A high radiation area is any area in which the radiation exposure to an individual would be greater than 100 millirem in any one hour. The high radiation area will be posted with signs bearing the standard radiation symbol and the words "CAUTION (or DANGER, HIGH RADIATION AREA".

5.4.2 The high radiation area should be calculated - DO NOT conduct surveys of high radiation areas.

6.0 POSTING OF VEHICLES

6.1 Vehicles used for temporary storage of radioactive materials shall be posted in accordance with Paragraph 4.2.1 of this Section.

6.2 Vehicles used for the transportation of radioactive materials shall be posted in accordance with the requirements of Section 7 paragraph 2.1.6 of this manual.

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SECTION VII

TRANSPORTATION OF RADIOACTIVE MATERIALS

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1.0 SCOPE

- 1.1 This section is intended to outline the procedures and requirements for the safe transportation of radioactive materials, exposure devices and source changers.
- 1.2 These procedures apply to the transportation of radioactive materials by company vehicle to and from temporary job sites and the shipping of radioactive materials by common carrier.
- 1.3 Western Stress is licensed to receive, ship and transport only sealed sources, exposure devices and source changers designated on its license.
- 1.4 A shipping package for radioactive materials is designed in accordance with Department of Transportation (D.O.T.) packaging requirements. It is designed to prevent loss or dispersal of the contents and to retain the efficiency of its radiation shielding under accident conditions during transport. A shipping package may be the exposure device or the source changer itself. When drums or over packs are used for protection against transport abuse, it is not classified as a shipping package when it is not a D.O.T. requirement. Though certain labeling is required, it is only a container, not a shipping package.

2.0 TRANSPORTATION TO TEMPORARY JOB SITES:

- 2.1 When transporting radioactive materials, exposure devices, or source changers to temporary job sites the following procedures shall be followed.
 - 2.1.1 The Utilization Log shall be completed prior to removing the device from the storage vault.
 - 2.1.2 The check out survey shall be performed in accordance with Section 5 Paragraph 4.0 of this manual and recorded on the Daily Radiation Report.
 - 2.1.3 Radioactive materials shipping papers shall be obtained prior to transporting the device.

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2.1.4 The device shall be secured in the vehicle transport compartment and the exterior surface of the vehicle surveyed in accordance with Section 5 Paragraph 5.2 of the manual and recorded on the Daily Radiation Report.

2.1.5 The radiographic exposure devices utilized by Western Stress, are certified as Type B (u) shipping containers and as such require no additional over pack for transport. However, if the exposure device is utilized as its own shipping container, certain D.O.T. labeling requirements must be observed.

The exposure device shall be surveyed on contact and at a distance of 1 meter:

AND

If the measured intensity is equal to or less than 0.5 mR/H on contact AND zero (0) at a distance of one (1) meter, D.O.T. Radioactive White I labels are required.

If the measured intensity is greater than 0.5 mR/H but equal to or less than 50 mR/H on contact AND/OR EQUAL to or less than 1.0 mR/H at a distance of one (1) meter, D.O.T. Radioactive Yellow II labels are required.

If the measured intensity is greater than 50 mR/H but equal to or less than 200 mR/H on contact AND/OR greater than 1.0 mR/H but equal to or less than 10 mR/H at a distance of one (1) meter, D.O.T. Radioactive Yellow III labels are required.

2.1.6 Appropriate "Diamond" (Radioactive) labels shall be affixed to two sides of all other devices which permit application in the proper manner. For example, the Model 660B and 680 Series are designed such that the appropriate "Diamond" Radioactive labels may be affixed to two opposite sides of the device.

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The information on the "Diamond" Radioactive labels must be properly completed, indicating the contents, activity and transport index. If the package contains more than 10 curies of Iridium 192 or 10 curies of Cobalt 60, the letters RQ must follow the contents, i.e., IR -RQ.

2.1.7 When exposure devices are secured in the transport compartment of mobile field units, the exterior of the compartment shall be labeled with the same "Diamond" (Radioactive) label that the device bears. Additionally, the exterior of the transport compartment shall bear a label which reads "Inside Package Complies with Prescribed Specifications".

2.1.8 If radiation levels on the exterior of the shipping container necessitate D.O.T. Radioactive Yellow III labeling, the exterior of the vehicle shall be placarded on four sides with D.O.T. approved placards which read "RADIOACTIVE". If radiation levels on the exterior of the shipping container necessitate D.O.T. Radioactive White I or Radioactive Yellow II labels, vehicle placards MUST (10 CFR 49 D.O.T.) be removed, covered or closed. Additionally, when the radioactive

materials have been returned to storage or if radioactive materials are not being transported in the vehicle, the placards MUST be removed, covered or close .

2.1.9 After completion of a job, the exposure device shall be surveyed prior to being secured in the transport compartment to meet the lockout survey requirements in Section 5 Paragraph 8.0 of this manual. Additionally, after the device is secured in the transport compartment and prior to leaving the job site, the outside surface of the vehicle shall be surveyed to meet the requirements of Section 5 Paragraph 5.3 of this manual.

2.1.10 Upon return to the storage facility, the exposure device shall be surveyed prior to being placed back in the storage vault to meet the requirements of Section 5, Paragraph 9.2 of this manual.

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2.1.11 After all the required surveys have been performed, the exposure device shall be secured in the storage vault and the utilization log completed.

3.0 RECEIPT AND DISPOSAL OF RADIOACTIVE MATERIALS:

3.1 The following procedures shall be followed whenever radioactive materials, exposure devices or source changers are received, disposed of or shipped.

3.2 Receipt of Radioactive Materials:

Upon receipt of any radioactive materials the following procedures shall be followed.

3.2.1 Surveys shall be performed in accordance with Section 5, Paragraph 2.0 of this manual.

3.2.2 The receipt record shall be signed and dated.

3.2.3 Examine the exposure device or source changer for any signs of physical damage and to assure that all seals, locks, safety plugs, etc. are in place.

3.2.4 Receiving surveys shall be completed on all new sources received and recorded on the Receipt/Camera Survey Record.

3.2.5 Information concerning the new source shall be entered on the Radioactive Materials Master Log, Attachment I of this Section.

3.2.6 A file shall be set up on the new source, containing the receipt records, transport documents, decay chart, leak test results and the receiving survey record.

3.2.7 If the exposure device is a new addition to the storage facility, or if it is being transferred from another company storage facility, it must be added to the permanent storage inventory record. If the device is being temporarily transferred from another company location it shall be added to the inventory record and the record should indicate a temporary transfer.

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3.2.8 After all required inspections and surveys have been completed, place the exposure device or source changer in the storage vault if not used immediately.

3.3 Disposal of Radioactive Materials:

The following procedures shall be followed when disposing of radioactive materials.

3.3.1 All radioactive materials shall be returned to the manufacturer/supplier for disposal.

3.3.2 Radiographic exposure devices being transported by company vehicle to the supplier for source exchange shall be prepared for transport as in Paragraph 2.0 of this Section.

3.3.3 The date of disposal shall be recorded on the Master Log Form.

3.3.4 Upon receipt of the disposal record from the supplier all information concerning the source shall be assembled and placed in the disposal file (i.e., receiving documents, decay charts, leak test records, receipt surveys, etc.)

4.0 TRANSPORTATION BY COMMON CARRIER:

4.1 When radiographic exposure devices are being shipped to the supplier for source exchange or are being shipped to other company locations, and, transport will be by common carrier, then these devices will be placed in protective overpacks where these are available.

4.2 Whenever overpacks are used to transport exposure devices proper D.O.T. labeling must be affixed to the outside surfaces of the container.

4.3 Whenever protective overpacks are shipped empty, all radioactive material labeling must be removed from the outside surfaces or covered with a label indicating that the container is empty.

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SECTION VIII

INVENTORY, INSPECTION AND MAINTENANCE

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1.0 SCOPE:

- 1.1 The following procedures are intended to outline the requirements for the inventory, inspection and maintenance of radiographic exposure devices and related integral equipment.
- 1.2 The inventory inspection and maintenance of equipment, as required by these procedures, shall be performed at intervals not to exceed three (3) months.
- 1.3 These procedures shall be performed by, or under the direction of, the District Radiation Safety Officer or Assistant Radiation Safety Officer.
- 1.4 Results shall be documented on the Quarterly Inventory, Inspection and Maintenance Record form, Attachment II of this Section.
- 1.5 Radiographic exposure devices present at a district storage facility, that have been temporarily transferred from another district, shall be inventoried, inspected and maintained by the district that has physical possession of the device. A duplicate record shall be maintained in both districts' radiation program records.

2.0 INVENTORY:

- 2.1 All radiographic exposure devices, source changers, radioactive materials (sources) or any other devices utilizing licensable by-product material for shielding or calibration shall be inventoried at least quarterly.
- 2.2 The inventory shall include all devices, whether in storage, in use, hold tagged or on temporary assignment to another district. The location of ALL radioactive materials assigned to the district must be accounted for at ALL times.
- 2.3 If a device, recorded on an original or previous inventory, is no longer present at the facility, the disposition of the device must be noted on the inventory record and on the equipment record.

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3.0 DAILY EQUIPMENT INSPECTION:

3.1 The required daily equipment inspection procedures are included in Section 17, "Equipment Handling Procedures", of this manual. Results of daily inspections shall be recorded on the Daily Equipment Inspection form, Attachment I of this Section.

4.0 QUARTERLY, INSPECTION AND MAINTENANCE:

4.1 In addition to the daily inspections performed by radiography personnel, the following inspection and maintenance procedures will be performed by, or under the direction of, the District Radiation Safety Officer. Results shall be recorded on the Quarterly Inventory, Inspection and Maintenance form, Attachment II of this section.

If, at any time, a question arises as to whether any radiographic exposure device, source changer or related equipment is functioning properly, DO NOT HESITATE to remove the equipment from service and contact the Corporate Radiation Safety Officer.

4.1.1 Inspection of Labels: All isotope identification labels and radiation warning labels should be in place and in legible condition. Any missing labels should be affixed to the device and any labels that cannot be read or are in poor condition should be replaced prior to use.

4.1.2 Caps, Plugs and Retaining Wires: Check the source connector protective plug by unlocking the device, raising the lock plunger and rotating the collar to the "connect" position, the connector plug should be easily withdrawn from the mechanism. If the plug is dirty, it should be cleaned before being placed back in position.

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Check source exit port safety plug for smoothness of operation and excessive play in the threads. Both the ID threads on the plug and the OD threads on the exit port should be cleaned at this time. Both plugs, and retaining wires must be attached, if any safety plug is missing, the device shall be red tagged "Out Of Service" and remain in storage until replacements can be obtained.

4.1.3 Locking Mechanisms: The lock plunger should be inspected for smoothness of operation. The rotating collar should be checked for smoothness of operation and for positive engagement at each of the three stop positions.

CAUTION In order to check the operations of the rotating collar at each of the stop positions, a drive cable assembly must be attached to engage the interlock. First, attempt to rotate the collar to the "operate" position without attaching the drive cable connector - DO NOT FORCE. The collar should NOT rotate to the "operate" position without the drive cable assembly, this will indicate that the interlock is functioning properly. Next, attach the drive cable assembly. WARNING - BE CERTAIN THAT THE SOURCE EXIT PORT SAFETY CAP IS PROPERLY IN PLACE BEFORE PROCEEDING. With the safety cap in place and the drive cable assembly attached, rotate the collar through all three positions, checking for smoothness of operation. It should rotate smoothly with positive stops (clicks) at the "lock" and "operate" positions. If the locking mechanism is malfunctioning, do not proceed with the inspection, red tag the device "OUT OF SERVICE" and notify the Corporate Safety Director.

