



Nuclear Regulatory Commission
ATTN: Bryan Parker
Health Physicist
475 Allendale Road
King of Prussia, PA. 19406-1415

February 2, 2005

Subject: License Amendment (LICENSE # 45-19703-01) 03019126

Dear Mr. Parker:

I am requesting an expeditious review of the Operating and Emergency Procedures as revised, of Schnabel Engineering, Inc. The revision includes a change in NDE-RS-03 "Training, Testing, And Qualification Of Radiographic Personnel". NDE-RS-03 was revised to include compliance with the requirements listed in 10 CFR Part 34.42 and 34.43 in a more detailed fashion, as opposed to the generic version previously submitted.

Attached is a copy of the revised Operating and Emergency Procedures for your review. If there are any questions that need to be answered, please feel free to contact me here in Richmond, Va. Thank you.

Sincerely,

A handwritten signature in dark ink, appearing to read 'Jackie C. Riggs, Jr.', is written over the typed name.

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NMSS/RGNI MATERIALS-002

RADIOGRAPHIC OPERATING EMERGENCY PROCEDURES
NDE-RS-01 – NDE-RS-08



RADIOGRAPHIC OPERATING AND EMERGENCY PROCEDURES

Procedures Number: NDE-RS-01

Revision: 3

Effective Date: 07/01/2004

Approved By:

Jackie C. Riggs, JR./ CRSO

Date

RADIOGRAPHIC OPERATING AND EMERGENCY PROCEDURES

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3. International Air Transport Association (IATA) Regulations
4. Alabama Rules of State Board of Health, Bureau of Environmental & Health Service Standards, Radiation Control
5. State of Florida Control of Radiation Hazard Regulations
6. State of Georgia Rules & Regulations for Radioactive Materials
7. Illinois Department of Nuclear Safety, Statutes and Regulations, 32 Illinois Administrative Code
8. Louisiana Nuclear Energy Division Radiation Regulations
9. Regulations for Control of Radiation in Mississippi
10. South Carolina Department of Health & Environmental Control, Regulations
11. Tennessee State Regulations for Protection against Radiation
12. Texas Regulations for Control of radiation
13. SEI NDE-RS-02, Radiation Safety Administrative Manual
14. SEI Quality Assurance Manual
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16. North American Emergency Response GuideBook
17. North Carolina Regulations for Protection Against Radiation
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**RADIOGRAPHIC OPERATING AND
EMERGENCY PROCEDURES**

SECTION A:

RULES FOR HANDLING AND USE OF SOURCES OF RADIATION

RADIOGRAPHIC OPERATING AND EMERGENCY PROCEDURES

1: Purpose

These rules describe the requirements of Schnabel Engineering Inc. (SEI) and Federal and State regulatory authorities for the safe use and handling of sources of radiation.

2: Scope

These rules apply to all SEI personnel who use or handle sources of radiation for industrial radiography, and are to be followed at all times when using or handling sources of radiation. All radiographic personnel are responsible for adhering to the guidelines set forth in this procedure and the rules and regulations of the applicable regulatory authorities when using or handling sources of radiation.

3: Definitions

PERSON- an individual, a corporation, a company, an association, a firm, a partnership, or any other organization or institution.

RESIDENTIAL LOCATION- any area where structures in which people lodge or live are located, and the grounds on which such structures are located including, but not limited to, houses, apartments, condominiums and garages.

Personal Radiation Safety Requirements for Radiographic Personnel

4: Limitations

No individual shall be permitted to act as a radiographer, radiographer trainer, radiographer instructor, radiographer's assistant, radiographer trainee, or qualified person, until such individual:

- a) Has met the training, testing and qualification requirements of SEI NDE-RS-03
- b) Has provided previous exposure history (NRC form 4 or equivalent) and,
- c) Has been authorized by the Corporate Radiation Safety Officer (CRSO)

5: Personnel Responsibilities

Administrative organization and responsibilities are detailed in SEI NDE-RS-02 Administrative organization and Responsibility.

5: Personnel Responsibilities (con't)

- a) **Corporate Radiation Safety Officer (CRSO)** – The CRSO shall be responsible for the overall radiation safety program of SEI.
- b) **Facility Radiation Safety Officer (FRSO)** – The FRSO shall be responsible for the overall radiation safety program for that facility of SEI.
- c) **Radiographer/Radiographer Trainer/Radiographer Instructor** – Individuals meeting the training and experience requirements of this certification shall be solely responsible to the Company and to the regulatory authority for strict compliance with these rules, the appropriate Federal or State regulations, and the conditions of the license during the use and/or handling of sources of radiation in his custody. Individuals who have been issued SEI wallet cards and/or Agency wallet cards shall be required to have the wallet card in their possession when performing radiographic operations.
- d) **Radiographer Assistant/Radiographer Trainee** – Individuals meeting the training and experience requirements of this certification shall be capable of using sources of radiation and related handling tools or radiation survey instruments and any other assignment covered by these rules, providing the individual is under the direct personal supervision of a radiographer, radiographer trainer, or radiographer instructor, as appropriate.
- e) **Qualified Person** – Individuals meeting the training and experience requirements of this certification shall be capable of performing only those tasks applicable to the individual's level of training and certification.

6: Personal Supervision of a Radiographer's Assistant/Trainee

Personal supervision means the radiographer, radiographer trainer, or radiographer instructor:

- a) Is physically present at the site
- b) Has direct observation of the performance of the radiographer's assistant/trainee
- c) Is in such proximity that immediate assistance can be provided, if required, and
- d) Provides guidance and instruction to the radiographer's assistant/trainee

7: Minimum Personnel requirements

As a minimum, two radiographic personnel, per each exposure device, shall be utilized at temporary job sites.

7: Minimum Personnel Requirements (con't)

If one of the individuals is a radiographer's assistant, the other shall be a radiographer. If one of the individuals is a radiographer trainee, the other shall be a radiographer trainer or a radiographer instructor, as appropriate.

NOTE: A trainee shall not be considered part of a two-man crew when sources of radiation are utilized in the state of Louisiana or Georgia.

8: Personnel Monitoring Control

Each individual handling or using sources of radiation shall wear personnel dosimeter devices, as required by SEI procedures, regardless if dosimetry is furnished by another company, i.e. (Nuclear Power Facility). The SEI – Atomic Energy or Landauer Report is the controlling record when determining personnel exposures.

(1) Luxel (OSL) Badge or Thermo luminescent Dosimeter (TLD):

- a) Never use another worker's badge/TLD. If a spare badge/TLD is used, mark it with the name of the individual using it.
- b) Wear badges/TLD's on the torso, at or above the waist and below the shoulder.
- c) Always protect badges/TLD's from extreme environmental conditions such as intense heat or light, which may affect their ability to accurately record radiation exposure, and
- d) Return badges/TLD's to the RSO by the 10th of each month to ensure rapid processing by a certified independent agency.

(2) Dosimeters shall:

- a) Meet the criteria of ANSI N322
- b) Have a range of 0-200 millirem
- c) Display a legible calibration sticker confirming calibration within the last year
- d) Be recharged daily or at the start of each work shift
- e) Have exposure readings recorded at least daily, and before each recharging
- f) Be monitored periodically during radiographic operations and the exposure readings recorded and the dosimeter recharged when exposure reads 75% of the dosimeter scale

Off-scale dosimeters: Industrial radiographic operations shall immediately cease by an individual if the individual's dosimeter is discharged beyond its range, i.e., goes "off-scale", and the procedures outlined in section B (9) shall be followed.

(3) Alarm Rate Meters shall:

- a) Meet the requirements of 10 CFR Part 34.47
- b) Emit an alarm signal at a preset dose rate of 500 mR/hr
- c) Require special means to change the preset alarm functions
- d) Be checked to ensure that the alarm and battery indicator light (if applicable) functions prior to use

8: Personnel Monitoring Control (con't)

- e) Be checked annually for correct response to radiation of a known intensity
- f) Display a legible calibration sticker confirming calibration within the last year
- g) Not be tampered with for the purpose of changing the preset dose rate of 500 mR/hr

Individuals losing or damaging any personnel monitoring equipment during radiographic operations shall cease work immediately until replacement equipment is provided. Notify the RSO.

Individuals losing or damaging a LUXEL badge or TLD shall forward a written report to the CRSO describing the events pertaining to the loss or damage, the estimated length of time the individual was not monitored, and the estimated exposure received for the period of time from issuance to loss or damage.

9: Radiation Survey Instrumentation

Sources of radiation shall not be handled or used without at least one calibrated and operable radiation survey instrument.

1) Radiation Survey Instruments Shall:

- a) Be capable of measuring 2 mR/hr thru 1 R/hr
- b) Be capable at energies appropriate for the intended use, by the company or a company licensed for instrument calibration
- c) Be checked at intervals not to exceed six (6) months and after each servicing by measuring the response to two known radiation intensities on each range, except those Agreement States requiring three (3) month calibration intervals
- d) Display a legible calibration sticker confirming calibration within the last six (6) months, instrumentation used in Agreement States shall be within their calibration intervals, respectively
- e) Be checked for proper battery charge prior to use
- f) Be checked with a radiation source prior to use each work day or shift to ensure that it properly responds to radiation (i.e., an exposure device with a source installed)

10: Locking of Sources of Radiation

- a) Sources of radiation shall be kept locked and the key removed, except when under the direct visual surveillance of an individual qualified to at least radiographer status

10: Locking of Sources of Radiation (con't)

- b) After each radiographic exposure, sealed sources shall be secured in the shielded position by a device which automatically secures the source when cranked back in to the shielded position
- c) Sources of radiation shall be locked and all cables removed prior to moving from one location to another or before being secured at a given location
- d) Upon securing from radiographic operations, a wire/plastic security seal or lock shall be placed on the outside of the package prior to transport to provide evidence that the package has not been opened any unauthorized persons during shipment. Outside of the package may mean the device, an over-pack or a transport container

11: Storage Precautions

- a) Sources of radiation shall be physically secured in storage to prevent tampering or unauthorized removal
- b) Exposure devices, source changers or transport containers shall not be stored or used in residential locations (see definitions in sec. A(3))
- c) Vehicles containing radioactive materials for use at temporary job sites shall be properly posted and secured
- d) Sources of radiation stored overnight shall include at a minimum two (2) locks; for example, locked exposure device, locked storage container and or locked room/vehicle. Sources of radiation shall not be stored in open bed pick-ups over night

12: Vehicle Identification

- a) Vehicles containing radioactive materials that are used at temporary job sites in the State of Louisiana shall have durable, clearly visible labels on the sides of the vehicle indicating the Company name, city and state

13: Picking Up and Receiving Radioactive Materials Packages

- a) Arrangements shall be made to receive packages delivered by common carriers at the time the package is offered for delivery and after notification of the arrival of the package, take possession of the package expeditiously
- b) Packages shall be monitored as soon as practical after receipt, but no more than three (3) hours after the package is received if received during normal working hours, or not later than three (3) hours from the beginning of the next working day if received after normal working hours. Refer to section B(5) and B(6) for procedural details concerning receiving and opening radioactive materials packages

14: Inspection and Maintenance

Exposure devices, source changers, transport containers, radiation machines and related handling equipment shall be inspected for obvious defects at the beginning of each work day or shift of equipment use.