Lock plungers or collars that do not operate freely should be lubricated with dry powder Graphite Lock Lubricant. Avoid the use of oils or

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greases as these materials tend to hold abrasive dirt particles that can clog the mechanism or cause excessive wear.

4.1.4 Positive Source Position Indicator: The operation of the source position indicator can be checked without exposing the source. First be certain that the source exit port safety cap is in place. Then, unlock and raise the lock plunger, rotate the collar to the "connect" position, remove the source connector safety plug and attach the drive cable assembly. Rotate the collar to the "operate" position and "cock" the source position indicator by depressing the interlock pin next to the exit port cap and raising the source position indicator until it locks in the UP position. Gently rotate the drive control crank until the source pigtail stops against the exit port cap (about 1/4 turn); DO NOT FORCE. Retract the drive mechanism as you would under normal operating conditions and the indicator should drop into the lock position. If the positive source position indicator fails to operate properly, the exposure device shall be red tagged "OUT OF SERVICE", placed in storage and the Corporate Safety Officer notified before attempting repair. Repair of the source position indicator should not be accomplished with a source in the exposure device.

4.1.5 Source Connector: The source assembly utilized in the Tech Ops 660B exposure device is reusable and is subjected to a series of tests by the manufacturer prior to each use. The connector, however, should be inspected for cleanliness and if necessary cleaned with spray solvent and or compressed air. The spring loaded inner sleeve that engages the ball connector of the drive cable should be checked for smoothness of operation and positive return.

4.1.6 Source Exit Port Nipple: The source exit port nipple should be round and smooth with no burrs on the ID or end radius. The OD threads on the port and the ID threads on the protective cap should be

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cleaned and fit smoothly. The source guide tube quick disconnect fitting should fit closely and connect securely to the exit port nipple. The spring should positively return the outer sleeve to the extended position. The quick disconnect should be cleaned with solvent and dried.

4.1.7

Drive Cable and Connector: The drive cable and connector should be inspected for frayed or broken wires, crimps and excessive corrosion as follows. Crank the cable out into a bucket or other suitable container that will hold the cable in a coil with a radius of not less than 6 inches to keep it clean. Do not use force, as this may damage the drive wheel.

Disconnect the control housings from the Retract side of the crank and remove the stop spring from the drive cable. The drive cable will now pass through the crank.

Turn the crank until the drive cable is totally disconnected and pull it out through the control cable connector, coiling the cable into the bucket.

Remove the control cable connector and connector plug from the control housings, and disconnect the other control housing from the crank. Label the housings for proper reassembly. The cable should be cleaned with chlorothen and dried prior to inspection. Minor rust may be removed by hand wire brushing. Cables with broken wires must be replaced. Check the connector to cable fitting very closely for broken or frayed wires. Be sure the connector is firmly attached to the cable. This is a swaged fitting and must be repaired by the manufacturer. Check the connector ball and shank with a Tech Ops Model 550 NO-GO Gauge. If the ball on the connector fits through the hole in the gauge or if the shank fits in the slot on the side of the gauge, the connector is worn beyond tolerance and MUST be replaced.

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Lightly grease the cable with Texaco "Uni-Temp" grease prior to re-installation. Other greases may form tars or corrosive compounds when exposed to radiation. Flush the control housings and guide tubes with chlorothen and thoroughly dry with compressed air (15 psi max.), remaining solvent can cause permanent damage.

Check the source guide tubes for binding by holding them vertically and dropping a dummy source or jumper through them.

Wipe the guide tubes and control housings with a cloth soaked in chlorothen and flex them to check for internal damage.

Check for dents, cuts, crimps, flat spots or burns on the guide tubes and control housings. Tubes with internal damage should be replaced. Tubes with damage to the outer coating should be repaired prior to being placed back in service.

4.1.8

Crank Assembly Control Unit: When disassembling the 604 Reel mounted or the 693 Pistol Grip control units for servicing, refer to the technical operations service manual for instructions, detailed parts lists and exploded assembly drawings. The Tech/Ops service and maintenance instructions shall form a part of this document by reference and shall be followed during the performance of quarterly maintenance. The Tech/Ops manual can be found in the equipment file of the radioactive material program records at each district office maintaining a radiography program.

HEAT TREATING & INSPECTION

DAILY EQUIPMENT INSPECTION

DOSIMETER

Visible Damage to TLD or Dosimeters: _____

TLD For Current Period: _____

Two Dosimeters Per Individual: _____

Dosimeter Hairline Visible and Set at Zero: _____

Visible Damage to Rate Meter: _____

Rate Meter Alarm and Battery Check: _____

SURVEY INSTRUMENTS

Two Instruments Present: _____

Instruments Free From Physical Damage: _____

Instruments Within Calibration: _____

Battery Levels: _____

Instruments Measure Radiation: _____

VEHICLE

Placards on Four Sides: _____

Door and Storage Compartment Locks: _____

EXPOSURE EQUIPMENT

Device Properly Labeled: _____

Source ID Plate in Place: _____

Locking Mechanism Operating Properly: _____

Connector and Exit Port Plugs in Place: _____

No Abnormal Radiation Levels: _____

Drive Cables and Source Guide Tubes
Free From Visible Damage: _____

Cranking Mechanism Operates Smoothly: _____

Pigtail Connector Operates Properly: _____

Drive Cable Fittings Operate Properly: _____

Source Guide Tube Fitting Operate Properly: _____

Discrepancies/Comments: _____

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SECTION IX

LEAK TEST INSTRUCTIONS

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	SECTION: 9.0	TITLE: LEAK TEST INSTRUCTIONS		
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1.0 SCOPE:

- 1.1 This section is intended to outline the procedures for the leak testing of radioactive sealed sources. Leak testing of sealed sources will normally be performed by the District Radiation Safety Officer, however, the following procedures are provided in the event that leak tests must be performed in the field by radiographic personnel.
- 1.2 Radioactive sealed sources shall be leak tested for removable contamination at intervals not to exceed six months
- 1.3 Commercially available leak test kits will be used for leak test sample acquisition. These kits will be provided by the facilities licensed and authorized to analyze leak test samples and provide the radio-assay.
- 1.4 Leak test samples will be analyzed by the following firms:
 - * W.H. Henken Industries, Inc.
Arlington, Texas
License No. 5-967
Kit Model Number: H-1
 - * Industrial Radiography Maintenance & Supply Co.
Amelia, Louisiana
License No. LA 4342-LO1
Kit Model Number: IRMS-1

2.0 LEAK TESTING OF EXPOSURE DEVICES:

- 2.1 All the information required on the kit must be filled out completely and legibly.
- 2.2 Dissolve the dry detergent supplied with the kit in a small amount of clean water.
- 2.3 Remove the protective cap from the exit port nipple.
- 2.4 Dampen one of the swabs with the detergent solution.
- 2.5 Insert the swab into the exit port nipple and wipe the interior surface. Replace the swab in the plastic envelope it was taken from.

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2.6 Remove the second swab from its envelope and repeat the wiping procedure with the dry swab. Replace the second swab in its plastic envelope.

2.7 Prior to mailing, the swabs must be surveyed to ascertain that there are no radiation levels in excess of background. Conduct this survey by placing a survey meter in a low background area. Set the selector switch to the most sensitive position (lowest scale). Move the kit toward the meter at the location of the GM tube. If there is no change in meter indication, or, if the indication is less than 0.2 mR/H above background intensity, the kit may be mailed. If the indication is greater than 0.2 mR/H above background, the kit SHOULD NOT be sent through the postal service. Contact the Radiation Safety Officer for express shipping instructions.

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SECTION X

NOTIFICATION REQUIREMENTS

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	SECTION: 10.0	TITLE: NOTIFICATION REQUIREMENTS		
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1.0 SCOPE:

1.1 This section establishes the requirements and responsibilities for notifications to regulatory agencies and to individuals.

2.0 RESPONSIBILITY FOR NOTIFICATION:

2.1 The Corporate Radiation Safety Officer shall be notified immediately by the District Radiation Safety Personnel in the event of any incident, situation or condition that requires agency notification. The Corporate Radiation Safety Officer will notify the appropriate agencies within a time frame as required by the severity classification of the incident.

In the event of an incident that requires immediate notification to the agency, and Corporate Safety Personnel cannot be reached, the District Radiation Safety Officer will notify the appropriate agency personnel directly. Should such a notification ever become necessary, the Corporate Radiation safety Officer shall be informed of such action as soon as he can be reached.

3.0 NOTIFICATION REQUIREMENTS:

3.1 Immediate Notification:

3.1.1 The administrator of the appropriate agency office shall be notified by telephone and by telegraph, mailgram or facsimile immediately after it has been determined that a loss or theft of licensed material has occurred.

3.1.2 The administrator of the appropriate agency office shall be notified by telephone and by telegraph, mailgram or facsimile immediately when a shipping container's radiation levels are in excess of 200 milliroentgens per hour at any exterior surface or 10 milliroentgens per hour at one meter from the exterior surface.

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3.1.3 The administrator of the appropriate agency office shall be notified immediately by telephone and by telegraph, mailgram or facsimile of any incident involving licensed material which may have caused or threatens to cause the exposure of any individual to 25 REMS or more of radiation.

3.2 24 Hour Notification:

3.2.1 The administrator of the appropriate agency office shall be notified within 24 hours by telephone and by telegraph, mailgram or facsimile of any incident involving licensed material which may have caused or threatens to cause the exposure of any individuals to 5 REMS or more of radiation.

3.3 5 Day Written Notification:

3.3.1 Within 5 days of the receipt of notification by the laboratory providing leak test radio assays, a written report shall be sent to the appropriate regulatory agency indicating each exposure device for which the radio assays revealed the presence of 0.005 microcuries or more of removable contamination.

3.3.2 Each report shall include the exposure device manufacturer, model, serial number, sealed source material, source serial number, activity at time of test, radio-assay results and corrective action taken.

3.4 30 Day Written Notification:

3.4.1 In addition to any of the above notifications, a written report will be provided to the appropriate authority within 30 days of the initial notification.

Such report shall describe in detail the events of the subject notification and shall include as a minimum the following information:

* A detailed sequence of events involved in the incident.

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- * Exposures and exposure levels as applicable.
- * Any required HP calculations.
- * Dosimetry data.
- * Individual's statements as applicable.
- * Any corrective action taken.
- * Any action taken to aid in preventing a recurrence of the incident.
- * Any additional information as may be required to necessitate a complete and accurate report.

3.5 Notices to Individuals:

3.5.1 Any individual involved in an incident, requiring notification of a regulatory agency, will be notified verbally and by letter and by letter of his/her exposure as a result of such incident. This notification shall be made within a time frame equivalent to the requirements for notification to the appropriate regulatory agency.

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SECTION XI

DOCUMENTATION AND RECORD RETENTION

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1.0 SCOPE:

1.1 This section establishes the requirements for the maintenance and retention of records and other documents pertaining to Western Stress' Radiation Safety Program.

2.0 GENERAL:

2.1 All records and forms shall be completed and filed in a clear and legible manner.

2.2 All records will be maintained at each district in a "current" status file for a period covering one calendar year, beginning on January 1st of each year. At the end of each calendar year current records will be removed to a storage file in each district office.