(1) Exposure devices shall:

- a) Be inspected in accordance with section B (1) Step 6
- b) Be immediately removed from service, and the CRSO notified, if the inspection reveals defects that would jeopardize the safe use of the equipment
- c) Display a legible sticker confirming preventive maintenance within the last three (3) months or first use thereafter. Procedural steps to perform quarterly inspections and maintenance on exposure devices are detailed in sections D(4) through D(6)
- d) Display a legible sticker with the Company's name, address and telephone number
- e) Place a red (danger or do not use) tag on the exposure device if the inspection reveals defaults, the need for quarterly maintenance, until deficiencies are corrected
- f) Be rotated every two (2) years to AEA for Preventative Maintenance

15: Leak Testing, Repair, Labeling, Opening, Modification and Replacement of Sealed Sources and Devices

Each sealed source shall be tested for contamination at intervals not to exceed six (6) months, and each exposure device shall be tested for depleted uranium at intervals not to exceed one (1) year. Leak tests shall be capable of detecting the presence of 0.005 microcuries of removable contamination. Sealed sources or exposure devices exhibiting the presence of 0.005 microcuries or more of radioactive contamination shall be immediately removed from service.

- a) No sealed source or exposure devices shall be transported or utilized if past due for leak test (procedural steps for leak testing of sealed sources or exposure devices are detailed in sections D(11) and D(12))
- b) Verification of leak test results, either in the form of a decay chart or a certificate, shall accompany the movement of each sealed source. In the absence of a certificate from a transferor that a test has been made within six months prior to the transfer, the sealed source shall not be put in to use until tested, and shall be red tagged "do not use" until such test has been made and the results obtained
- c) The replacement, repair, opening, or any other modification of exposure devices used in radiographic operations will be performed only by a person authorized by

15: Leak Testing, Repair, Labeling, Opening, Modification and Replacement of Sealed sources and Devices (con't)

- d) the applicable regulatory agency and or trained by the manufacturer

Precautionary Procedures in Radiographic Operations

16: Security During Radiographic Operations

- a) An individual qualified to at least radiographer status shall maintain direct visual surveillance of the operation to protect against unauthorized entry into a **"Restricted Area"** or a **"High Radiation Area"** except where the high radiation area meets the requirements of a "Permanent Radiographic Exposure Cell" (see section A(26)). Each individual within any radiation boundary shall have a calibrated, operable survey meter for their use
- b) Sources of radiation shall not be left unattended except when secured in storage to prevent unauthorized removal
- c) In the event unauthorized personnel cross into the restricted area during radiographic operations, cease work, record the name, address and phone number of all personnel involved in the unauthorized entry and document the estimated dose(s) received. If over 100mRem, notify the RSO immediately, otherwise, notify the RSO at the end of the shift

17: Specific Equipment Requirements

Radiographic operations shall not be performed if any of the following items are not available at the temporary job site, or are in operable

- a) Initially two(2) operable, calibrated survey meters are required for each source of radiation being used. Should one survey meter become inoperable, one survey meter is allowed with CRSO approval
- b) Personnel monitoring devices are described in section A(8)(1)
- c) The appropriate barrier ropes and signs
- d) A dosimeter charger shall be available for use during radiographic operations
- e) A collimator shall be used at all times except when physically impossible

18: Posting of Radiographic Work Areas

Radiographic work areas shall be conspicuously posted

- a) Restricted Areas shall be posted with a sign(s) displaying the words:
" Caution, Radiation Area"

18: Posting of Radiographic Work Areas (con't)

A "Restricted Area" is any area to which access is controlled by the licensee for purposes of protection of individuals from exposure to radiation and radioactive materials. Restricted areas shall be posted such that, if continually present at the restricted area boundary, an individual would receive a whole body dose of less than 2 Millirem in any one hour

Note: The States of Tennessee and Maine also require "Radioactive Material" signs to be posted at the "Radiation Area" boundaries

- b) High Radiation areas shall be posted with a sign(s) displaying the words: "Caution" or "Danger" "High Radiation Area"

A "High Radiation Area" is any area, accessible to personnel, in which radiation levels could result in an individual receiving a dose equivalent in excess of 100 Millirem in 1 hour at 30 centimeters from the source of radiation or from any surface that the radiation penetrates

- c) Very High Radiation Areas shall be posted with a conspicuous sign(s) bearing the radiation symbol and words: "Grave Danger" "Very High Radiation Area"

A "Very High Radiation Area" means an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 500 RAD in any 1 hour at 1 meter from a source of radiation or from any surface that the radiation penetrates

NOTE: "Very High Radiation Area" should only apply when using sources of greater intensity than those normally used by Schnabel Engineering, Inc.

19: Summary of Required Radiation Surveys

- 1) The following radiation surveys shall be performed and documented as required, when using or handling sources of radiation:
 - a) Survey of the storage container or facility whenever an exposure device or changer is being placed in or taken out of storage, or whenever conditions in the storage facility change
 - b) Survey of packages and/or vehicles containing radioactive material prior to transportation
 - c) Survey of the exposure device or source changer before moving from one location to another

19: Summary of Required Radiation Surveys (con't)

- d) An adequate survey of the exposure device, starting from the drive cable connection moving along the surface of the exposure device and ending at the source guide tube connection, along the source guide tube and the collimator, after each exposure to ensure that the source was fully retracted, secured and returned to it's shielded position and/or prior to dismantling the equipment
- e) An "Area Survey" to confirm adequacy of the restricted area boundaries, during the first exposure and each time the exposed position of the source is changed
- f) A "Lock-out Survey" of the exposure device or source changer to verify that the source is in the shielded position prior to securing in storage
- g) A survey of the exposure device and source changer afyer a source exchange
- h) A survey of a radiation producing machine to determine that the machine is off

2) Instructions regarding reference readings when removing sources from storage:

- a) Following a source removal from storage, survey the entire circumference of the device and record the highest contact reading in the daily utilization log and radiation survey report. If the meter reads zero, it is not working properly; tag it for repair and obtain another calibrated meter
- b) If the reading varies significantly higher than the last recorded reading or from the reading derived from the source decay chart, one of two possible problems exist: (1) the meter is malfunctioning or (2) the source is not fully secured in the shielded position. Until you can verify the accuracy of your reading, assume the worse
- c) Using another calibrated meter, resurvey the device. If the reading remains significantly higher than the last recorded reading or from the reading derived from the source decay chart, assume that the source is exposed; immediately return the device to storage and notify the RSO. The device cannot be used until the RSO evaluates its condition
- d) If the reference reading is significantly lower than the last recorded reading or from the reading derived from the source decay chart, assume that the source is not in the device and notify the RSO. If another meter is available, resurvey. NOTE: Because depleted uranium is typically used as shielding in source devices, low radiation levels may be measured 1-2 mR/hr (.01msv.hr-.02msv/hr) even if the source is not present
- e) If significantly higher or lower readings are noted during field operations, use the reference reading to verify the operation of your meter and the location of the source in the manner described above

Record Keeping Requirements

20: Utilization Logs

- 1) Current logs of the use of each source of radiation, containing the following information, shall be maintained
 - a) Unique identification of each exposure device and sealed source (make and model number, serial number and activity)
 - b) Unique identification of each X-ray machine, including KV and MA
 - c) Name of radiographer, radiographer trainer or radiographer instructor to whom
 - d) Location where the source of radiation is to be used, and reciprocity if required
 - e) Date removed from storage and date returned to storage
- 2) Utilization logs shall be kept at the Division office or at the location specified by the applicable license
- 3) Utilization logs for the duration of use for all sources of radiation shall also be maintained at a temporary job site if the source of radiation will be stored at, and signed out from, that storage

21: Records Required at Temporary Job Sites

The following records are required at temporary job sites:

- a) Current rules and regulations for the state in which the radiographic activities are being performed
- b) Current radioactive materials license and amendments for the state where radiographic operations are being performed (or license under which reciprocity was granted)
- c) SEI Radiographic Operating and Emergency Procedures
- d) Notice to employees for applicable state
- e) Records of surveys performed in accordance with this procedure
- f) Daily pocket dosimeter records for the period of operation at the site
- g) Latest leak test results for sealed sources and exposure devices at the site
- h) Latest instrument calibration records and latest preventive maintenance records for exposure devices. Acceptable records include tags or labels, which are attached to the device or instrument
- i) Utilization logs for duration of use for all sources of radiation if the source of radiation will be stored at, and signed out from, that storage location
- j) A copy of the certificate of registration for an X-ray machine in use

NOTE: Copies of the radiation survey/shipping records generated at temporary job sites shall be forwarded to the facility RSO on a weekly basis or upon completion of the job, whichever comes first and the originals to remain at the job site

22: Receipt, Transfer and Disposal of Sources of Radiation

Records showing the receipt, transfer and disposal of sources of radiation containing the following information shall be maintained:

- a) Date of receipt, transfer or disposal
- b) Name of individual making the record
- c) Radionuclide
- d) Number of curies
- e) Make, model number and serial number of source
- f) Make, model number and serial number of exposure devices and source changers

23: Shift Change

When responsibility for sources of radiation is transferred to another radiographer during shift changes, the outgoing crew shall complete the radiation survey/shipping record for their period of operation, and the incoming crew shall generate a new radiation survey/shipping record

24: Reciprocal Notification

- a) Industrial radiographic operations performed in states where SEI holds no radioactive materials license shall require notification to that state of SEI's intent to perform radiography under reciprocity
- b) Written notification to an Agreement State of SEI's intent to perform radiography within the State's jurisdiction shall be provided to the applicable State agency at st three days prior to entering the state. In the event a three-day notification is not possible, the applicable Agreement State agency shall be notified by telephone, and a written notification shall be provided immediately after the telephone notification
- c) Radiographic operations shall be performed in accordance with the regulations of the applicable state in which radiography is being performed
- d) Radiographic personnel responsible for performing the radiographic operations shall review the applicable State regulations, and ensure the applicable state agency has been notified prior to performing radiography
- e) Maintain reciprocity notifications on file for review during future in house and state record reviews

25: Notification of Events

The following events shall be immediately reported to the Facility RSO and the Corporate RSO for investigation and reporting to the agency, as required:

- a) Thefts or losses of sources of radiation
- b) Events that may cause or threaten to cause exposure of the whole body to 1.250 Rem of radiation or more

25: Notification of Events (con't)

- c) Off-scale dosimeters
- d) Whenever a sealed source cannot be returned to the fully shielded position and properly secured
- e) Whenever a sealed source becomes disconnected from the drive cable
- f) Failure of any component critical to the safe operation of the device to properly perform its intended function
- g) Equipment defects jeopardizing the safe operation of radiographic equipment
- h) Restricted area perimeter radiation levels in excess of regulatory limits
- i) Whenever an unauthorized individual breaches an established restricted area boundary
- j) Storage facility surveys in excess of 2mR/hr at the surface
- k) Exposure device surveys in excess of 200mR/hr (2.0msv/hr) at the surface or 2mR/hr (.02msv/hr) at one meter from the surface
- l) Whenever an indicator on a radiation producing machine fails to show that radiation is being produced, or an exposure switch fails to terminate production of radiation when turned to the "off" position
- m) Source changer surveys in excess of 200.R/hr (2.0msv/hr) at the surface or 10mR/hr (.1msv/hr) at one meter from the surface