2.3 At no time will records pertaining to the Radiation Safety Program be altered, destroyed or disposed of. All records, both current and stored, will be maintained for inspection by the appropriate regulatory agencies.

3.0 THE FOLLOWING RECORDS WILL BE MAINTAINED BY THE DISTRICT RADIATION SAFETY OFFICER OR HIS DESIGNEE:

3.1 Exposure Records

The records shall include daily dosimeter reports, monthly TLD reports, occupational exposure histories, annual exposure reports and termination reports. TLD reports shall be reviewed on receipt. Daily dosimeter reports shall be reviewed at least weekly by the District Radiation Safety Officer to monitor exposure rates. Occupational exposure history and current exposure records shall be maintained on NRC forms 4 and 5 or on forms containing, as a minimum, equivalent information.

3.2 Survey Records

Survey records shall include storage surveys, receipt surveys, vehicle surveys, area surveys and daily camera surveys as recorded on daily survey reports.

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3.3 Calibration Records

These records shall include certificates for the quarterly calibration of radiation survey instruments and the annual calibration of pocket dosimeters.

3.4 Utilization Logs

Utilization logs will normally be kept at the storage vault to facilitate access to the logs by radiography personnel. These logs will be checked weekly by the District Radiation Safety Officer to assure accuracy and completeness. Completed log pages will be removed to the Radiation Safety Files.

3.5 Inventory, Inspection and Maintenance Records

As outlined in Section 8 of this manual, inventory, inspection and maintenance reports will be maintained by the District Radiation Safety Officer.

3.6 Leak Test Records

Records of leak tests will be maintained in the individual camera files.

3.7 Receipt, Transfer and Disposal Records

Receipt, transfer and disposal of radioactive materials shall be conducted in accordance with Section 7 of this manual. Receipt and transfer records will be maintained in the individual camera files until such time as the source is transferred to the supplier for disposal. On disposal of the source, all records pertaining to that source, including the disposal slip, will be transferred to the disposal file. A perpetual record of receipt and disposal will be maintained on the master log.

3.8 Training Records

All training shall be conducted in accordance with Section 16 of this manual. Records of training, retraining, qualifications and test documents will be maintained in the personnel files by the District Radiation Safety Officer.

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3.9 Field Inspections

Records of field inspections conducted by the District Radiation Safety Officer on field personnel, shall be maintained in the District Radiation Safety Files.

Records of Corporate audits will be maintained in the Corporate records. Copies will be provided to the District Radiation Safety Officer for corrective action.

3.10 Safety Meeting Records

Documentation of safety meetings conducted at the district offices will be maintained in the radiation safety files.

3.11 Gender Specific Records

Female Radiographer's or Radiographer's assistants planning pregnancy, or suspects they may be pregnant, shall notify the district radiation safety officer in writing asking to be placed in non-radiographic operations until after child birth.

Women working in radiographic operations shall notify the district radiation safety officer in writing as soon as they are declared pregnant. The district radiation safety officer shall immediately suspend pregnant woman from radiographic operations until after child birth. The dose to the pregnant woman, embryo/fetus shall not exceed 0.5 rem. After declaration of pregnancy the woman shall not receive a dose greater than 0.05 rem. Records of declaration and dose to the woman, embryo/fetus shall be maintained in the woman's district personnel radiation safety files.

All newly hired female radiographer's or radiographer's assistants shall sign an acknowledgement statement of Section 11.3.11. The acknowledgement statement will be maintained in the woman's district personnel radiation safety files.

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4.0 RECORDS TO BE MAINTAINED AT TEMPORARY JOB SITES:

4.1 The following records shall be available at temporary job sites for inspection by the regulatory agency or company audit personnel.

- * Copy of radioactive material license.
- * Copies of applicable regulations.
- * Transport papers.
- * Radiation safety manual.
- * Daily survey records.
- * Daily dosimeter records.
- * Evidence of survey instrument calibration and leak test records for equipment present at the site.

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SECTION XII

EMERGENCY PROCEDURES

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1.0 SCOPE:

- 1.1 With the safest equipment and the best of safety procedures the possibility of an accident or equipment malfunction must still be considered. This section establishes the procedures to be followed in the event of an emergency situation while utilizing radioactive materials.
- 1.2 It is the responsibility of every individual involved in the use of radioactive materials to become thoroughly familiar with the procedures outlined in this section and to follow these procedures explicitly in the event of an emergency.

2.0 GENERAL POLICY:

- 2.1 If there is ever a question as to whether or not a given situation constitutes an emergency, then emergency procedures are to be implemented until a determination is made that an emergency does not or no longer exists.
- 2.2 In every case where an emergency condition exists or may exist, the radiographer in charge should NEVER leave a restricted area or exposure device unattended. Send another individual with a written message to telephone the District Radiation Safety Officer.
- 2.3 In every case where an emergency condition exists or may exist, the District Radiation Safety Officer shall notify the Corporate Radiation Safety Officer immediately. In the event that the District Radiation Safety Officer cannot be reached, the Corporate Radiation Safety Officer shall be notified by other district personnel. The Corporate Radiation Safety Officer will determine what action is to be taken, which regulatory agencies require notification, and whether emergency response and health physics personnel will be dispatched from Corporate Headquarters.
- 2.4 If, after studying these procedures, there are any questions, the District Radiation Safety Officer should be contacted for an explanation.

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3.0 LOST OR STOLEN DEVICES:

3.1 In the event that a radiographic exposure device or source changer is lost or stolen, immediately notify the District Radiation Safety Officer or Assistant Radiation Safety Officer. If District Safety personnel cannot be reached, contact the Corporate Radiation Safety Officer. If no company safety personnel can be reached within a reasonable time, contact the appropriate state or federal regulatory agency directly. The necessary telephone numbers are listed at the end of this section.

4.0 EQUIPMENT MALFUNCTIONS:

4.1 In the event of an emergency arising from malfunction of an exposure device or source changer (including a disconnected source), damage to a source assembly, or damage to the device or changer the following steps are to be taken.

4.1.1 Conduct a survey of the area and establish an actual 2 mR/H restricted area boundary. Post the perimeter with "CAUTION RADIATION AREA" signs.

4.1.2 Maintain constant visual surveillance over the area. UNDER NO CIRCUMSTANCES is the area to be left unattended by the radiographer in charge.

4.1.3 The radiographer in charge should send the assistant or other individual, with a written message, call the District Radiation Safety Officer. In the event the District Radiation Safety Officer cannot be reached, contact the Corporate Radiation Safety Officer or appropriate state or federal regulatory agency.

4.1.4 If help is not immediately available DO NOT PANIC! No harm will be done if all individuals stay outside the restricted area.

4.1.5 After establishing security over the area and sending someone to notify the District Radiation Safety Officer for assistance, maintain surveillance over the area until help arrives. Do not leave untrained personnel to maintain area surveillance.

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4.1.5 UNDER NO CIRCUMSTANCES ARE RADIOGRAPHERS TO ATTEMPT TO RETRIEVE DISCONNECTED SOURCES UNLESS THEY HAVE BEEN SPECIFICALLY TRAINED AND APPROVED TO DO SO BY THE CORPORATE RADIATION SAFETY Officer!!!!

5.0 ACCIDENT INVOLVING A VEHICLE TRANSPORTING A SEALED SOURCE:

- 5.1 If the accident is of a minor nature and no radiation hazard exists, continue on to the destination or return to the shop (after meeting legal requirements for a vehicular accident) as directed by District supervisory personnel.
- 5.2 If there is any chance that a possible radiation hazard exists, the following steps shall be taken:
- 5.2.1 Utilizing a survey meter, determine if the source is in the shielded position.
- 5.2.2 If the source is in the shielded position, remain with the device and send someone with written instructions to notify the District Radiation Safety Officer.
- 5.3 If the survey meter indicates that the source is in the unshielded position or if both survey meters are damaged beyond operation, the following steps must be taken:
- 5.3.1 Do not panic or incite panic! Calmly move everyone as far back from the vehicle as possible, establish a perimeter and maintain surveillance over the area to ensure that no one enters.
- 5.3.2 Calculate the 2 mR/H boundary and make any necessary adjustments to the perimeter established above.
- 5.3.3 Inform civil authorities of any radiation hazard (or suspected radiation hazard) and enlist their assistance in preventing persons from entering the restricted area.

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5.3.4 Maintain surveillance over the areas and send someone with written instructions to notify the District Radiation Safety Officer. The District Radiation Safety Officer will notify the Corporate Radiation Safety Officer and determine what action is to be taken. Under no circumstances is the radiographer in charge to leave the area. Maintain surveillance until assistance arrives.

5.3.5 With the only exception of a life and death situation, no entrance into the restricted area, for the purposes of retrieval or shielding of the radioactive source, by the radiographer should be attempted unless trained and authorized to do so.

6.0 ACCIDENTS INVOLVING EXPOSURE TO UNMONITORED PERSONNEL:

6.1 In the event that unauthorized individuals, who are not wearing personnel dosimetry, become exposed to radiation, the following steps are to be taken.

6.1.1 If the source is exposed, IMMEDIATELY return the source to the shielded position.

6.1.2 If the source cannot (due to equipment malfunction) be returned to the shielded position, refer to Paragraph 4.0 of this Section.

6.1.3 Record the names, addresses and telephone numbers of unmonitored personnel involved.

6.1.4 Record the approximate position of these unmonitored personnel with relation to the exposed position of the source (not the camera). Record the approximate time duration of exposure to the unmonitored personnel.

6.1.5 Immediately notify the District Radiation Safety Officer and report the pertinent facts. The District Radiation Safety Officer will notify the Corporate Radiation Safety Officer to determine any additional information required and action to take.

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7.0 DAMAGE TO STORAGE AREA:

7.1 If no radiation hazard exists.

- 7.1.1 Establish a new storage area and place all exposure devices and source changers in the new storage area.
- 7.1.2 If placement in a new storage area is not possible, set up a restricted area and notify the appropriate personnel in regard to the restricted area. Refer to Section 3 of this manual for Radioactive Material Security.
- 7.1.3 Notify the District Radiation Safety Officer and report all pertinent facts.
- 7.1.4 The District Radiation Safety Officer shall notify the Corporate Radiation Safety Officer to determine the required action to take.

7.2 If a radiation hazard exists.

- 7.2.1 Immediately set up a restricted area.
- 7.2.2 Notify all personnel in the general area, in regard to the restricted area, radiation hazard, etc.
- 7.2.3 Maintain surveillance over the area and send someone to notify the District Radiation Safety Officer.
- 7.2.4 The District Radiation Safety Officer shall notify the Corporate Radiation Safety Officer to determine the required action to take.

8.0 DAMAGE TO EXPOSURE DEVICE OR SOURCE CHANGER:

8.1 If no radiation hazard exists.

- 8.1.1 Perform a survey of the device to assure that the seal of source is in the sealed position.

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8.1.2 Lock the exposure device or secure the hold down cover on the source changer.

8.1.3 Place the exposure device or source changer in the storage area.

8.1.4 Notify the District Radiation Safety Officer and report all pertinent facts.

8.1.5 The District Radiation Safety Officer shall notify the Corporate Radiation Safety Officer to determine the required action to take.

8.2 If a radiation hazard exists.

8.2.1 Immediately set up a restricted area.

8.2.2 DO NOT handle the exposure device or source changer.

8.2.3 Notify site personnel in regard to the restricted area, radiation hazard, etc.

8.2.4 Maintain surveillance over the area and send someone to notify the District Radiation Safety Officer.

8.2.5 The District Radiation Safety Officer shall notify the Corporate Radiation Safety Officer to determine the required action to take.