Permanent Facilities

26: Permanent Radiographic Exposure cells

Permanent radiographic exposure cells shall:

- a) Be approved by the applicable regulatory agency
- b) Be conspicuously posted with a sign(s) bearing the radiation symbol and the words "Caution" or "Danger", "High Radiation Area"
- c) Be equipped with a conspicuously visible alarm activated by the presence of radiation
- d) Be equipped with an audible signal activated when an attempt is made to enter the installation when the source is exposed
- e) Be maintained and locked except when access to the area is in positive control over each individual entry
- f) Have controls established in such a way that no individuals will be prevented from leaving a high radiation area
- g) Have controls established such that when the device is activated, it shall be necessary to shut off or secure the source of radiation and secure all tripped entrances prior to being able to inactivate the alarm system
- h) One radiographer is required to conduct operations
- i) All radiographic operations shall be accomplished entirely within the permanent exposure cell. No radiographic operations are permitted outside of the cell, unless agency approval has been obtained

Step 1 Remove the exposure device or source changer from storage. Refer to Section B(1) for the proper procedure to follow

Step 2 Document the following additional items in the **Radioactive Material Transport Data** section of the Radiation Survey/Shipping Record:

- A) Transport Personnel & Dosimeter Data for qualified person preparing package for transport
 - Qualified Person's Name
 - LUXEL Badge Number
 - Dosimeter Number
 - Ratemeter Number and Function Test
 - Dosimeter Start mR
- B) Shipping Division
- C) Weight of Package
- D) Radionuclide
- E) Package identification of the exposure device shipping container or source changer model number.
- F) If the transport and RT operations personnel are the same individuals the block Dosimetry Same As Above may be checked provided personnel dosimetry used in RT operations is the same used in transport.

Step 3 Properly mark the package as follows:

NOTE: The markings must be in English, ½" high and unobscured.

- A) The proper shipping name- **"Radioactive Material, Special Form, N.O.S., 7, UN 2916, R.Q"**

NOTE: RQ need only be affixed to the package if it contains more than 10 curies of radioactive material. RQ will have to be added to the label on the shipping container.

- B) The proper package identification- see package identification block on the Radiation Survey/Shipping Record
- C) The name and address of the shipper and consignee (receiving destination)
- D) The weight of the package

NOTE: If the exposure device is shipped in the Model # OPL-660 shipping container, proper markings should already be on the container name plate, (review for accuracy)

NOTE: If the exposure device or source changer is placed within an overpac then the overpac shall contain those markings as outlined in Step 3, along with the statement "**INNER PACKAGE COMPLIES WITH PRESCRIBED SPECIFICATIONS**" preceding the package identification.

Step 4 Perform a **Transport Survey of the Package** on all sides at the surface and at one meter from the surface to determine the appropriate warning labels to be applied to the package, based upon the highest radiation intensities noted.

NOTE: The radiation survey one meter from the surface of the package is referred to as the Transport Index (T.I.).

Step 5 Record the highest noted radiation intensities (in Millirem & msv) in the **Radioactive Material Transport Data** section of the Radiation Survey/Shipping Record

Step 6 Select the appropriate warning labels based on the following criteria:

I-White- Selected for packages 0.5 mRem/hr (.005 msv/hr) **or** less at the surface

at II-Yellow- Selected for packages not exceeding 50 mRem/hr (.5 msv/hr) the surface **or** 1.0 mRem/hr (.01 msv/hr) at 1 meter from the surface.

III-Yellow- Selected for packages exceeding 50 mRem/hr (.5 msv/hr) at the surface **or** 1.0 mRem/hr (.01 msv/hr) at 1 meter from the surface.

Warning: UNDER NO CIRCUMSTANCES ARE SEI PERSONNEL TO TRANSPORT A YELLOW III PACKAGE.

NOTE: The Transport Index shall be recorded in Millirem and msv/hr on the warning label.

NOTE: Attach a wire/plastic security seal to prevent tampering during transport.

NOTE: Source activity must be recorded in Gigabecquerels (GBq) on the warning label (1 ci = 37 GBq).

Step 7 Place the package in the vehicle or trailer and secure it so that it cannot change position during conditions normally incident to transportation. Acceptable securing methods would include, but not be limited to, blocking, bracing tying or bolting to the vehicle.

(1) Name or Symbol of Radionuclide:

Example: "Iridium 192"

(2) Number of Packages, their Type of Package and Activity in Gigabecquerels (activity in curies may be noted in brackets following the GBq units):

Example: "1 Type B(u) Package 370 GBq (10 curies)"

(3) Indication of Use of Overpac: When an overpac is used, the wording "OVERPAC USED" must be inserted immediately after all relevant package entries.

(k) Packing Instructions

(1) Category of Package: Enter appropriate category (i.e., "III Yellow" or "II Yellow").

(2) Transport Index and Dimensions (including dimensional units) **of Package or Overpac:** Enter Transport Index, in millirem rounded to the first decimal place. Enter dimensions of package in centimeters, and the units of measure (i.e., Dim. 30 x 30 x 30 cm)

NOTE: Transport boxes typically used by SEI have the following dimensions:

OverPack 72 cm (28.375") by 31 cm (12.250") by 33.6 cm (13.250")

OPL-660 48.26 cm (19") by 36.83 cm (14.5") by 20.32 cm (8")

(l) Authorization: Enter identification of documents issued by a competent authority, together with a statement that such documents are attached to the Declaration.

Example: "Special Form Certificate No. 0000"
"Type B(u) Package Certificate No. USA/9033/B(u)"
"Attached"

(m) Additional Handling Information: Enter "CARGO AIRCRAFT ONLY", and also provide an emergency (24 hr) telephone number in this block.

26: Permanent Radiographic Exposure Cells (con't)

Exposure cell control devices shall be tested for proper operation at the beginning of each day of use, or just prior to use, and recorded on the exposure cell utilization log. Controls found defective shall be labeled and the defective equipment repaired. Radiographic operations may continue provided constant surveillance is maintained for up to seven (7) days while the alarm is being repaired. Two (2) radiographic personnel will be required to be present during operations

27: Permanent Storage and Use facilities

- 1) Radioactive material shall not be stored or used at permanent locations unless specifically authorized by the regulatory agency
- 2) A storage or use location is considered permanent if radioactive material is stored at the location for more than 90 days and any one of the following applies:
 - a) Telephone service is established
 - b) Industrial radiographic services are advertised for or from the location
 - c) Industrial radiographic operations are conducted at other sites due to arrangements made from the location

28: Equipment Identification

All associated radiographic equipment (drive cables, source guide tubes, J-tubes, etc) shall be inventoried and assigned a unique serial number to be used to determine preventative maintenance compliance. Periodic inspection and maintenance reports shall be used to document that all maintenance has been performed. The Facility RSO shall maintain these forms on file and readily available for inspection.

Reciprocity Reporting Addresses/Telephone

Alabama 334-206-5391	State Dept. of Public Health Radiological Health Board 434 Monroe St. Room 510 Montgomery, AL 36130	Nebraska 402-471-8566	Division of Radiological Health State Dept. of Health 301 Centennial Mall S. Lincoln, Neb. 68509
Arizona 602-255-4845	Arizona Radiation Regulatory 4814 South 40 th St. Phoenix, AZ 85040	Nevada 702-687-5394	Radiological Health Section Dept. Of Human Resources 1179 Fairview Dr. Suite 102 Carson City, Nev. 39710
Arkansas 501-661-2301	Division of Radiation Control 4815 W. Markham S. E. Little Rock, Ark. 72205	New Hampshire 603-271-4588	Radiological Health Bureau 6 Hazen Dr. Concord, N. H. 03301
California 916-323-6484	Radiological Health Section 606N. 7 th St. Sacramento, Ca. 94234	New Mexico 505-827-1557	Radiation Protection Bureau Environmental Improvement division Dept. of Health & Environment 2044 Galisteo Rd. Santa Fe, N. M. 87502
Colorado 303-331-3480	Radiation Control Division 4210 E. 11 th Ave. Denver, Co. 30220	New York 518-458-6461	Bureau of Environment Rad. Protection New York State Health Program Two University Place Albany, N. Y. 12203
Florida 850-487-1004	Office of Radiation Control 1317 Winewood Blvd. Tallahassee, Fl. 32399	North Carolina 919-571-4141	Division of Radiation Protection Dept. of environment, Health, & Natural Resources 3825 Barrett Dr. Raleigh, N. C. 27609
Georgia 404-362-2575	Radiological Health Section Dept. of Natural Resources 4244 International Pkwy, Suite 111 Atlanta, Ga. 30354	North Dakota 701-328-5188	State Dept. of Health Box 5520 Bismark, N. D. 58502
Illinois 217-785-5500	Illinois Dept. of Nuclear Safety 1035 Outer Park Dr. Springfield, Ill. 52704	Rhode Island 401-222-2438	Div. Of Occupational Health & Radiation Control Rhode Island Dept. of Health #3 Capital Hill Providence, R. I. 02908
Iowa 515-281-3478	Bureau of Radiological Health Iowa Dept. of Health Lucas State Office Bldg. Des Moines, Iowa 50319	South Carolina 803-737-7400	Bureau of Radiological Health State Dept. of Health & Environmental Health 2600 Bull St. Columbia, S. C. 29201
Kentucky 504-564-3700	Radiation control Branch Cabinet for Human Resources 275 Main St. Frankfort, Ky. 40621	Tennessee 615-532-364	Div. of Radiological Health 3 rd floor L & C Annex 401 Church St. Nashville, TN. 37243
Louisiana 207-287-5698	Radiation Protection Division Office of air Quality PO Box 82135 Baton Rouge, La. 70884	Texas 512-834-6679	Bureau of Radiation Control Texas Dept. of Health 1100 W. 49 th St. Austin, TX. 78756
Maine 207-287-5698	Radiation Control Program State House Station #10 Augusta, Me. 04333	Washington 360-236-3210	Div. Of Radiation Protection Dept. of Health PO Box 47827 Olympia, WA 98504
Maryland 410-537-3300	Radiological Health Program 1800 Washington Blvd. Ste. 750 Baltimore, Md. 21230	Mississippi 601-987-6893	Division of Radiological Health State Dept. of Health 3150 Lawson St. Jackson, Ms. 39215

SECTION B:

PROCEDURAL REQUIREMENTS FOR RADIOGRAPHIC ACTIVITIES

(1) REMOVAL OF SOURCES OF RADIATION FROM STORAGE

This procedure shall be followed when removing sources of radiation from storage.

NOTE: A separate Radiation Survey/Shipping Record must be filled out for each source of radiation removed from storage.

NOTE: Radiographic personnel shall wear all required personnel dosimeter devices and utilize an operable, calibrated survey meter when removing sources of radiation from storage.

NOTE: Only Radiographers or Qualified Persons may remove sources of radiation from storage, completing all the requirements of this section.