9.0 EMERGENCIES DUE TO FIRE EXPLOSION, PERSONNEL INJURY, ETC. DURING OPERATIONS:

9.1 Immediately return the source to the shielded position, lock the exposure device and remove it from the hazard area.

9.2 If the exposure device cannot be removed from the area, notify emergency personnel, upon their arrival, of the condition of the source (i.e., exposed, or shielded, but device still in area).

9.3 If the source is exposed, obtain the names of all emergency personnel who were near the source during the emergency.

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- 9.4 If the source is exposed and cannot be brought back to the shielded position after the emergency condition is over (fire extinguished, etc.) proceed with the procedures in Paragraph 4.0 of this Section.
- 9.5 Maintain surveillance and send someone with written instructions to notify the District Radiation Safety Officer.
- 9.6 The District Radiation Safety Officer shall notify the Corporate Radiation Safety Officer to determine the required action to take.

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EMERGENCY RESPONSE TELEPHONE NUMBERS

Corporate Headquarters:
Analytic Stress Relieving, Inc.
117 Board Road
Lafayette, LA 70508

Corporate Radiation Safety Officer:
7523 Whitepine Road
Richmond, Virginia 23237
Mike Martin - Office: (804) 271-5447
Home: (804) 530-1952
Pager: (800) 719-3702

Richmond District Office:
7523 Whitepine Road
Richmond, Virginia 23237

District Radiation Safety Officer - Richmond, Virginia
Mike Martin - Office: (804) 271-5447
Home: (804) 530-1952
Pager: (800) 719-3702

Pennsauken District Office:
1602 Hylton Road
Pennsauken, New Jersey 08110

District Radiation Safety Officer - Pennsauken, New Jersey
Leo Clark - Office (609) 665-0700
Home: (609) 939-3606
Pager: (609) 725-0660

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United States Nuclear Regulatory Commission:

Region I
U.S. Nuclear Regulatory Commission

Region I
475 Allendale Road
King of Prussia, PA 19406-1415
(800) 432-1156

Region II
U.S. Nuclear Regulatory
Commission
Region II
101 Marietta St., NW - Suite 2900
Atlanta, GA 30323-0199
(900) 577-8510

Region III
U.S. Nuclear Regulatory Commission

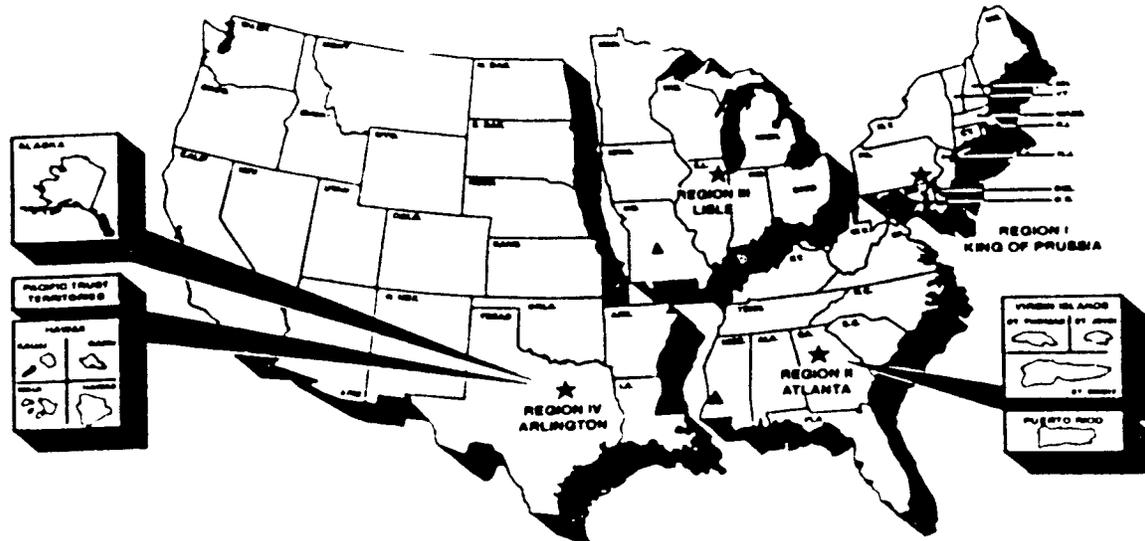
Region III
801 Warrenville Road
Lisle, IL 60532-4351
(800) 522-3025

Region IV
U.S. Nuclear Regulatory
Commission
Region IV
611 Ryan Plaza Drive - Suite 400
Arlington, TX 76011-8064
(800) 952-9677

Walnut Creek Field Office
U.S. Nuclear Regulatory Commission
Region V
1450 Maria Lane
Walnut Creek, CA 94596-5368
(800) 882-4672

To report safety concerns or
violations of
NRC requirements
by your employer
telephone
**NRC
SAFETY HOTLINE**
1-800-695-7403

To report incidents involving
trust funds or abuse
by an NRC employee
or NRC contractor
telephone
**OFFICE OF THE
INSPECTOR GENERAL
HOTLINE**
1-800-233-3497



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SECTION XIII

QUALITY ASSURANCE PROGRAM FOR SHIPPING CONTAINERS

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1.0 ORGANIZATION:

- 1.1 Corporate Radiation Safety Officer - It shall be the responsibility of the Corporate Radiation Safety Officer to ensure that the QA program for shipping containers is effectively executed. Any changes in the program, or additional procedure implementation due to regulatory requirements, shall be the responsibility of the Corporate Radiation Safety Officer.
- 1.2 District Radiation Safety Officer - It shall be the responsibility of the District Radiation Safety Officer to ensure the inspection of shipping containers is performed and that deficiencies are corrected. He shall be personally responsible for inspecting shipping containers on a quarterly basis and shall make a record of such inspections. He shall notify the Corporate Radiation Safety Officer of deficiencies that require the acquisition of additional equipment or labels and shall see that these deficiencies are corrected.
- 1.3 Radiographer - It shall be the responsibility of the radiographer to inspect shipping containers on a daily basis. Any deficiencies shall be reported to the District Radiation Safety Officer to be corrected. Radiographers shall be appointed by the District Radiation Safety Officer and shall be trained in the method of inspection for shipping containers.

2.0 QUALITY ASSURANCE PROGRAM:

- 2.1 Operating Procedures - The following procedures shall be adhered to when operating or using transport containers.
- 2.1.1 Only authorized personnel shall be allowed to use the transport containers.
- 2.1.2 Inspection of the devices shall be performed in accordance with 2.2 below.
- 2.1.3 The nut and bolt running through the bolt ring (overpacks), shall be secured to ensure the top is secure.

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2.1.4 On vehicles without locked transport compartments, the container shall be secured on the vehicle by running a piece of chain through the handle and attaching it to an integral part of the vehicle. This chain shall then be locked with a pad-lock.

2.2 Inspection Procedures - The following procedures shall be adhered to when inspecting transport containers.

2.2.1 Only authorized personnel shall be allowed to inspect transport containers.

2.2.2 The overall condition of the transport container shall be inspected to ensure that it is not visibly damaged.

2.2.3 All components shall be inspected for proper and secure fit.

2.2.4 Locks shall be inspected to ensure that they operate properly and hold securely.

2.2.5 Bolt rings and nut and bolt locks (overpacks) shall be checked to ensure that they work properly.

2.2.6 Inner packing (overpack) shall be checked to ensure it is in place and not damaged.

2.2.7 Labels shall be inspected to ensure that they are not worn off and that they are legible.

2.2.8 Handles shall be inspected to ensure that they are attached securely and are not in need of repair.

2.2.9 Containers shall be checked to ensure that source plugs and dust covers are in good condition and are in place on the device before it is used.

2.2.10 Radiation levels shall be checked when a new source is placed into the container, as well as on a daily basis by the radiographer.

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- 2.3 Maintenance and Repair Procedures - The following procedures shall be adhered to in order to ensure proper maintenance and repair of transport containers.
- 2.3.1 Maintenance and repair shall only be performed by personnel authorized to do so.
 - 2.3.2 Maintenance, and any necessary repair, shall be performed on at least a quarterly basis.
 - 2.3.3 Any severe package damage (i.e., punctures, holes in the package, etc.) shall be repaired. If the damage is severe enough that repair is not possible the package shall not be used.
 - 2.3.4 If a problem is found with a lock, it shall be corrected, or the lock shall be replaced before the device is used.
 - 2.3.5 Bolt rings, nuts and bolts (overpacks) shall be oiled. Any thread damage shall be repaired, or the part shall be replaced.
 - 2.3.6 Inner packing shall be inspected and, if necessary, replaced.
 - 2.3.7 If labels are not legible, they shall be replaced.
 - 2.3.8 Handles that are not securely attached shall be repaired before the device is used.
 - 2.3.9 If source plugs or dust covers are missing, or if they are in bad condition, they shall be replaced before the device is used.
 - 2.3.10 If radiation levels exceed permissible levels the device shall have additional shielding added, or be re-positioned on the vehicle in order to bring levels into acceptable limits.
- 2.4 Packaging, Loading and Unloading of Transport Containers - The following procedures shall be followed when packaging a container and when loading and unloading containers.

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2.4.1 Packaging, loading and unloading of transport containers shall only be performed by persons authorized to do so.

2.4.2 For vehicles without transport compartments or when overpacks are used in lieu of the transport compartments, the following shall be adhered to.

2.4.2.1 Containers shall be checked to ensure proper inner packing.

2.4.2.2 The exposure device shall be loaded into the container in the proper position, as indicated by the molded inner packing.

2.4.2.3 Packing shall be placed on top of the device and the lid shall be fastened using the bolt ring and nut and bolt.

2.4.2.4 After ensuring that all labels are present and legible, the device shall be loaded into the vehicle.

2.4.2.5 The device shall be secured to the vehicle by running a piece of chain through the handle and attaching it to an integral part of the vehicle and locking it with a pad-lock.

2.5 Handling Procedures - Specific handling procedures are outlined in 2.1 (Operating Procedures) and 2.4 (Packaging, Loading and Unloading of Transport Containers) above.

3.0 PROCUREMENT AND CONTROL OF DOCUMENTS:

3.1 Suppliers shall be required to submit appropriate verification that shipping containers were manufactured under control of an NRC-Approved QA program.

3.2 Renewals of suppliers documents shall be obtained upon their expiration.

3.3 QA documents shall only be issued to personnel involved in the company's QA program.

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3.4 It shall be the responsibility of the District Radiation Safety Officer to ensure that the above items are adhered to.

4.0 IDENTIFICATION AND CONTROL OF MATERIALS, PARTS AND COMPONENTS:

All parts and components used to repair shipping containers shall be ordered from the manufacturer of the container. No part shall be used that has been changed or altered in any manner.

5.0 HANDLING, STORAGE AND SHIPPING:

All shipping containers, which contain radioactive materials, shall be kept in a locked storage container at all times when not being used. Keys to the locks on storage containers and shipping containers shall be controlled by the District Radiation Safety Officer. The only individuals who will have keys issued are the ones who have had, as a minimum, training that is required for radiographers as outlined in the regulations.

6.0 CORRECTIVE ACTION:

The corrective action for items found to be in non-compliance are those outlined in 2.3 of this document. It shall be the responsibility of the District Radiation Safety Officer to ensure that these corrective actions are taken for all items of non-compliance.