Step 1 Verify that a Utilization Log exists from the source of radiation or initiate a Utilization Log if none exists. Document the following additional items on the Utilization Log:

- A) Date Out of Storage
- B) Name
- C) Location of Use (or Destination)
- D) Activity or KVP
- E) Reciprocal Notification Required (yes/no)

Step 2 Document the following items on the Radiation Survey/Shipping Record:

- A) Date
- B) Daily equipment checks
- C) Customer/Destination (location of use or transport destination, as appropriate)
- D) City, State
- E) Source of Radiation Data:
 - Check appropriate type
 - Source Serial Number or X-Ray Tubehead Serial Number,
 - Activity of Source, in Gbq's & Curies, or KVP of X-Ray Unit, and
 - Leak Test Due Date (sources or exposure devices past due for leak test shall not be utilized).
- F) Exposure Device, Source Changer or X-Ray Control Unit Data:
 - Model Number,
 - Serial Number, and
 - PM Due Date (exposure devices or source changers past due for PM shall not be utilized)
- G) Survey Meter Data: (2) If conducting RT operations
 - Model Number
 - Serial Number, and

- Calibration Due Date (survey meters past due for calibration shall not be utilized)

Step 3 Perform a **Storage Facility Removal Survey** of all accessible surfaces of the storage facility before unlocking to ensure radiation levels are not greater than 2mR/hr (0.02msv/hr) at the surface of the storage facility

NOTE: Radiation levels greater than 2 mR/hr (.02 msv/hr) at the surface of the storage facility shall be considered abnormal and shall warrant immediate notification of the Facility and Corporate RSO.

Step 4 Remove the exposure device or source changer from the storage facility if no abnormal levels of radiation are observed.

Step 5 Immediately upon removal, perform a **Removal Survey of Source of Radiation** on all sides of the source of radiation at the surface and at one meter from the surface. Record the highest noted radiation intensity during the removal survey on the Radiation Survey/Shipping Record.

NOTE: The source of radiation shall be immediately returned to storage and the Facility and Corporate RSO notified if radiation levels are in excess of 200 mR/hr (2.0 msv/hr) at the surface and/or 10 mR/hr (.1 msv/hr) at one meter from the surface for source changers and 200 mR/hr (2.0 msv/hr) at the surface and/or 2 mR/hr (.02 msv/hr) at 1 meter from the surface for exposure devices.

Step 6 Perform the daily maintenance checks of the exposure equipment and related radiography equipment. Note any discrepancies on the back of the original Survey/Shipping Record.
Immediately notify the Facility and Corporate RSO of any defect that would jeopardize the safe operation of the equipment. Inspect the radiographic equipment to verify the following conditions are satisfactory.

A. Storage Facility

- no abnormal radiation levels
- storage facility was locked, and
- properly posted

B. Radiographic Exposure Unit

- no abnormal surface radiation levels anywhere on exposure device, collimator or guide tube,
- exposure device locked and all safety plugs in place
- condition of safety plugs and pigtail connector

- proper labeling (i.e., "CAUTION" or "DANGER", "RADIOACTIVE MATERIAL")
- presence of a current PM sticker
- presence of a sticker stating the Company's name, address and emergency telephone number

C. Source Tube

- no rust, dirt, or sludge buildup inside the source tube
- condition of source tube connector, and source stop
- no kinks, cuts or damage that could prevent proper operation
- Bed radius of cable should not exceed 20"

D. Control Cables and Drive Mechanism

- Inspect the drive cable directly behind the drive cable connector and approximately 12" beyond
- Connect drive mechanism with camera
- Connector should not be bent at an angle exceeding 15 degrees
- Cuts, breaks, nicks, or fraying of spiral windings
- Rust on the inner core
- Uniformity of spacing or any flattened areas and excessive wear
- Flexibility, and freedom of movement back and forth
- Bend radius of cable should not exceed 36 degrees

Step 7 The Radiographer or Qualified Person certifying that the daily equipment inspection was performed and found to be acceptable for use that shall initial the Daily Inspection block on the Utilization Log, and sign the Radiation Survey/Shipping Record before performing any other activities.

Step 8 Once method of shipment is determined, a wire/plastic/lock security seal will be placed on the outside of the package, to provide evidence that the package has not been opened by unauthorized persons, during shipment. According to the way of shipment, the outside package could be the exposure device, overpac, or transport container.

Step 9 Refer to the following sections, as applicable:

- B(8), Radiographic Operations in Permanent Exposure Cells
- B(7), Radiographic Operations at Temporary Job Sites
- B(2), Transportation of Exposure Devices or Source Changers Containing a Radioactive Source by Company Vehicles, or

- B(3), Transportation of Exposure Devices or Source Changers
Containing a Radioactive Source by Common Carriers

**(2) TRANSPORTATION OF EXPOSURE DEVICES OR SOURCE CHANGERS
CONTAINING A RADIOACTIVE SOURCE BY COMPANY VEHICLES**

This procedure shall be followed when preparing a Type B exposure device or source changer containing a radioactive source for transportation in a Company vehicle. These rules do not apply to Type A packages.

Using an overpack: Radioactive Material labels in the overpack will be determined by the survey intensity on the outside of the overpack.

When the exposure device (660) is placed into the OPL-660 (shipping container), surveys are taken and recorded from the readings obtained on the outside of the OPL-660. The OPL-660 is an NRC approved type B package.

Source changer requiring a Yellow III label cannot be shipped by company personnel, except by common carrier back to the manufacturer. A Yellow III container may be received by company personnel, but not transported beyond area received.

Whichever method is used to ship the 660, an overpack, OPL-660, or source changer, the item must be properly secured to prevent movement in the transport vehicle.

A single Radiation Survey/Shipping Record may be utilized for round-trip transportation of an exposure device or source changer to a job site and return to the SEI facility.

However, transportation of an exposure device or source changer to multiple destinations before return to the SEI facility will require that a separate Radiation Survey/Shipping Record be completed for each transportation of the exposure device or source changer.

NOTE: Only Radiographers or Qualified Persons may transport Radioactive Materials, completing all requirements of this section.

Examples:

1. An individual is departing from the division to perform radiography at worksite A and worksite B. A new radiation Survey/Shipping Record would have to be generated to leave worksite A and go to worksite B
2. An individual who is traveling to point A to point B and has to stop overnight. A new Radiation Survey/Shipping Record would have to be generated to resume transportation after stopping for the night.

NOTE: When transporting multiple packages, a separate Radiation Survey/Shipping Record must be completed for each package.

NOTE: Every company vehicle used to transport sources shall have a permanent fixture to keep the source from shifting during transportation.

NOTE: The package shall be secured in the vehicle's trunk if an automobile is utilized to transport radioactive material.

NOTE: Exposure devices or source changers transported in open-bed vehicles shall always be transported in an overpack or OPL-660 shipping container that is secured to the body of the vehicle, and shall not be transported in the passenger compartment.

Step 8 Perform the following **Transport Vehicle Surveys** and record the highest noted intensity level in the **Transport Vehicle Survey** section of the Radiation Survey/Shipping Record:

- A) **Passenger Compartment Survey** – confirm the dose rate does not exceed 2 Millirem per hour in any position normally occupied by personnel in the vehicle.
- B) **Vehicle Survey** – confirm the dose rate at any external surface of the vehicle does not exceed 2 mR/hr.

NOTE: Additional shielding shall be added as necessary, or the package repositioned in the vehicle to keep radiation levels below these limits.

Step 9 Record Finish mR and Total mR in the **Transport Personnel & Dosimeter Data** section of the Radiation Survey/Shipping Record after securing the package in the transporting vehicle.

Step 10 Attach a copy of the source decay chart, an ERI form, and, if appropriate, leak test results to the Radiation Survey/Shipping Record and place in a holder inside the vehicle, or in a position readily visible to a person entering the driver's compartment.

Step 11 If transportation is for the purpose of disposal or transfer of material, document on the "Receipt, Transfer or Disposal Record".

NOTE: Transfer or disposal of sources of radiation shall be entered on the same line as the original receipt documentation on the Receipt, Transfer and Disposal Record.

NOTE: A calibrated, operating survey meter shall be kept in the driver's compartment of the vehicle while transporting radioactive material.

NOTE: In the event that it is necessary to leave a transporting vehicle unattended, the vehicle shall be locked and conspicuously posted with a sign or signs bearing and radiation symbol and the words "Caution" or "Danger", "Radioactive Material" on all accessible sides.

NOTE: Open-bed vehicles utilized to transport radioactive material shall not be left unattended under any circumstances.

Step 12 Refer to the following sections, as applicable:

- B(6) Receiving and Opening Packages at Temporary Job Sites, or
- B(5) Receiving and Opening Packages at SEI Facilities

(3) **PREPARATION OF EXPOSURE DEVICES OR SOURCE CHANGERS CONTAINING A RADIOACTIVE SOURCE FOR TRANSPORTATION BY COMMON CARRIER VEHICLES**

This procedure shall be followed when preparing a Type B exposure device or source changer containing a radioactive source for transportation by a Common Carrier vehicle. These rules do not apply to transportation of Type A packages.

NOTE: If the exposure device or source changer is shipped in an overpack, "package" refers to the overpack. If shipped without an overpack, "package" refers to the exposure device.

NOTE: A separate Radiation Survey/Shipping Record must be completed for each package.

NOTE: Only Radiographers or Qualified Persons may transport Radioactive Materials, completing all requirements of this section.

Step 1 Remove the exposure device or source changer from storage. Refer to Section B(1) for the proper procedure to follow.

Step 2 Document the following additional items in the **Radioactive Material Transport Data** section of the Radiation Survey/Shipping Record:

A) Monitoring information for qualified person preparing package for transport shall be documented in the Transport Personnel & Dosimeter Data Section:

- Qualified Person's Name
- LUXEL Badge Number
- Dosimeter Number
- Ratemeter Number and Function Test
- Dosimeter Start MR

B) Shipping Division

C) Weight of Package

D) Radionuclide

E) Package identification of the exposure device or source changer model number

Step 3 Attach a wire/plastic security seal through the source exit plug, and remove or obliterate any irrelevant markings already on the package.

Step 4 Properly mark the package as follows:

NOTE: The markings must be in English, ½" high and un-obscured.

- A) The proper shipping name – **“Radioactive Material, Special Form, N.O.S., 7, UN 2916, R.Q.”**
- NOTE: RQ need only be affixed to the package if it contains more than 10 curies of radioactive material.
- B) The proper package identification – see package identification block on the Radiation Survey/Shipping Record.
- C) The name and address of the shipper and consignee (receiving destination)
- D) The weight

NOTE: If the exposure device or source changer is place within an overpack, then the overpack shall contain those markings as outlined in Step 4, along with the statement **“INNER PACKAGE COMPLIES WITH PRESCRIBED SPECIFICATIONS”** preceding the package identification.

Step 5 Perform a **Transport Survey of the Package** on all sides at the surface and at one meter from the surface to determine the appropriate warning labels to be applied to the package, based upon the highest radiation intensities noted.

NOTE: The radiation survey one meter from the surface of the package is referred to as the Transport Index (T.I.), and shall be recorded as mR/hr.

Step 6 Record the highest noted radiation intensities (mr/hr and msv/hr) in the **Radioactive Material Transport Data** section of the radiation Survey/Shipping Record.