7.0 AUDITS:

7.1 Quarterly audits of all shipping containers and their components shall be performed by the District Radiation Safety Officer to ensure the containers are in compliance with the regulations.

7.2 Annual audits of the QA program shall be performed by the Corporate Radiation Safety Officer to determine the overall effectiveness and compliance with management policies and procedures. These audits may also include evaluations by outside consulting firms employed by the company.

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8.0 QA RECORDS:

8.1 QA records which shall be maintained shall include the following: records of quarterly audits and inspection of equipment, procurement documents, non-conformances, personnel training and certification records, evidence of operational capability and verification of repair, replacement and maintenance.

8.2 QA records shall be maintained indefinitely for inspection by the appropriate regulatory agency.

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SECTION XIV

INTERNAL AUDIT AND INSPECTION PROGRAM

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1.0 SCOPE:

- 1.1 In keeping with Western Stress' corporate policy of "Safety First", the following system of internal inspections and audits shall be implemented as part of the Radiation Safety Quality Assurance program.
- 1.2 All inspections and audits shall be documented on the appropriate forms. All areas of non-compliance shall be recorded along with any corrective action or disposition for any item which is not in conformance with the Radiation Safety Program.
- 1.3 Any inspection or audit form on which an item of non-conformance is noted shall be transmitted by the District Radiation Safety Officer to the Corporate Radiation Safety Officer for review.
- 1.4 Any report of non-conformance shall include the following:
 - 1.4.1 A detailed description of the non-conforming item.
 - 1.4.2 Any corrective action taken or disposition of the non-conforming item.
 - 1.4.3 Any corrective action or disposition planned.
 - 1.4.4 Any corrective action or retraining required to avoid a recurrence of the non-conformance.
 - 1.4.5 Time frame within which corrective action will be taken in order to achieve full conformance.

2.0 DAILY EQUIPMENT INSPECTIONS:

- 2.1 Equipment inspections shall be performed on a daily basis by the radiographer.
- 2.2 Results of equipment inspections shall be recorded on the Daily Equipment Inspection form, Attachment I of this Section.
- 2.3 The Daily Equipment Inspection shall be performed prior to leaving the storage facility and any discrepancies noted

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shall be rectified, or equipment replaced, PRIOR to transporting equipment to temporary job sites.

- 2.4 Daily equipment reports shall be submitted daily to the District Radiation Safety Officer or the Assistant Radiation Safety Officer.

3.0 QUARTERLY INSPECTION OF EQUIPMENT:

- 3.1 Quarterly equipment inspections shall be performed and documented by, or under the direction of, the District Radiation Safety Officer, in accordance with Section 8 of this manual.

4.0 QUARTERLY FIELD INSPECTIONS:

- 4.1 Each radiographer and assistant radiographer shall be inspected in the field, on an unannounced basis, by the District Radiation Safety Officer or an Assistant Radiation Safety Officer.
- 4.2 Field inspections of personnel shall be conducted at a minimum of once each quarter.
- 4.2.1 Personnel that have not performed radiography for a period greater than three months shall be inspected the first time they engage in radiographic operations.
- 4.3 The results of field inspections conducted in accordance with Paragraphs 4.2 and 4.2.1 shall be recorded on the District Field Inspection Report form, Attachment II of this Section.

5.0 CORPORATE AUDITS:

- 5.1 Each District radiographic operation shall undergo a complete audit of the entire Radiation Safety Program, a minimum of once each calendar year by Corporate Safety personnel.

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SECTION XV

QUALIFICATION OF PERSONNEL

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1.0 SCOPE:

- 1.1 This section establishes the qualification and experience requirements for personnel actively responsible for Western Stress' Radiation Safety Program.
- 1.2 All references to experience are in regard to the use and radiation protection aspects of radioactive materials. Experience acquired solely in X-radiology (medical or industrial) shall not be considered as having met the experience requirements of this document.

2.0 CORPORATE RADIATION SAFETY Officer:

The Corporate Radiation Safety Officer's qualifications shall include:

- 2.1 Possession of a high school diploma or G.E.D.
- 2.2 Shall have completed the training requirements of Section 16 of this manual or provide documentation of previous training in the subjects outlined in Section 16.
- 2.3 Demonstrate an understanding of the topics outlined in Section 16 of this manual, Western Stress' operating and emergency procedures and topics related to radiation protection in industrial operation.
- 2.4 A minimum of four (4) years experience in radiographic field operations management, including qualification as a radiographer.
- 2.5 A minimum of two (2) years experience in radiological protection and radiation safety operations including training and testing of personnel.

3.0 DISTRICT RADIATION SAFETY OFFICER:

The District Radiation Safety Officer's qualifications shall include:

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- 3.1 Possession of a high school diploma or G.E.D.
- 3.2 Shall have completed the training requirements of Section 16 of this manual or provide documentation of previous training in the subjects outlined in Section 16.
- 3.3 Demonstrate an understanding of the topics outlined in Section 16 of this manual, Western Stress' operating and emergency procedures and topics related to radiation protection in industrial operations.
- 3.4 A minimum of four (4) years experience in radiographic field operations, including qualification as a radiographer.

4.0 RADIOGRAPHER TRAINER:

The radiographic trainer shall be the individual which provides on the job field instruction to radiographic trainees. A radiographer trainer shall have the following qualifications:

- 4.1 Shall have met all of the requirements for qualification as a radiographer and have a minimum of two (2) years experience as a radiographer.

5.0 RADIOGRAPHER:

- 5.1 Before an individual will be permitted to act as a radiographer, the individual shall:
 - 5.1.1 Have completed the training and testing requirements of Section 16 of this manual or provide documentation of previous training in the subjects outlined in Section 16.
 - 5.1.2 Demonstrate an understanding of the applicable regulations, license conditions and Western Stress' operating and emergency procedures.
 - 5.1.3 Have three (3) months of on the job training by a radiographer trainer.

NOTE: Requirement 5.1.3 above may be waived if:

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A. The individual can provide documentation of previous experience under another license.

OR

B. The individual holds a valid license as a radiographer issued by an appropriate state or federal regulatory agency.

6.0 RADIOGRAPHER ASSISTANT OR TRAINEES:

6.1 Before an individual will be permitted to act as a radiographer assistant or trainee, the individual shall:

6.1.1 Complete the training and testing requirements of Section 16 of this manual or provide documentation of previous training in the subjects outlined in Section 16 of this manual.

6.1.2 Demonstrate an understanding of the applicable regulations, license conditions and Western Stress, Inc.'s operating and emergency procedures.

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SECTION XVI

RADIATION SAFETY TRAINING PROGRAM

Western Stress A Division of Analytic Stress Relieving, Inc. HEAT TREATING & INSPECTION	MANUAL NO.:	TITLE: RADIATION SAFETY MANUAL		
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1.0 SCOPE:

1.1 This section establishes the requirements for the training and qualification of radiographic personnel and shall apply to all personnel involved in radiographic operations

2.0 GENERAL:

2.1 ALL personnel, including assistants and trainees, will complete the training and testing requirements of this Section unless documentation of previous training (acceptable to the Corporate Radiation Safety Officer) is provided.

2.2 If documentation of previous training is substituted for training in the subjects outlined in this section, the following requirements must still be completed:

- 2.2.1 Completion with a passing grade (70%) of the Radiation Safety General, Specific and Practical Examinations.
- 2.2.2 All personnel will receive a copy of, and a minimum of eight (8) hours of instruction in, the applicable regulatory regulations, license conditions and operating and emergency procedures.
- 2.2.3 Demonstrate an understanding of the documents listed in Item 2.2.2 above.
- 2.2.4 A minimum of eight (8) hours of on the job instruction in the handling and operation of the radiographic exposure devices and related equipment utilized by Western Stress. This training will be administered by a Radiation Safety Officer or an individual designated as a radiographer trainer.

3.0 INSTRUCTORS:

3.1 Formal classroom instruction in the subjects outlined in this section may be administered by Western Stress personnel or by outside training facilities.

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3.2 Instruction in the operation and emergency procedures for previously trained personnel will normally be conducted by the District Radiation Safety Officer or Assistant Radiation Safety Officer.

4.0 ADDITIONAL TRAINING:

4.1 Refresher Courses:

4.1.1 All personnel will attend a formal 16 hour radiation safety refresher course, conducted by training personnel, at least once annually.

Refresher courses will include a review of the subjects covered during initial training, and additionally, will address any operation of new equipment, changes in operating procedures, use of emergency procedures, changes in regulations, etc. A 'Closed Book' refresher examination shall be administered and retained in personnel files.

4.2 Safety Meetings:

4.2.1 All personnel will be required to attend a Radiation Safety Meeting, conducted by the District Radiation Safety Officer or Assistant Radiation Safety Officer, at least once each quarter. Safety meetings will include topics such as changes in procedures or regulations, any weak points in the program, findings of quarterly field inspections and a review of at least one radiation protection subject.

4.3 Annual refresher training and quarterly safety meetings are intended to provide training and discussion in radiological protection, the ARF NOT conducted for the purpose of providing training in radiographic technique.

4.4 ALL training, including quarterly safety meetings, shall be documented and records of training activities shall be retained.

4.4.1 Initial training and annual refresher training will be documented by Certificate of Completion

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issued by the Corporate training activity.

- 4.4.2 Quarterly safety meetings will be documented by letter indicating topics discussed and personnel in attendance.

5.0 EXAMINATIONS:

- 5.1 A series of three (3) examinations will be administered to all personnel prior to these individuals handling radioactive materials or working within restricted areas.

5.1.1 General Examination

The general examination shall be comprised of fifty (50) multiple choice questions and shall be administered "closed book" except that certain charts and graphs distributed by the test administrator may be used. A passing grade of 70% is required.

5.1.2 Specific Examination

This examination is intended to determine an individuals ability to locate specific pieces of information in reference documents. This examination shall be comprised of twenty (20) questions requiring the individual to locate and extract specific information in Western Stress' operating and emergency procedures, and the applicable regulations. A passing grade of 70% is required.

5.1.3 Practical Examination

This examination will be comprised of a twenty (20) point checklist to determine an individuals ability to set up and operate the specific equipment utilized by Western Stress.

- 5.2 The examinations above are intended to determine an individuals knowledge in the areas of radiation protection and safety equipment operation. These examinations SHALL NOT include questions concerning radiographic technique, vehicle maintenance, etc.

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5.3 Failure to successfully complete any of the above examinations will require a minimum of eight (8) hours of retraining prior to re-examination.

With the exception of the practical checklist, individuals that are being retested after retraining shall not be administered the same examination previously taken.

5.4 In actual practice, in order to avoid personal familiarity with a particular examination, the training activity will utilize multiple examinations such that these may be rotated in use.