Step 7 Select appropriate warning labels based on the following criteria:

I-White – Selected for packages 0.5 mRem/h (.005 msv/hr) **or** less at the surface.

II-Yellow – Selected for packages not exceeding 50 mRem/hr (.5 msv/hr) at the surface **or** 1.0 mRem/hr (.01 msv/hr) at 1 meter from the surface

Note: It is acceptable to offer packages that contain radioactive materials that qualify for Yellow III label to common carriers for transportation. Proper placarding must be noted and provided if required.

Step 8 Complete two of the selected warning labels and affix next to **“CARGO AIRCRAFT ONLY”** stickers on opposite sides of the package.

NOTE: The Transport Index shall be recorded in Millirem, on the warning label.

NOTE: Source activity must be recorded in Gigabecquerels (GBq) on the warning label (1 ci = 37 GBq)

Step 9 Record Finish mR and Total mR in that **Transport Personnel & Dosimeter Data** section of the Radiation Survey/Shipping Record.

Step 10 Complete Shippers Declaration of Dangerous Goods, following these outlined steps:

(a) **Shipper:** Enter full name and address of shipper

(b) **Consignee:** Enter full name and address of consignee
(receiving location)

(c) **Air Waybill Number:** Enter number of the air waybill
(supplied by common carrier representative)

(d) **Page of Pages:** Enter the page number and total number of pages of the Declaration.

(e) **Aircraft Limitations:** Delete "passenger" box to indicate the shipment is packed to comply with the limitations for Cargo Aircraft Only.

(f) **Airport of Departure:** Enter full name of airport or city of departure.

(g) **Airport of Destination:** Enter full name of airport or city of destination.

(h) **Shipment Type:** Delete "Non-Radioactive" box to indicate shipment contains radioactive material.

(i) **Nature and Quantity of Dangerous Goods:**

(1) **Proper Shipping Name:** Radioactive Material,
Special Form, N.O.S.

(2) **Class or Division:** 7

(3) **UN Number:** UN 2916

(j) **Quantity and Type of Packaging:**

(n) **Name and Title of Signatory:** Print or type the name and title of the person signing the Declaration

(o) **Place and Date:** Enter the place and date of signing the Declaration

(p) **Signature:** This must be the original signature of the person preparing the package for shipment, a typewritten or printed name is not acceptable.

Step 11 Attach a copy of the Radiation Survey/Shipping Record, the applicable Certificates of Compliance for both the source and the package, and the applicable source decay chart and, if appropriate, leak test results to the completed Shippers Declaration of Dangerous Goods and submit to the Common Carrier representative at the time of package pickup.

Step 12 Document transfer or disposal on "Receipt, Transfer and Disposal Record"

NOTE: Transfer or disposal of sources of radiation shall be entered on the same line as the original receipt documentation on the Receipt, Transfer and Disposal Record.

Step 13 Retain a copy of all transport paperwork and forward it to the appropriate Division RSO.

NOTE: Examples of transport documentation by two common carriers follow

(4) **PREPARATION OF EMPTY EXPOSURE DEVICES OR SOURCE CHANGERS (ARTICLES MANUFACTURED FROM DEPLETED URANIUM) FOR TRANSPORTATION**

This procedure shall be followed when preparing empty exposure devices or source changers for transportation.

NOTE: If the exposure device or source changer is shipped in an overpack, "package" refers to the overpack. If shipped without an overpack, "package" refers to the exposure device source changer, or type B shipping container, OPL-660.

NOTE: Only Radiographers or Qualified Persons may transport Radioactive Materials, completing all requirements of this section

Step 1 Remove the exposure device or source changer from storage. Refer to Section B (1) for the proper procedure to follow, document/delete information on the Radiation Survey/Shipping Record.

Step 2 Document the following items in the Radiation Survey/Shipping Record:

- A) Transport Personnel & Dosimeter Data for qualified person preparing package for transport
 - Qualified Person's Name
 - LUXEL Badge Number
 - Dosimeter number
 - Ratemeter Number and Function Test
 - Dosimeter Start mR
- B) Shipping Division
- C) Weight of Package if the package exceeds 110 pounds
- E) Package identification of the exposure device or source changer model number

Step 3 Properly mark the package as follows:

NOTE: The markings must be in English, ½" high and un-obscured

- A) The proper shipping name – **"Radioactive material, Excepted Package, Articles Manufactured from Depleted Uranium, UN 2910"**
- B) The name and address of the shipper and consignee (receiving destination)
- C) The weight of the package if the package exceeds 110 pounds

NOTE: If the exposure device or source changer is placed within an overpack, then the overpack shall contain those markings as outlined in Step 3, along with the statement **"INNER PACKAGE COMPLIES WITH PRESCRIBED SPECIFICATIONS"** preceding the package identification.

NOTE: No labels (i.e., II Yellow) are required for shipments of articles manufactured from depleted uranium (empty exposure devices or source changers)

Step 4 Affix two **"CARGO AIRCRAFT ONLY"** stickers on opposite sides of the package, if required.

NOTE: If transporting the package by common carrier, proceed to Step 12, if transporting by company vehicle, proceed to Step 6

Step 5 Place the package in the vehicle or trailer and secure it so that it cannot change position during conditions normally incident to transportation. Acceptable securing methods would include, but not be limited to, blocking, bracing or tying. Attach a wire/plastic/lock security seal to prevent tampering during transport.

NOTE: The package shall be secured in the vehicle's trunk if an automobile is utilized to transport radioactive material.

NOTE: Exposure devices or source changers transported in open-bed vehicles shall always be transported in an overpack that is secured to the body of the vehicle, and shall not be transported in the passenger compartment.

Step 6 Perform the following **Transport Vehicle Surveys** and record the highest noted intensity level in the **Transport Vehicle Survey** section of the Radiation Survey/Shipping Record.

A) **Passenger Compartment Survey** – confirm the dose rate does not exceed 2 millirem per hour in any position normally occupied by personnel in the vehicle.

B) **Vehicle Survey** – confirm the dose rate at any external surface of the vehicle does not exceed 2 mR/hr.

NOTE: Additional shielding shall be added as necessary, or the package repositioned in the vehicle to keep radiation levels below these limits.

- Step 7 Record Finish mR and Total mR on the Radiation Survey/Shipping Record after securing the package in the transporting vehicle
- Step 8 Place a copy of the Radiation Survey/Shipping Record in a holder inside the vehicle, or in a position readily visible to a person entering the driver's compartment.
- Step 9 If transportation is for the purpose of disposal or transfer of material, document on the "Receipt, Transfer or Disposal Record"

NOTE: Transfer or disposal of exposure devices or source changers shall be entered on the same line as the original receipt documentation on the Receipt, Transfer and Disposal Record.

NOTE: In the event that it is necessary to leave a transporting vehicle unattended, the vehicle shall be locked and conspicuously placard with a sign or signs bearing the radiation symbol and the words "Caution" or "Danger", "Radioactive Material"

NOTE: Open-bed vehicles utilized to transport radioactive material shall not be left unattended under any circumstances.

Step 10 Retain a copy of all transportation paperwork and forward to the appropriate Facility RSO.

Step 11 Refer to the following sections, as applicable.

- B(6) Receiving and Opening Packages at Temporary Job Sites
- B(5) Receiving and Opening Packages at SEI Facilities

INSTRUCTIONS FOR SHIPPING BY COMMON CARRIER

- Step 12 Complete the common carrier's airway bill according to section B(3), inserting the appropriate package dimensions for the particular package you are shipping.
- Step 13 Attach a copy of the Radiation Survey/Shipping Record and the Certificate of Compliance for the package to the completed airway bill or bill of lading for submission to the common carrier's representative at package pick up.
- Step 14 Retain a copy of all transport paperwork and forward to the appropriate Division RSO.

(5) **RECEIVING AND OPENING PACKAGES CONTAINING
SOURCES OF RADIATION AT SEI FACILITIES**

This procedure shall be followed when receiving and opening packages that contain a radioactive source at SEI facilities, including those packages returning from temporary job sites.

NOTE: The receiving individual may be the Radiographer or Qualified Person who transported the package, or a Radiographer or a Qualified Person who is already present at the SEI facility.

NOTE: If an exposure device or source changer is placed in the storage facility by a transporting radiographer or Qualified Person after normal business hours, the transporting radiographer or Qualified Person shall perform and document the required receiving inspection surveys on the Radiation Survey/Shipping Record, and document receipt on the Receipt, Disposal and Transfer Record and/or Utilization Log, as applicable.

NOTE: No Assistant or Trainee shall receive packages containing radioactive material unless they have Qualified Person status.

Step 1 Document the following information in the **Package Receipt Data** section of the Radiation Survey/Shipping Record that accompanied the shipment. If this is a receipt of new material, a Radiation Survey/Shipping Record shall be generated.

- A) Receiving Personnel & Dosimeter Data for Qualified Person receiving package
 - Name
 - LUXEL Badge Number
 - Dosimeter Number
 - Ratemeter Number and Function Test
 - Dosimeter Start mR
- B) Date Received
- C) Received at (location)
- D) Originating Shipper

Step 2 The receiving Qualified Person shall perform a **Survey of Package Upon Receipt** at the surface and at 1 meter, and inspect the package and wire security seal for damage.

NOTE: The Qualified Person shall immediately notify the Division and Corporate RSO if the survey reveals radiation levels significantly higher than those noted on the transport paperwork that accompanied the package, if the package exhibits obvious damage, or if the overpack (if applicable), exposure device or source changer is not locked.

- Step 3 Record the highest radiation intensities noted in the **Package Receipt Data** section of the Radiation Survey/Shipping Record, if the OPL-660 Type B shipping container is used, then remove the exposure device.
- Step 4 Remove the exposure device or source changer from the overpack, if applicable.
- Step 5 Perform a survey of the exposure device or source changer at the surface and at 1 meter from the surface before placing in storage. Document the results of this survey in the "Lock-Out" survey block of the Radiation Survey/Shipping Record if no previous "Lock-Out" survey has been documented.
- NOTE: Radiation levels in excess of 200 mR/hr (2.0 msv/hr) at the surface or 10 mR (.1 msv/hr) at one meter from the surface shall be considered abnormal and shall warrant immediate notification of the Division and Corporate RSO.
- Step 6 Survey all surfaces of the Storage facility before placing the exposure device or source changer in storage.
- NOTE: Radiation levels greater than 2 mR/hr at the surface of the storage facility shall be considered abnormal and shall warrant immediate notification of the Division and Corporate RSO.
- Step 7 Place the exposure device or source changer in the storage facility if no abnormal radiation levels are noted, and ensure the facility is properly locked.
- Step 8 Perform a **Storage Facility Return Survey** on all exterior surfaces of the storage facility after placing the exposure device or source changer in storage. The dose rate at any exterior surface of the storage facility shall not exceed 2 mR/hr. Additional shielding shall be added as necessary to keep radiation levels below this limit.
- Step 9 Record the highest radiation intensity noted on the Utilization Log.
- IF RECEIPT IS FROM ANOTHER FACILITY/LOCATION**
- Step 10 If the exposure device or source changer is being received from another facility/location, document receipt of the source of radiation on the Receipt, Transfer or Disposal Record and generate a new Utilization Log. Post the Utilization Log and a copy of the source decay chart in the designated location.

IF RECEIPT IS A RETURN TO ORIGINAL STORAGE LOCATION

- Step 11 If the source of radiation is returning from a temporary job site to its original storage location, document the return of the source of radiation to storage on the applicable existing Utilization Log.
- Step 12 Record Finish mR and Total mR in the **Receiving Personnel & Dosimeter Data** section of the Radiation Survey/Shipping Record.
- Step 13 Retain a copy of all transport paperwork and receipt surveys and forward to the appropriate Division RSO.

(6) RECEIVING AND OPENING PACKAGES CONTAINING SOURCES OF RADIATION AT TEMPORARY JOB-SITES

This procedure shall be followed when receiving and opening packages at temporary job-sites.

NOTE: The receiving individual may be the radiographer or Qualified Person who Transported the package, or a radiographer or a Qualified Person who is already present at the temporary job site.

NOTE: **No assistant or trainee shall receive packages containing radioactive material unless they have Qualified Person status.**

- Step 1 Document the following information in the **Package Receipt Data** section of the Radiation Survey/Shipping Record that accompanied the shipment.
- A) Receiving Personnel & Dosimeter Data for Qualified Person receiving package
 - Name
 - LUXEL Badge Number
 - Dosimeter Number
 - Ratemeter Number and Function Test
 - Dosimeter Start mR
 - B) Date Received
 - C) Received at (location)
 - D) Originating Shipper

NOTE: Check integrity of the wire/plastic security seal. Notify the FRSO if discrepancies are noticed.

- Step 2 The receiving Qualified Person shall perform a **Survey of Package Upon Receipt** at the surface and at 1 meter, and inspect the package for obvious damage

NOTE: The Qualified Person shall immediately notify the Facility and Corporate RSO if the survey reveals radiation levels significantly higher than those noted on the transport paperwork that accompanied the package, if the package exhibits obvious damage, or if the overpack (if applicable), exposure device or source changer is not locked.

- Step 3 Record the highest radiation intensities noted in the **Package Receipt Data** section of the Radiation Survey/Shipping Record, if the OPL-660 Type B shipping container is used, then remove the exposure device.
- Step 4 Remove the exposure device or source changer from the overpack, if applicable, then measure and record radiation intensity on the package section of the transport document.
- Step 5 At this time the exposure device or source changer may either be placed in storage at the temporary job site or utilized to perform radiographic operations.

IF PROCEEDING DIRECTLY TO RADIOGRAPHIC OPERATIONS

If the exposure device or source changer is to be utilized immediately for radiographic Operations at the temporary job site, the receiving Qualified Person shall:

- Record Finish mR and Total mR in the **Receiving Personnel & Dosimeter Data** section of the Radiation Survey/Shipping Record
- Retain a copy of all transport paperwork and source receipt surveys and forward to the appropriate Division RSO
- Refer to Section B(7) for procedures to follow for radiographic operations

IF STORING EXPOSURE DEVICE AT TEMPORARY JOB SITE

If the exposure device is to be stored at the temporary job site, Steps 6 through 13 shall be followed

- Step 6 Perform a **Lock-Out** Survey of the exposure device at the surface and at 1 Meter from the surface before placing in storage

NOTE: The Qualified Person shall immediately notify the Facility and Corporate RSO if the survey reveals radiation levels exceeding 200 mR/hr (2.0 msv/hr) at the surface of source changers or 10 mR/hr (.1 msv/hr) at 1 meter, and 200 mR/hr (2.0 msv/hr) at the surface of exposure devices or 2 mR/hr (.02 msv/hr) at 1 meter.

- Step 7 Record highest radiation intensities noted on the Radiation Survey/Shipping Record
- Step 8 Secure the exposure device in the storage facility. Ensure the storage facility is locked and secured from unauthorized removal of the exposure device.
- Step 9 Conspicuously post the storage facility with a sign or signs bearing the radiation symbol and words "Caution" or "Danger", "Radioactive Material".
- Step 10 Perform a **Storage Facility Return Survey** on all exterior surfaces of the storage facility after placing the exposure device or source changer in storage.
- NOTE: The dose rate at any exterior surface of the storage facility shall not exceed 2 mR/hr. Additional shielding shall be added as necessary to keep radiation levels below this limit.
- Step 11 Record the highest radiation intensities noted on the Utilization Log
- Step 12 Record Finish mR and Total mR in the **Receiving Personnel & Dosimeter Data** section of the Radiation Survey/Shipping Record.
- Step 13 Generate a Utilization Log to document utilization of source of radiation while at the temporary job site
- NOTE: Utilization Logs shall be forwarded to the appropriate Facility RSO at the conclusion of the job, or upon transfer of the source of radiation.
- Step 14 Retain a copy of all transport paperwork and source receipt surveys and forward to the appropriate Facility RSO

(7) RADIOGRAPHIC OPERATIONS AT TEMPORARY JOB SITES

These procedures shall be followed when performing radiographic operations at temporary job sites.

- Step 1 If the source of radiation is stored at the temporary job site, remove the source of radiation from storage in accordance with Section B(1)
- Step 2 Document the following information on the Radiation Survey/Shipping Record:
- A) Record Radiographic Operations Personnel & Dosimeter Data for radiographic personnel
- Radiographer and Assistant(s)/Trainee name
 - LUXEL Badge number
 - Dosimeter number,/cal due date
 - Ratemeter Number and Function Test, and/cal due date
 - Dosimeter Start mR
- Step 3 Conspicuously post the calculated 2 mR/hr and 100 mR/hr perimeter before the initial exposure of the source.
- Step 4 After posting the perimeter and before exposure of the source, verify that the radiographic work area is clear of all unauthorized personnel
- Step 5 Inform appropriate Customer Representative that radiographic operations are about to begin and record name of informed person on Radiation Survey/Shipping Record.
- Step 6 After verifying that the radiographic work area is clear of all unauthorized personnel and permission to commence has been obtained, expose the source and monitor the restricted area boundary to confirm that Section A(18)(a)(1) requirements have been met. If necessary, adjust the perimeter or add additional shielding. Do not continue radiography until establishment of the restricted area.
- NOTE: No verification of High Radiation Area shall be made due to the safety hazards involved and in keeping with Schnabel Engineering Inc.'s ALARA Program.
- Step 7 Document the **Record of Restricted Area Perimeter** on the Radiation Survey/Shipping Record, including surveys above and below the radiographic work area, if applicable. Do not use symbols such as (>) greater than or (<) less than.

Steps 8 through 11 must be followed at the conclusion of each exposure of the source.

- Step 8 Retract the source to the shielded position. Listen for the "click" sound produced by the slide bar lock.
- Step 9 Approach the exposure device with the survey meter, observing the instrument readings to ensure the source has returned to the fully shielded position.
- Step 10 Verify the source has returned to the fully shielded position by performing an adequate survey of the exposure device, including the source guide tube, drive cable, crank assembly and collimator.
- Step 11 Ensure the exposure device is properly locked to prevent accidental exposure of the source.

Radiographic operations may continue until the exposure device is relocated and/or the exposed position of the sealed source is changed, in which case the restricted area boundary shall be re-verified.

If any unauthorized person attempts to enter the perimeter of the restricted area, radiographic operations shall be immediately terminated and the source retracted to the shielded and locked position. A written report shall be generated including the individual's name and employer, if available, and forwarded to the Facility and Corporate RSO.

- Step 12 Before moving the exposure device to another location, remove the crank-out assembly and source guide tube, insert the storage plug into the source exit orifice, ensure the plunger on the lock mechanism is depressed, and remove the lock key. Survey the entire circumference of the exposure device to verify the source is in the fully shielded position.
- Step 13 Remove all signs and barricade equipment from the work area. Do not leave any signs or barricades at the work site.
- Step 14 Record radiographic exposure time for the work period on the Radiation Survey/Shipping Record
- Step 15 Check off the barricade equipment utilized on the Radiation Survey/Shipping Record
- Step 16 Perform a **Lock-Out Survey** of the exposure device at the surface and at 1 meter from the surface prior to transportation or storage of the exposure device, and record the highest noted radiation intensities on the Radiation Survey/Shipping Record.

NOTE: If the survey reveals radiation levels exceeding 200 mR/hr at the surface or 2mR/hr at 1 meter, immediately notify the Facility and Corporate RSO

Step 17 Record Finish mR and Total mR for radiographer and applicable assistant(s)/trainee(s)

NOTE: Radiation Survey/Shipping Record(s) generated at the temporary job site shall be turned in to the appropriate Facility RSO weekly, or at the completion of the job, whichever is earliest.

IF STORING EXPOSURE DEVICE AT TEMPORARY JOB SITE

If the exposure device is to be stored at the temporary job site, refer to Section B(6) Steps 8 through 13

IF TRANSPORTING EXPOSURE DEVICE TO ANOTHER LOCATION

If the exposure device is to be transported to another worksite or storage location, generate a new Radiation Survey/Shipping Record and refer to the applicable transportation section:

Section B(2) TRANSPORTATION OF EXPOSURE DEVICES OR SOURCE CHANGERS CONTAINING A RADIOACTIVE SOURCE BY COMPANY VEHICLES, or

Section B(3) PREPARATION OF EXPOSURE DEVICES OR SOURCE CHANGERS CONTAINING A RADIOACTIVE SOURCE FOR TRANSPORTATION BY COMMON CARRIER VEHICLES

(8) RADIOGRAPHIC OPERATIONS AT PERMANENT RADIOGRAPHIC EXPOSURE CELLS

This procedure shall be followed when performing radiographic operations at permanent radiographic exposure cells.

NOTE: Permanent radiographic exposure cells must conform to the requirements of Section A(26). A minimum of one (1) Radiographer shall be present for all RT operations.

Step 1 Remove the source of radiation from storage in accordance with Section B(1).

Step 2 Document the following information on the Radiation Survey/Shipping Record:

A) Record Radiographic Operations Personnel & Dosimeter Data for radiographic personnel:

- Radiographer and Assistant(s)/Trainee name
- LUXEL Badge number
- Dosimeter number,/cal due date
- Ratemeter Number and Function Test, and /cal due date
- Dosimeter Start mR

Step 3 Perform an inspection of the exposure cell alarm system during the first exposure to verify conformance to the requirements of Section A(26), and initial the Utilization Log signifying that it is functioning properly.

NOTE: Radiographic operations can proceed if the exposure cell alarm system is inoperative. Direct surveillance must be accomplished while repairs are being made up to 7 days. In this case, two people are required to conduct RT operations, (1) Radiographer and Radiographer Assistant/Trainee.

Step 4 Inform appropriate Company representative that radiographic operations are about to begin and record name of informed person on Radiation Survey/Shipping Record.

Radiographic operations may commence. Steps 5 through 8 must be followed at the conclusion of each exposure of the source.

Step 5 Retract the source to the shielded position.