6.0 RADIATION SAFETY TRAINING COURSE:

6.1 Radiation safety training, conducted by Western Stress' training activity shall include the following subjects:

<u>TOPIC</u>	<u>INSTRUCTION HOURS</u>
1. <u>INTRODUCTION</u>	1
A. Program Syllabus	
B. Purpose	
C. Background	
D. Alara Program	
2. <u>STRUCTURE OF MATTER</u>	1-1/2
A. Atoms/Molecules	
B. Elements/Compounds	
C. Subatomic Particles	
1. Protons	
2. Neutrons	
3. Electrons	
4. Positrons	
D. Atomic Number	
E. Atomic Mass	

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- F. Isotopes
 - 1. Natural/Man Made
 - 2. Production
 - 3. Radio Isotopes

3. ELECTROMAGNETIC RADIATION 1

- A. Energy
 - 1. Wavelength
 - 2. Frequency
 - 3. Units
- B. Gamma Radiation
- C. X-Radiation
- D. Characteristics

4. PARTICLE RADIATION 1/2

- A. Alpha Particles
- B. Beta Particles

5. NUCLEAR REACTIONS 3

- A. Radio Isotopes
- B. Radioactive Decay
- C. Activity
 - 1. Curie
 - 2. Half Life
- D. Specific Activity
 - 1. Activity/Unit Mass
- E. Emissivity
 - 1. Co
 - 2. Or
- F. Interaction of Radiation with Matter
 - 1. Ionization
 - a. Particle Ionization
 - b. Electromagnetic Ionization
 - (1) Photo Electric
 - (2) Compton Effect
 - (3) Pair Production
 - 2. Ionization Effects

6. RADIATION HAZARDS 1/2

- A. Risk Perspective
- B. Natural Background Exposure

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- C. Man Made Sources
- D. Medical Applications
- E. Risk to Industrial Radiographers

7. RADIATION HEALTH PROBLEM 1

- A. External Problem
- B. Internal Exposure
 - 1. Radiological Half Life
 - 2. Biological Half Life
 - 3. Effective Half Life

8. RADIATION DOSE MEASUREMENT 1-1/2

- A. Dose Rate
- B. Cumulative Dose
- C. Roentgen
- D. Radiation Equivalent Man
- E. Radiation Absorbed Dose
- F. Relative Biological Effectiveness

9. TYPES OF RADIATION INJURY 1/2

- A. Dose Levels
 - 1. Severity Classification
- B. Radiation Sickness
- C. Radiation Injury
- D. Radioactive Poisoning
 - 1. Contamination
 - a. Gamma Emitters
 - b. Alpha/Beta Emitters

10. PERSONNEL EXPOSURE MONITORING 4

- A. Permissible Exposure
- B. Exposure Banking Concept
- C. Types of Exposure
 - 1. Fractional
 - 2. Noncontinuous
 - 3. Excessive
 - 4. Medical Exposures

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11. RADIATION DETECTION

4

- A. Dose/Dose Rate
- B. Detection Instrumentation - Dose
 - 1. Film Badge
 - 2. Dosimeter
 - a. Use
 - b. Charging
 - 3. Thermal Luminescent Dosimeters
- C. Detection Instrumentation - Dose Rate
 - 1. Alarming Meters
 - a. use, operation, calibration
 - 2. Survey Meters
 - a. Ionization Chamber
 - b. Geiger Mueller Tube
 - 3. Use - Checkpoints
 - 4. Calibration - Requirements
 - 5. Survey Techniques
 - a. Reading Meter Indications
 - b. Individual Surveys
 - c. Recording
 - d. Identifying Problems
 - 6. Instrument Maintenance

12. METHODS OF CONTROLLING EXPOSURE

4-1/2

- A. Time
- B. Distance
 - 1. Inverse Square Law
 - a. Definition
 - b. Use
 - c. Calculation
- C. Shielding
 - 1. Absorption
 - 2. Half/Tenth Value Layers
 - a. Definition
 - b. Values
 - c. Use
 - d. Calculations
- D. Radiation Boundaries
 - 1. Limits
 - 2. Exposure Levels
 - 3. Establishing and Posting Perimeters
 - 4. Calculations - Homestudy Problems

13. REVIEW HOME STUDY PROBLEMS

1

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14. STORAGE AND HANDLING OF RADIOACTIVE MATERIAL 1

- A. Storage
1. Surveys
 - a. Frequency
 - b. Levels
 2. Source Inventory
 3. Utilization Log
 4. Leak Testing
 - a. Procedure
 - b. Frequency
 - c. Precautions
 5. Handling
 6. Security

15. EQUIPMENT HANDLING 2

- A. Source Assembly
1. Construction
 2. Connectors
 3. Special Design Consideration
- B. Exposure Device
1. Safety Features
 2. Connections
 3. Interlock Systems
 4. Operation
 5. Inspection
 6. Labeling Requirements
 7. Control and Source Tube Assembly
 8. System Inspection Prior to First Exposure
 9. System Inspection After Last Exposure

16. TRANSPORTATION OF RADIOACTIVE MATERIAL 1-1/2

- A. Company Vehicle
- B. Temporary Job Sites
- C. Common Carrier
- D. Procedures
1. Transport Containers
 2. Labeling
 3. Surveys - Transport Index
 4. Transport Documents
 5. Placarding of Vehicles

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17. HAZARDOUS MATERIAL VEHICLE SAFETY 1-1/2

A. Regulatory Authority - 49 CFR

1. Drivers
 - a. Licensing
 - b. DMV Reports
 - c. Restrictions
 - d. Defensive Driving
 - e. Traffic Regulations
 - f. Seat Belts
 - g. Drugs/Alcohol
2. Vehicles
 - a. Loading
 - b. Safety Equipment
 - c. Placards
 - d. Radiation Intensities
 - e. Parking
 - f. Security
 - g. Special Handling Considerations
 - h. Handling in Inclement Weather
 - i. Accidents

18. OPERATING AND EMERGENCY PROCEDURES 4

- A. Radiation Safety Manual
1. Radioactive Material Security
 2. Radiation Monitoring Equipment
 3. Radiation Surveys
 - a. Reports
 4. Posting and Labeling Requirements
 5. Inventory Inspection and Maintenance
 6. Notification Requirements
 7. Documentation
 8. Emergency Procedures
 9. Equipment Handling Procedures

19. REVIEW OF EXPOSURE CALCULATIONS 1

20. REGULATORY AUTHORITY 3

- A. Applicable Regulations

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21.	<u>DOCUMENTATION</u>	1
	A. Documentation Required in Transit	
	B. Documents Required at Job Sites	
	C. Use of Company Record Forms	
	D. Recording Procedures/Record Retention	
22.	<u>REVIEW</u>	1
23.	<u>EXAMINATIONS</u>	3

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Rev. No.: 0

Training Activity: Corporate Health Physics

Examination: IRG-001

RADIATION SAFETY TESTING

INDUSTRIAL RADIOGRAPHY

GENERAL EXAMINATION

Each of the questions on this examination has only one correct answer, circle the letter of the correct response. Should you decide to change an answer, erase completely or otherwise indicate the change in your choice. Show all calculations where required.

Name: _____ S.S. No.: _____

District: _____ Date: _____

Administered By: _____ Grade: _____

Corrected By: _____

Audited By: _____

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1. An isotope is a variation of a basic nuclide with a differing number of:
 - A. Protons
 - B. Electrons
 - C. Neutrons
 - D. Positrons

2. The measure of activity of a radioisotope is given in units of:
 - A. Grams
 - B. Curies
 - C. Roentgens
 - D. Electron volts

3. Electromagnetic gamma radiation is produced through the process of spontaneous decay in the nucleus of:
 - A. An unstable atom
 - B. A stable atom
 - C. An unbalanced atom
 - D. Atoms of all isotopes

4. The roentgen is a measure of _____ in air.
 - A. Activity
 - B. Specific activity
 - C. Radiation intensity
 - D. Biological effect

5. The physical effects of radiation exposure on the individual that was actually exposed are termed:
 - A. Somatic effects
 - B. Personal effects
 - C. Genetic effects
 - D. Isotropic effects

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6. True or False: The biological effect of X and gamma radiation on human tissue is the same for any given exposure level:
- False, because the electrons in an X-ray tube moves slower than gamma rays and hence have a lesser effect.
 - True, because the relative biological effectiveness for both X and gamma radiation is a factor of 1.
 - True, because the alpha and beta particles emitted by the gamma source make up for the slower X-rays.
 - False, because X and gamma rays travel at different velocities.
7. Personal radiation exposure is measured in units of:
- Roentgens or milliroentgens
 - Rems or millirems
 - Curies per gram
 - Curies or millicuries
8. The energy of X and gamma rays is measured in units of:
- Roentgens
 - Curies
 - Rems
 - Electron volts
9. Radiation exposure damages human tissue through the process of:
- Bremsstrahlung
 - Positron annihilation
 - Ionization
 - Heat
10. The length of time required for the activity of a radioactive isotope to be reduced, through the process of spontaneous disintegration, to one half of its original activity is referred to as:
- Half value layer
 - Half time
 - Half life
 - Decay

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11. The emissivity (dose rate) of an Iridium isotope at a distance of one foot is:
 - A. 3.3 R/Ci/H
 - B. 5.9 R/Ci/H
 - C. .661 MeV
 - D. 14.5 R/Ci/H

12. Electronic instrumentation is used to detect the presence, and measure the intensity of electromagnetic radiation because:
 - A. Human senses can detect the presence of electromagnetic radiation but cannot make an absolute measurement of the intensity.
 - B. Electromagnetic radiation can be more accurately measured with instrumentation.
 - C. Electromagnetic radiation cannot be detected by any of the human senses.
 - D. None of the above.

13. The maximum permissible exposure at the perimeter of the restricted area shall not exceed:
 - A. 5 mR per hour
 - B. 2 millirems in any one hour
 - C. 2 mR per hour
 - D. 100 mR per day

14. Any area in which the exposure rate would be equal to or greater than 100 mR/H is defined as:
 - A. Restricted area
 - B. Radiation area
 - C. High radiation area
 - D. Radiation security area

15. A direct reading pocket dosimeter used by radiography personnel measures:
 - A. Exposure rate
 - B. Dose rate
 - C. Cumulative exposure
 - D. Radiation activity levels

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16. A T'D or film badge is always worn by radiography personnel to provide:
- Accurate measurements of exposure rates
 - A permanent record of accumulated exposure
 - A means to "cross check" the accuracy of pocket dosimeters
 - A measurement of radiation intensity
17. All four sides of a vehicle transporting radioactive materials must be placarded when the transport index is sufficient that the shipping package be labeled with:
- DOT White I Labels
 - DOT Yellow II Labels
 - DOT Yellow III Labels
 - Type B (u) Package Labels
18. Pocket Dosimeters worn by radiography personnel must have a range of:
- At least 200 mRems
 - At least 500 mRems
 - From 0 to 200 mRems
 - From 2 to 200 mRems
19. Thermoluminescent dosimeters (TLD's) worn by industrial radiographers must be exchanged:
- Weekly
 - Monthly
 - Quarterly
 - Annually
20. The inverse square law states:
- That the intensity of radiation is directly proportional to the distance.
 - That the intensity of radiation is reduced at a rate that is inversely proportional to the distance.
 - That the intensity of radiation is reduced by the square of the distance.
 - That the intensity of radiation is reduced at a rate that is inversely proportional to the square of the distance.