- Step 6 Approach the exposure device with the survey meter, observing the instrument reading to ensure the source has returned to the fully shielded position
- Step 7 Verify the source has returned to the fully shielded position by performing an adequate survey of the exposure device, including the source guide tube, drive cables, crank assembly and collimator.
- Step 8 Ensure the exposure device is properly locked to prevent accidental exposure of the source.
- Step 9 At the termination of radiographic activities, perform a **Lock-Out Survey** of the exposure device at the surface and at 1 meter from the surface prior to transportation or storage of the exposure device, and record the highest noted radiation intensities on the Radiation Survey/Shipping Record.
- NOTE: If the survey reveals radiation levels exceeding 200 mR/hr at the surface or 2 mR/hr at 1 meter, immediately notify the Corporate RSO.
- Step 10 Record radiographic exposure time for the work period on the Radiation Survey/Shipping Record
- Step 11 Check off the barricade equipment utilized on the Radiation Survey/Shipping Record
- Step 12 Record Finish mR and Total mR for radiographer and applicable assistant(s)

If source of radiation is to be returned to storage, refer to Section B(5) Steps 6 through 13

If the source of radiation is to be transported to another worksite or storage location, generate a new Radiation Survey/Shipping Record and refer to the applicable transportation section:

Section B(2) **TRANSPORTATION OF EXPOSURE DEVICES OR SOURCE CHANGERS CONTAINING A RADIOACTIVE SOURCE BY COMPANY VEHICLES, or**

Section B(3) **PREPARATION OF EXPOSURE DEVICES OR SOURCE CHANGERS CONTAINING A RADIOACTIVE SOURCE FOR TRANSPORTATION BY COMMON CARRIER VEHICLES**

(9) (A) PROCEDURE FOR ALARMING RATE METER

This procedure shall be followed in the event that an individual's rate meter alarms

during radiographic operations. (Observe for a steady alarm, not an intermittent chirp)

- Step 1 Halt all radiographic operations and exit the area
- Step 2 Check the pocket dosimeter reading
- Step 3 Check the operation of the survey meter
- Step 4 Check the dosimeters of other workers in the area
- Step 5 Check proper storage of the source
- Step 6 Notify your Facility RSO

(9) (B) **PROCEDURE FOR RESPONSE TO OFF-SCALE DOSIMETER**

This procedure shall be followed in the event that an individual's pocket dosimeter is found to be off-scale during radiographic operations.

- Step 1 Halt all radiographic operations and return the source to its shielded locked position. Survey the circumference of the exposure device, including the guide tube and collimator, to verify the source is in the shielded position and the survey meter is operable.
- Step 2 All radiographic personnel shall check and document their pocket dosimeter readings.
- Step 3 Compare the results of the survey of the exposure device at the surface with the previously documented survey at the surface performed when the device was initially removed from storage. This comparison will serve as confirmation of the survey meter's accuracy.
- Step 4 Immediately notify the Facility and Corporate RSO of the event. The RSO shall evaluate the situation and provide further instructions.
- Step 5 Evaluate and document the possible cause of the off-scale dosimeter(s) by retracing prior actions and making calculations to determine the highest possible exposure(s) which could have been received.
- Step 6 The Corporate/Facility RSO shall notify the dosimeter processor that LUXEL badge(s) are being sent in for rush processing, and instruct the processor to phone in the exposure results as soon as they are known.
- Step 7 The Corporate RSO shall document the event, including the results of the internal inspection, and maintain the documentation on file for inspection by regulatory agencies.

Step 8

If the event meets regulatory notification requirements, the Corporate RSO shall notify the appropriate regulatory authority

**RADIOGRAPHIC OPERATING AND
EMERGENCY PROCEDURES**

SECTION C:

EMERGENCY PROCEDURES

SOURCE RETRIEVAL GUIDELINES

Purpose: The following information provides guidelines for use in the retrieval of isotope radiography Sources involved in accidents

Scope:

- 1) The information contained in this document is intended to be used as an operational guide only. This is due to consideration that no two emergency retrievals are exactly the same and are rarely handled in the same fashion and must be handled on a case by case basis. Each emergency retrieval presents its own unique set of circumstances and must be handled accordingly.
- 2) The use of these operational guidelines is limited to the Radiation Safety Officer/Designee. An in-depth knowledge of the equipment, problem assessment/planning, survey techniques, shielding techniques, problem repair/remedy and dosimetry considerations is required beyond the information provided in the operational guidelines.
- 3) All other individuals providing assistance in operations covered in these operational guidelines shall be under the direct instruction/supervision of the CRSO or designee.
- 4) The use of sound radiation safety practices and common sense, in addition to properly assessing the emergency will be the first consideration to maintain exposure to radiation ALARA.
- 5) All personnel engaged in source retrieval operations must wear appropriate dosimetry to monitor whole body and extremity exposure as applicable.
- 6) Unshielded radiation shall only be moved or manipulated by the use of remote handling tongs or tools in lengths sufficient to provide the operator protection.
- 7) Radiography personnel suspected of possible exposure during discovery of the emergency shall be excluded from the participation in the retrieval operations.
- 8) If required, additional information, assistance or a second opinion can be obtained from the manufacturer by calling the 24 hour response telephone number: SENTINEL/AEA Technology @ 800-815-1383. Inform the operator that you have a "Radiological Emergency."

PROBLEM TYPE: SOURCE HANG-UP

- 1) Upon notification, the RSO/Designee must ensure the "Restricted Area" is secured at the site. The RSO/Designee should gather sufficient information to ensure appropriate equipment and response personnel are available for the emergency. Start a "chain of events" log to record all details of the response upon notification.
- 2) At the site, interview the radiography personnel. Limit access to the "Restricted Area" to response personnel only.
- 3) Determine the exposure expected to result from the assessment.
- 4) Perform the assessment to verify the type of problem. If movement of the source is possible, attempt to crank the source into the collimator or to a greater distance away from the site of damage if possible. Read dosimeter and record.
- 5) Verify the location of the source by survey technique. Read dosimeter and record.

Corporate Office, Glen Allen, VA
Richmond Office, Richmond, VA

8042643222
8046497035

AEA Technologies, Burlington, MA
USNRC Region I, Daily
ing of Prussia, PA 24hrs.
USNRC Region II, Daily
Atlanta, GA 24hrs
USNRC Region III Daily
isle, IL 24hrs
Oregon Daily
24hrs
DOT Notification
Alabama Daily
24hrs
Florida Daily
24hrs
Georgia Daily
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Kentucky Daily
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Louisiana 24hrs
Mississippi Daily
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Carolina Daily
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Tennessee Daily
Maryland Daily
California Daily

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3342887207
8504872437
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5025643700
5025647815
5047650160
6019876893
6013529100
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4106313302
9163235027

SOURCE RETRIEVAL GUIDELINES

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- 2) The use of these operational guidelines is limited to the Radiation Safety Officer/Designee. An in-depth knowledge of the equipment, problem assessment/planning, survey techniques, shielding techniques, problem repair/remedy and dosimetry considerations is required beyond the information provided in the operational guidelines.
- 3) All other individuals providing assistance in operations covered in these operational guidelines shall be under the direct instruction/supervision of the CRSO or designee.
- 4) The use of sound radiation safety practices and common sense, in addition to properly assessing the emergency will be the first consideration to maintain exposure to radiation ALARA.
- 5) All personnel engaged in source retrieval operations must wear appropriate dosimetry to monitor whole body and extremity exposure as applicable.
- 6) Unshielded radiation shall only be moved or manipulated by the use of remote handling tongs or tools in lengths sufficient to provide the operator protection.
- 7) Radiography personnel suspected of possible exposure during discovery of the emergency shall be excluded from the participation in the retrieval operations.
- 8) If required, additional information, assistance or a second opinion can be obtained from the manufacturer by calling the 24 hour response telephone number: SENTINEL/AEA Technology @ 800-815-1383. Inform the operator that you have a "Radiological Emergency."

PROBLEM TYPE: SOURCE HANG-UP

- 1) Upon notification, the RSO/Designee must ensure the "Restricted Area" is secured at the site. The RSO/Designee should gather sufficient information to ensure appropriate equipment and response personnel are available for the emergency. Start a "chain of events" log to record all details of the response upon notification.
- 2) At the site, interview the radiography personnel. Limit access to the "Restricted Area" to response personnel only.
- 3) Determine the exposure expected to result from the assessment.
- 4) Perform the assessment to verify the type of problem. If movement of the source is possible, attempt to crank the source into the collimator or to a greater distance away from the site of damage if possible. Read dosimeter and record.
- 5) Verify the location of the source by survey technique. Read dosimeter and record.

- 6) Develop a plan for retrieval based on the conditions. Ensure enough personnel and handling tools are present. Sketches, Polaroids and diagrams are helpful in the planning phase. Determine the exposure for each individual for each task to be performed. Review the plan for ALARA and revise any portion as needed.
- 7) Straighten and position the source guide tube on the ground using remote handling tools. Shield the source using a remote technique to allow repair. Add sufficient shielding to reduce personnel exposure. Survey the area that the personnel will occupy during repair/remedy. Read dosimeter and record.
- 8) Examples of corrective repairs/remedies:
 - a. For small dent repair, gently hammer dented area of guide tube until round
 - b. For more severe damage such as a flattened section, cut and remove the polyvinyl wrap from the damaged area to expose the metal conduit. Using caution, cut partially through the metal conduit. An impression of the drive cable may be seen through the conduit, be extremely careful to avoid cutting the drive cable. Insert a screwdriver into the cut to open up the flattened area and repeat until damaged section is completely opened up.

NOTE: Right angle tools may be needed for this operation if the damage site is in close proximity to the shielded source.

In both examples, keep extremities out of the primary beam emanating from the shielded materials. Use tools long enough to keep extremities outside of the beam. Wear TLDs or dosimeter on wrist. Read dosimeter and record.

- 9) Ensure all personnel are out of the "Restricted Area". Crank the source into the device using remote controls.
- 10) Perform surveys of the device, guide tube, lead shielding and collimator. Secure the source in the device by locking. Record the device survey results. Read dosimeter and record.
- 11) Remove the equipment from service for evaluation. Send the equipment to the manufacturer for detailed evaluations. Save returned equipment for use in training sessions.
- 12) Reference "Retrieval Sequence" flow chart for sequential steps.

PROBLEM TYPE: SOURCE DISCONNECT

- 1) Upon notification, the RSO/Designee must ensure the "Restricted Area" is secured at the site. The RSO/Designee should gather sufficient information to ensure appropriate equipment and response personnel are available for the emergency. Start a "chain of events" log to record all details of the response upon notification.
- 2) At the site, interview the radiography personnel. Limit access to the "Restricted Area" to response personnel only.
- 3) Determine the exposure to result from the assessment.
- 4) Perform the assessment to verify the type of problem. Crank the controls to project source into the collimator or farthest distance possible. Confirm disconnect using survey technique while retracting crank. Read dosimeter and record.