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21. A collimator affixed to the tip of the source guide tube:
- focuses the primary wavelength of the radiation beam.
 - intensifies the radiation beam, through a process known as build up, by surrounding it with high density material.
 - directionalizes the radiation beam by shielding with high density material and as such reduces radiation intensities in all but one direction.
 - is merely a positioning or "aiming" device and serves no real safety function.
22. The thickness of any material required to reduce the radiation intensity from a given source to one half the original intensity is:
- Half life
 - Half factor
 - Half value layer
 - A beam filter
23. Survey meters used in industrial radiography must have a range of:
- 0 to 2000 mR/H
 - 2 to 1000 mR/H
 - 0 to 200 mR/H
 - 2 to 2000 mR/H
24. While working in the field, you discover that your dosimeter is discharged "off scale", you would:
- Re-zero your dosimeter and continue working.
 - Record a maximum reading, re-zero your dosimeter and continue working.
 - Immediately stop working, notify your Radiation Safety Officer and submit your TLD or film badge for processing.
 - Borrow a better dosimeter and tell your Radiation Safety Officer at the end of the day.
25. Radiation survey instruments must be calibrated:
- Every 30 days
 - Every 75 days
 - Every 90 days
 - At least annually

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26. After radiographic field operations have ended, and prior to transporting the exposure device back to the storage facility, a survey of the device, called a lock-out survey, is taken. The purpose of this survey is to:
- A. Measure how much radiation was used for billing purposes.
 - B. Determine the remaining activity of the source.
 - C. Determine that the source is secured in the shielded position.
 - D. The question above is false, and only a check-in survey is required to complete the utilization log.
27. What would be the maximum permissible accumulated dose for a person that is 25 years old and has no previous exposure?
- A. 5 Rem
 - B. 20 Rem
 - C. 30 Rem
 - D. 35 Rem
28. Radioactive sources must be leak tested at what intervals to determine that there are no unacceptable levels of removable contamination?
- A. Every month
 - B. Every three months
 - C. Every six months
 - D. Every twelve months
29. Source changers used for sealed source exchange are not required to be surveyed in the same manner as exposure device because:
- A. The changer has two chambers and usually only one chamber at a time contains a source.
 - B. They are larger than most exposure devices and have about thirty percent more shielding.
 - C. The question above is false and the changer has to be surveyed whenever there is a "hot" source in one of the chambers.
 - D. The question above is false and the changer is subject to all of the same survey requirements of an exposure device that is used for transport.

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30. While working in the field you return the source to the shielded position at the end of an exposure. Upon approaching the camera to change film, you notice an abnormally high reading on your survey meter, you would:

- A. Assume that the survey meter probably isn't working properly and proceed to change out the film.
- B. Assume a disconnect, establish a restricted area and begin retrieval procedures immediately.
- C. Assume the possibility that a disconnect or other equipment malfunction may have occurred, immediately establish an actual 2 mR/H perimeter and refer to the emergency procedures in your safety manual.
- D. Run like hell.

31. The radiographer in charge at a job site is sleeping in the dark room after drinking profusely the night before. In order to save valuable production time, the assistant, who already has one month experience, can finish "shooting out" the job. True or false.

- A. True, because all Western Stress personnel are required to have the same formal training prior to working in the field.
- B. True, because in addition to his training, the assistant also has a months experience.
- C. False, because an assistant can only operate the exposure equipment under the direct surveillance of a qualified radiographer.
- D. False, because it takes two people to operate the equipment and the assistant couldn't handle it alone.

32. In the case of a vehicle accident while you are transporting radioactive materials, and the possibility of a radiation hazard exists, you would:

- A. Immediately call your Radiation Safety Officer to have another vehicle come out to pick up the source.
- B. Immediately survey the area and if the possibility of a radiation hazard exists, establish a 2 mR boundary and send someone to call the Radiation Safety Officer.
- C. Call the Insurance Company to report the accident before doing anything else.
- D. Have the police watch over the truck and source while you go to notify the Radiation Safety Officer.

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33. The radiation intensity from an unshielded Iridium source is 230 R/H at a distance of one foot from the source. At which distance would the intensity be reduced to 2 mR/H?
- A. 229 feet
 - B. 239 feet
 - C. 339 feet
 - D. 115,000 feet
34. The radiation intensity from an unshielded 30 Ci Iridium source would be reduced to what intensity at a distance of 31 feet?
- A. 184 R/H
 - B. 184 mR/H
 - C. 5.7 R/H
 - D. 5709 mR/H
35. If the radiation intensity from a 28 Ci Iridium source is 103 mR/H at 40 feet from the source, what would the exposure be for 10 minutes?
- A. 17 mRem
 - B. 2 mRem
 - C. 17 mRem
 - D. 27 mRem
36. You are using a 60 Ci Iridium source and you are going to make seven exposures of 2 minutes each per hour. At what distance would you place the restricted area boundary so that an individual standing at the perimeter would not receive more than 2 millirems of exposure.
- A. 33 feet
 - B. 203 feet
 - C. 420 feet
 - D. 543 feet
37. You received a new 102 Curie Iridium source on April 15th, today is Sept. 15th. If the half life of Ir is 75 days what is the activity of the particular source at this time?
- A. 75 curies
 - B. 51 curies
 - C. 25.5 curies
 - D. 12.75 curies

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38. You have prepared a radiographic source changer for shipment, the changer is certified as a Type B (u) shipping package. You survey the changer and record readings of 37 mR/H on the surface and .75 mR/H at one meter. In this case you would:

- A. Affix what labeling to two sides of the device.
- B. List what transport index on each label.

Answer A

Answer B

- | | |
|--|---------|
| A. DOT White I Labels | A. 0.5 |
| B. DOT Yellow II Labels | B. 0.75 |
| C. DOT Yellow III Labels | C. 37.0 |
| D. It's a certified package
so labeling isn't required. | D. None |

39. You are conducting radiographic operations in the field with a 58 Curie Iridium source. You are using a 21 foot source guide tube and a 25 foot control cable assembly. With the source in an unshielded position at the source tube tip and all the cables extended full length, what would your exposure be if you stayed with the control crank for eight exposures of 57 seconds each.

- A. 2.69 mRem
- B. 20.4 mRem
- C. 161.7 mRem
- D. 342 mRem

40. While conducting radiographic operations at a temporary job site, a construction laborer lifts up the boundary rope and begins to walk into the restricted area while the source is exposed. You would:

- A. Yell as loudly as possible to try to scare him off.
- B. Immediately run into the restricted area with a survey meter to try to stop him.
- C. As soon as you see him in the restricted area, immediately return the source to the shielded position.
- D. Do nothing, he's only a laborer and it might ruin the film.

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41. You travel 147 miles to a temporary job site only to find that the decay chart for the source that you are carrying is not in the document package. The package does, however, contain a leak test certificate showing that the source has been tested for removable contamination within the last six months. The problem, however, is how to calculate exposure times without knowing the curie strength of the source. The source ID plate attached to the camera tells you that the ^{90}Sr isotope was loaded five weeks earlier at an activity of 102 curies. With the source cranked out to the unshielded position, your survey meter gives you a reading of 2.39 with the meter set at the 100X scale, at a distance of 40 feet from the source. What is the activity of the source?

- A. 55 Ci
- B. 65 Ci
- C. 75 Ci
- D. 85 Ci

42. Six exposure devices are stored inside a metal gang box. The exposure level on the outside surface of the box is 82 mR/H. If the half value layer of lead for these isotopes is .19 inches, what thickness of lead would have to be added to the inside of the box in order to reduce the intensity on the outside surface to a level that is equal to or less than 2 mR/H.

- A. Approx. 0.250 inch
- B. Approx. 0.500 inch
- C. Approx. 0.750 inch
- D. Approx. 1.000 inch

43. If the intensity from an unshielded ^{90}Sr source is 71 mR/H on one side of an eight inch thick concrete wall, what would your exposure rate be if you stood on the other side of this wall? Assume the half value layer thickness of this concrete to be 2.0 inches.

- A. 35.0 mR/H
- B. 17.7 mR/H
- C. 8.8 mR/H
- D. 4.4 mR/H

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44. You are conducting radiographic operations with a 50 Ci Cobalt source. You anticipate making four exposures of 7 minutes each in an hour time. At what distance would you establish the restricted area boundary?
- A. 203 feet
B. 338 feet
C. 411 feet
D. 543 feet
45. In the problem above, at what distance would you be able to establish the restricted area boundary if you were to utilize a Model 527 Collimator with an attenuation factor of 1.0×10^5 ?
- A. 47 feet
B. 60 feet
C. 115 feet
D. 130 feet
46. You are conducting radiographic operations with a 96 Curie Or source. If you utilize a Model 911 Collimator with an attenuation factor of 5.0×10^5 , at what distance would you establish the actual 2 mR per hour boundary?
47. If the exposure rate at a given distance from a Cobalt source was 26 R/H, what would your exposure be in 4.5 minutes?
- A. 1200 mRem
B. 1650 mRem
C. 1950 mRem
D. 2225 mRem
48. If you are conducting radiographic operations at a temporary job site with a 75 Ci Or source and you establish the calculated 2 mR restricted area boundary at 149 feet based on twelve, 30 second exposures per hour. What would the actual reading be on your survey meter when you verified your boundary calculations?
- A. Approx. 20 mR/H
B. Approx. 70 mR/H
C. Approx. 120 mR/H
D. Approx. 147 mR/H

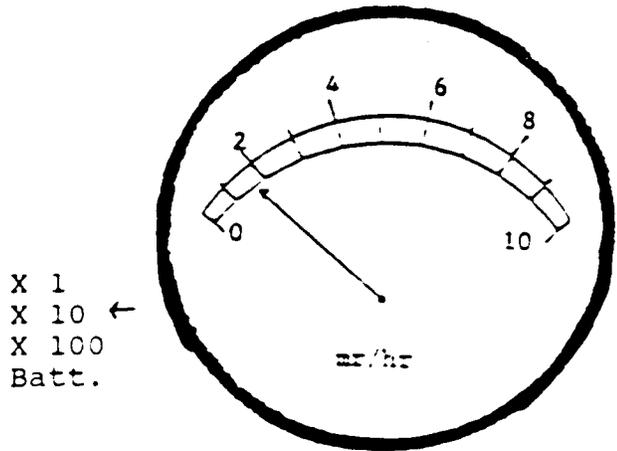
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49. What is the exposure reading on the dosimeter scale shown below?

- A. 12 mRem
- B. 20 mRem
- C. 24 mRem
- D. 26 mRem

50. What is the reading on the survey meter dial shown below?

- A. 1.8
- B. 18
- C. 80
- D. 180



ANSWER KEY

RADIATION SAFETY

EXAMINATION NO. IRG-001

<u>QUESTION #</u>	<u>CORRECT RESPONSE</u>	<u>QUESTION #</u>	<u>CORRECT RESPONSE</u>
1	C	26	C
2	B	27	D
3	A	28	C
4	C	29	D
5	A	30	C
6	B	31	C
7	B	32	B
8	D	33	C
9	C	34	B
10	C	35	C
11	B	36	B
12	C	37	C
13	B	38	a) B b) B
14	C	39	B
15	C	40	C
16	B	41	B
17	C	42	D
18	C	43	D
19	B	44	C
20	D	45	D
21	C	46	D
22	C	47	C
23	B	48	A
24	C	49	D
25	C	50	B

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SECTION XVI

EQUIPMENT HANDLING PROCEDURES

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1.0 SCOPE:

1.1 This section establishes the procedures to be followed during the handling and operation of radiographic exposure devices, source changers and related equipment.

2.0 DAILY EQUIPMENT INSPECTION:

2.1 Radiography personnel shall conduct inspections of all equipment assigned to them, on a daily basis. Results of daily inspections shall be documented on the Daily Equipment Inspection form, Attachment I in Section 8 of this manual.

2.2 The following areas shall be checked during daily equipment inspections.

- 2.2.1 Visible damage to TLD's or dosimeters.
- 2.2.2 TLD's are for current period.
- 2.2.3 Each individual is equipped with two dosimeters.
- 2.2.4 The dosimeter hairline is visible and set at zero.
- 2.2.5 Alarming ratemeter battery condition and functional operation checks.
- 2.2.6 Two survey instruments are present.
- 2.2.7 Survey instruments are free from physical damage.
- 2.2.8 Both survey instruments are within calibration.
- 2.2.9 Battery levels are adequate to last through the entire day or spare fresh batteries are available.
- 2.2.10 Both instruments demonstrate the ability to measure radiation.
- 2.2.11 "Radioactive" placards mounted on four sides of vehicle and "open" if necessary.

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- 2.2.12 Locks on vehicle, darkroom and storage compartment are operational.
- 2.2.13 Exposure device is properly labeled.
- 2.2.14 Source identification plate is in place on exposure device.
- 2.2.15 Locking mechanism on exposure device is operating properly.
- 2.2.16 Pigtail connector plug and exit port protective cap are in place.
- 2.2.17 No abnormal radiation levels on exterior of exposure device.
- 2.2.18 Control assembly drive cables and source guide tubes are free from visible damage.
- 2.2.19 Pigtail connector spring locking mechanism operates properly.
- 2.2.20 Drive cable fittings operate and connect properly.
- 2.2.21 Source guide tube quick disconnect fitting operates properly and engages positive source position interlock properly.

3.0 RADIOGRAPHIC EXPOSURE DEVICE OPERATING PROCEDURES:

3.1 Technical Operations Model 660B

The following is a step by step guide to the operation of the technical operations Model 660B Iridium exposure device.

- 3.1.1 Be certain that the daily equipment inspection has been completed and recorded.
- 3.1.2 Be certain that all of the dosimetry and survey equipment required by the various sections of this manual are present and in proper operating condition.

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- 3.1.3 Position the exposure device near the radiographic exposure location.
- 3.1.4 Position the tip of the source guide tube at the radiographic focal position and install the collimator over the guide tube tip.
- NOTE: Except in cases where exposure geometry physically prevents their use, a collimator shall be used for all exposures.
- 3.1.5 Extend the guide tube out as straight as possible. Avoid any bend radius less than 20".
- 3.1.6 Extend the drive cable assembly as straight as possible with the control reel (crank) as far away from the exposure point as possible. Avoid any bend radius less than 36" in the drive cables.
- 3.1.7 Unlock the control connector on the exposure device, rotate the control to the "connect" position and remove the source connector storage plug.
- 3.1.8 Connect the male drive cable connector to the female source assembly connector. Be certain of a positive connection.
- 3.1.9 Insert the outer drive cable connector lugs into the control connector and rotate the control connector to the "lock" position. The positive source position locking mechanism is mounted horizontally in the rotating locking collar at the rear of the device. With the red end of the blade showing at the right of the collar, the device is 'armed' or 'unlocked'. When the green end of the blade is showing at the left of the collar, the device is in the 'safe' or locked position.
- 3.1.10 Depress the key lock plunger to lock the device until all other connections have been made and the device is ready to operate.
- 3.1.11 Attach the source guide tube threaded fitting to the exit port nipple. Be certain the threaded connection is secure.

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- 3.1.12 Calculate and establish the restricted area boundaries at a point where no individual will receive an exposure in excess of 2 millirems in any one hour.
- 3.1.13 Rope off the restricted area boundaries and post "Caution - Radiation Area" signs at intervals not to exceed 30 feet.
- 3.1.14 Calculate the high radiation area and post "Caution - High Radiation Area" signs.
- 3.1.15 Set the brake on the control reel.
- 3.1.16 Unlock the control connector on the exposure device and rotate the control to the "operate" position.
- 3.1.17 Lift the positive source position indicator until the slide locks in the up position.
- 3.1.18 CAUTION: The source assembly is now free to operate! If for any reason you must stay in the vicinity of the exposure device, return the control connector to the "lock" position!!
- 3.1.19 If you are ready to make the exposure, return to the control reel taking the survey meter(s) with you. DO NOT leave survey meters with the exposure device during exposures. This may damage the meter and you CANNOT read a survey meter from forty feet away.
- 3.1.20 Release the brake on the control reel and turn the crank in the "expose" direction, as indicated on the control housing. Do not force the handle. If resistance is felt, return the source to the shielded position. Approach the exposure device with a survey meter. Check the exposure assembly for proper connections, control settings, guide tube and drive cable bend radii, etc., before attempting to expose the source again.

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- 3.1.21 Once the source is exposed, use a survey meter to verify restricted area boundary calculations and adjust perimeter if necessary.
- 3.1.22 During exposures, maintain direct surveillance over the entire restricted area such that access by unauthorized or non-monitored individuals is prevented.
- 3.1.23 If multiple exposures are to be made, rotate the control connector to the "lock" position while changing film between exposures.
- 3.1.24 The positive source position indicator has to be raised "or cocked" prior to each exposure.
- 3.1.25 The radiation survey requirements and procedures outlined in Section 5 of this manual are to be followed at all times during radiographic operations.

3.2 Technical Operations Model 680 Series:

The technical operations Model 680 Series Cobalt exposure device is operated in the same manner as the Model 660 B outlined above, with the following exceptions:

- 3.2.1. The Model 680 Series has no positive source position indicator to prevent accidental source assembly movement. As such, the control connector shall be rotated to the "lock" position and the lock plunger depressed AT ALL TIMES when an exposure is not actually being made.
- 3.2.2. These procedures require the use of a minimum 35 foot long drive cable assembly, rather than the standard 25 foot length.
- 3.2.3. AT NO TIME shall a source guide tube in excess of 21 feet be used.

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3.2.4. A Model 527 (or equivalent) collimator shall be used with this equipment at all times except where physical geometry prevents access.

NOTE: Extra care must be exercised when positioning the guide tube tip as this collimator weighs 32 pounds. Be certain that the exposure assembly is steady and safe.

3.2.5. Due to the high emissivity rate of the Cobalt isotope, extreme caution should be exercised in its use. Additional shielding should be utilized whenever possible to protect radiographic personnel and keep personnel exposures as low as possible.

4.0 SOURCE EXCHANGE PROCEDURES:

4.1 Technical Operations (Amersham) Model 650 Series Source Changer:

The following is a step by step guide to the operation of the Technical Operations (Amersham) Model 650 series source changer for use with the Amersham Model 660 B exposure device. In addition to these procedures, refer to Section 7 of this manual for receipt and disposal procedures.

4.1.1 The same safety procedures used during radiographic operations must be observed during source exchange operations.

4.1.2 Be certain that proper personnel dosimetry is being worn by all individuals involved in the operation.

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- 4.1.3 All operations must be monitored with a calibrated, operational survey meter. All surveys shall be conducted in accordance with Section 5 of this manual.
- 4.1.4 A restricted area must be established and properly posted prior to beginning source exchange operations.
- 4.1.5 Upon receipt of a source changer, survey the source changer on all sides to assure that the source is in its proper storage position. Radiation levels should be less than 200 mR/H on the exterior surface and less than 10 mR/H at a distance of one meter.
- 4.1.6 Place the source changer and exposure device in the restricted area and position them so that one length of source guide tube fits between them without any bends or kinks.
- 4.1.7 Place the control assembly drive control as far away from the exposure device as possible and preferably behind some type of shielding material in order to help reduce exposures.
- 4.1.8 Remove the cover from the source changer by unlocking the padlock, breaking the seal wires and removing the bolts. The key for the pad lock will be located in the plastic "shipping instructions" envelope attached to the outside of the source exchanger when it is shipped.

NOTE: DO NOT LAY THE MODEL 650 SERIES SOURCE CHANGER ON ITS SIDE - THIS DEVICE MUST REMAIN IN AN UPRIGHT POSITION THROUGHOUT THE ENTIRE SOURCE EXCHANGE PROCEDURE.

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4.1.9 Once the cover is removed, remove the source hold down cap that covers the source by breaking the seal wires and unbolting. Be certain to retain the new source identification plate for attachment to the exposure device.

CAUTION: WHEN THE SOURCE HOLD DOWN CAP IS REMOVED, THE SOURCE IS FREE TO MOVE. EXTREME CARE MUST BE EXERCISED TO ASSURE THAT THE SOURCE ASSEMBLY IS NOT DISLODGED FROM THE CHANGER.

4.1.10 Unlock the exposure device and connect the drive control cable to the source connector. Connect the drive control assembly to the exposure device. Rotate the locking collar to the lock position and depress the key lock plunger to secure the device while remaining connections are made.

4.1.11 Connect one end of a guide tube extension to the exposure device and the other end to the cold (empty) chamber of the source changer. Keep the tube as straight as possible with no bend radius less than 24 inches. Close and latch the source guides.

4.1.12 Assuring no unauthorized personnel are in the restricted area, unlock the key lock plunger, rotate the control collar to the operate position, 'lock' the positive source position slide and, taking the survey meter, retreat to the drive control operating crank.

4.1.13 At the drive control operating crank, rapidly crank the source assembly from the exposure device into the source changer.

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- 4.1.14 Approach the source changer with a survey meter to assure that the source is properly stored in the 'empty' chamber of the source changer. Survey the entire circumference of the source changer, the guide tube and the entire circumference of the exposure device.
- 4.1.15 After assuring that the source is properly stored, open the source guides. Disconnect the drive cable from the 'old' source assembly connector and slide the drive cable out through the key way.
- 4.1.16 After disconnecting the drive cable, remove the guide tube from the source changer.
- 4.1.17 Connect the guide tube to the fitting over the chamber containing the new source. Connect the drive cable to the connector of the new source assembly. **BE CAREFUL NOT TO MOVE THE NEW SOURCE ASSEMBLY UP MORE THAN ONE-HALF INCH WHILE MAKING OR TESTING THE CONNECTION - MONITOR THE OPERATION WITH A SURVEY METER.** Close and latch the source guides above the new source.
- 4.1.18 Taking the survey meter, retreat to the drive control operating crank. Making certain that no unauthorized personnel are in the restricted area, rapidly crank the new source from the changer into the exposure device.
- 4.1.19 When the source is completely retracted into the exposure device, the positive position source indicator slide will 'snap' to the left showing the green indicator blade.
- 4.1.20 After verifying the position of the source indicator slide, approach the device with a survey meter. Survey the entire circumference of the exposure device, the guide tube and the entire circumference of the source changer.

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- 4.1.21 On determining that the source is secured in the shielded position within the exposure device, rotate the locking collar to the 'lock' position and depress the key lock plunger.
- 4.1.22 With the exposure device locked, remove the guide tube from the exit port nipple and install the front shipping plug. Disconnect the drive controls and install the lock assembly cover.
- 4.1.23 Remove the guide tube from the source changer and install the source hold down cap over the old source assembly changer in the source changer.
- 4.1.24 Attach the old source identification plate to the hold down cap for proper source disposal identification. Securely bolt down the source hold down cap and install seal wires.
- 4.1.25 Bolt the source changer in place, install seal wires and attach pad lock.
- 4.1.26 Install new source identification plate to exposure device.
- 4.1.27 Be certain that the exposure device is properly locked, survey the device for abnormal radiation levels (maximum 50 mR/H at 6 inches), complete the receipt/camera survey form, place the device in storage and make the appropriate entries on the master log.
- 4.1.28 Place source changer in the storage vault until ready for return shipment.
- 4.1.29 If the total activity (number of curies) in the storage vault has increased, a storage survey must be performed in accordance with Section 5 of this manual.