- 5) Develop plan of retrieval based on the conditions. Ensure enough personnel and handling tools are present. Sketches, Polaroids and diagrams are helpful in the planning phase. Ensure each member of the team understands their assigned tasks and the entire plan. Determine the exposure for each individual for each task to be performed. Review plan for ALARA and revise any portion as needed.
- 6) The equipment and source involved in disconnect/misconnect retrievals must be removed from service for repair and evaluation. Equipment and sources should be sent to the applicable manufacturer for a comprehensive evaluation.
- 7) Examples of corrective repair/remedies:
 - a. **Shield/Cut/Push Method:** Straighten and position guide tube on ground. Retract drive cable halfway into guide tube. Raise end of guide tube and shake to move source to end of drive cable. Shield source.
 - b. Check dosimeter and record.
 - c. Position guide tube into U shape near side of shield.
 - d. Remove controls from device, set lock mechanism on "operate". Leave guide tube attached to the device.
 - e. Cut off the source stop. Duct tape controls onto cut end.
 - f. Ensure all personnel are out of the "Restricted Area". Crank controls to PUSH the source assembly into the device.
 - g. Survey the device, guide tubes and shielding materials. Secure the source in the device.
 - h. **Direct Hot Stick Into Device-Outlet Port:** This technique requires practice prior to the actual operation. Time of "Open Air" handling is critical to control radiation exposure.
 - i. Locate source using survey technique and shield source.
 - j. Detach source guide tube from device.
 - k. Remove controls and set lock mechanism to "Operate". Position device near shields containing source with plug.
 - l. Shake until source drops out of guide tube. Have a second person time this action. If unable to perform this operation during the allocated time, you must stop and retreat. Repeat this process using a second response person.
 - m. After source drops to ground, remotely pick the source up and introduce CONNECTOR FIRST into the device outlet port. Using the remote tongs pick up the shipping plug and insert into the outlet port. Push the source into the fully shielded position. Survey the device, guide tube and shielding materials. Secure the source. Read dosimeter and record.
 - n. **Hot Stick/Source Transfer Method:** This method requires the use of a second device containing a source assembly or dummy source assembly. If a source changer is available, use the source changer.
 - o. Locate the source with the survey technique and shield the source.
 - p. Retract drive cable carefully and detach guide tube from the device. The source is contained in the shielded guide tube. Check drive cable connector for damage. Replace controls or drive cable if the connector or controls are worn or damaged. Attach a source guide tube extension in preparation for a source exchange.

- q. Position the second device between the shielded source and the device prepared for the source exchange. Remove the shipping plug from the device and ensure the out let port is facing towards the person who will perform the HOT STICK work.
- r. Ensure all personnel are out of the "Restricted Area".
- s. Remove shielding materials from the source using remote handling tongs. Elevate guide tube by the source stop to spill the source out onto the ground. Remotely pick up the source assembly and introduce it 'CAPSULE FIRST' into the device containing the source.
- t. Survey the two devices, and then secure them both. Read dosimeter and record.
- u. **Direct Hot Stick Into Device:** Locate the source using survey technique and shield the source.
- v. Carefully retract the drive cable. Disconnect the source guide from the device and remove the controls from the device.
- w. Remove back plate and locking mechanism assembly from the device. Install shipping plug into the device. Attach funnel to exposed "S" tube where the back plate was removed.
- x. Position the device funnel up, on two blocks of wood, next to the shielded source. Ensure all personnel are out of the "Restricted Area".
- y. Using remote handling tongs, remove the shield. Remotely pick up the guide tube by the source stop and rise into a vertical position to spill the source onto the ground. Remotely pick up the source assembly and introduce it CAPSULE FIRST into the funnel. Tap the source assembly remotely to fully push it home.
- z. Survey the device and secure the source by placing the back plate onto the device and securing it with the fasteners. The source is secured after the back plate is fastened to the device. Read dosimetry and record.
- aa. **Drive Cable/Modified Connector "Fishing" Method:** From controls, push the disconnected source into the collimator distal position within guide tube. Verify the disconnect problem by survey measurement. Retract drive cable as far as possible.
- bb. Verify source location using survey technique. Shield source using remote method. Position guide tube in straight line on ground. Disconnect guide tube from the device.
- cc. Remove entire drive cable from device controls. Install modified connector drive cable into the device and through the control housing (drive side only, crank removed). Reattach source guide tube to device.
- dd. Push drive cable into guide tube by hand until it stops against source assembly connector. Push and rotate simultaneously to attempt a remote connection. Withdraw cable and observe the survey instrument for an increase of radiation intensity. Repeat "fishing" technique until an increase is observed. Do not fully withdraw the source from the shielding at this point.
- ee. Ensure all personnel are out of the "Restricted Area".
- ff. Grasp drive cable and walk quickly in a direction away from the device and source in the guide tube. Monitor movement of the source using a survey instrument.
- gg. Once source has been manipulated back into the device, survey the source device and set lock mechanism to the "lock" position. Source is secure. Read dosimeter and record.

RADIOGRAPHIC OPERATING AND EMERGENCY PROCEDURES

Intensity and Dose Calculations

1. Inverse Square Law

$$\frac{I_1}{I_2} = \frac{D_2^2}{D_1^2}$$

Where: I_1 = Initial Radiation Intensity at d_1
 I_2 = Radiation intensity at d_2
 D_1 = Initial Distance from Source
 D_2 = Distance at which intensity is I_2

Dose Rate Formula

D = Dose Rate (multiplied by) Time

Where D = radiation dose in units of mR or R
 DR = radiation dose per unit of time (unit of mR/hr or R/hr)
 T = time

Radiation Intensity/Half-Life Table

<u>Radioactive Material</u>	<u>Dose Rate at 1 foot</u>	<u>Half-Life</u>	<u>Energy of Gamma Rays (Mev)</u>
Iridium 192	5.2 R/hr	75 days	.137 to .65
Cobalt 60	14.0 R/hr	5 years	1.17 and 1.33

RADIOGRAPHIC OPERATING AND EMERGENCY PROCEDURES

Shielding Table

Radioactive Material	Half-Value Layer Thickness in Inches		
	Lead	Steel	Concrete
Iridium 192	.19	.61	1.9
Cobalt 60	.49	.87	2.7

**RADIOGRAPHIC OPERATING AND
EMERGENCY PROCEDURES**

SECTION D: EQUIPMENT OPERATION

(1) OPERATION OF THE AMERSHAM (AEA) MODEL 660, 680 AND 880 EXPOSURE DEVICES

This procedure shall be followed when operating the Amersham (AEA) 660, 680 and/or 880 exposure devices.

Personnel shall wear all required personnel monitoring devices when operating the Amersham (AEA) model 660, 680 and/or 880 exposure devices.

All requirements of SEI QCP 203, Sections A and B shall be strictly adhered to when operating the Amersham (AEA) model 660, 680 and/or 880 exposure devices.

Assembly

Step 1: Position and secure the source stop of the terminating source guide tube at the radiographic focal point with no bend radius less than twenty inches. Ensure that the source end stop is in place on the terminating guide tube. Use a collimator to limit the radiation beam in unwanted directions.

WARNING: ENSURE THAT THE AVAILABLE LENGTH OF DRIVE CABLE IS GREATER THAN THE TOTAL LENGTH OF SOURCE GUIDE TUBES

Step 2: Locate the control unit at the maximum distance from the source with the control cable lay out as straight as possible to avoid any bends or sharp radii. Position the control unit behind a protective shield whenever practical.

WARNING: NEVER OPERATE THE SYSTEM WITH MORE THAN THREE SOURCE GUIDE TUBE SECTIONS, INCLUDING THE MASTER

Step 3: Unlock the exposure device and turn the selector ring from "LOCK" to "CONNECT". The storage cover will disengage, exposing the female connector on the source assembly.

Step 4: Slide the control cable collar back and open the jaws to expose the male portion of the swivel type coupling (i.e., the ball end on the drive cable).

Step 5: Press back the spring loaded locking pin and engage the male and female portions of the swivel connector.

Step 6: Release the locking pin and check that the connection is secure. Close the jaws of the control cable connector over the swivel type connector.

Step 7: Slide the control collar over the connector jaws.

Step 8: Push and hold the collar flush against the control unit connector and rotate the selector ring from "CONNECT" to "LOCK". Keep the exposure device locked until operation is ready to start.

Operation

Step 1: Remove the storage plug from the exposure device and connect the source guide tube to the exposure device.

NOTE: THE 880 DEVICE HAS A SHUTTER MECHANISM THAT SLIGHTLY PULLS OUT AND ROTATES CLOCKWISE AND A SOURCE GUIDE TUBE CONNECTOR ATTACHED TO THE END OF THE SOURCE GUIDE TUBE IN ORDER TO CONNECT THE EXPOSURE DEVICE WITH THE SOURCE GUIDE TUBES.

Step 2: Unlock the exposure device lock and rotate the selector ring to the "OPERATE" position.

Step 3: Push the slide bar (green marking) laterally from left to right (as seen from behind the exposure device) until the slide bar (red marking) fully appears on the right side of the selector ring.

NOTE 1: WHEN THE GREEN MARKING IS VISIBLE, THE SOURCE ASSEMBLY IS LOCKED INTO THE SAFE STORED POSITION. WHEN THE RED MARKING IS VISIBLE, THE SOURCE ASSEMBLY IS FREE TO BE MOVED OUT OF THE EXPOSURE DEVICE INTO THE EXPOSED POSITION.

NOTE 2: THE SHUTTER MECHANISM ON THE 880 DEVICE WILL REQUIRE A SECOND SLIGHT TURN CLOCKWISE TO OPEN THE SHUTTER WINDOW PRIOR TO PUSHING THE SLIDE BAR.

Step 4: Rapidly rotate the crank in the exposed direction (counter-clockwise) to move the source out of the exposure device until the source reaches the end stop of the guide tube. Set the brake to "ON" to prevent movement of the source during the exposure.

Step 5: To return the source to the exposure device after the desired exposure time has elapsed, set the brake to "OFF" and rapidly rotate the crank in the retract direction (clockwise) until the crank no longer moves. You should hear the slide bar "click" back into its original position. Ensure the exposure device has locked by verifying the green marking is visible on the slide bar.

Step 6: Apply a slight amount of forward pressure on the crank handle to ensure that the positive locking mechanism has actuated. Allow the crank handle to return to a neutral position, thereby relieving any tension on the drive cable.

Step 7: At the termination of radiographic activities, rotate the selector ring from "OPERATE" to "LOCK", secure with the exposure device lock, and remove the lock key.

Disassembly

Step 1: Unscrew the source guide tube sections. Place the plastic caps on the tubes to exclude dirt. Screw the shipping plug into the exposure device guide tube connector.

Step 2: Unlock the exposure device and then rotate the selector ring from "LOCK" to "CONNECT". The safety control connector will partially disengage.

Step 3: Slide the control cable collar back and open the jaws to expose the swivel type drive cable connector.

Step 4: Press back the spring loaded locking pin and disengage the male and female portions of the swivel connector.

Step 5: Replace and hold the storage cover on the exposure device connector and rotate the selector ring to the "LOCK" position.

Step 6: Remove the key and push in the lock to secure the exposure device.

Step 7: Survey the entire circumference of the exposure device to ensure the source is properly secured.

(2) OPERATION OF X-RADIATION PRODUCING MACHINES

This procedure shall be followed when operating x-radiation producing machines.

Personnel shall wear all required personnel monitoring devices when operating x-radiation producing machines.

When exposures are made outside of an approved x-ray cabinet, two radiographic personnel shall be present for all operations.

All requirements of SEI NDE-RS-01, Sections A and B shall be strictly adhered to when operating x-radiation producing machines.

Assembly

- Step 1 Place the tube head in position to expose the test object
- Step 2 Using the appropriate power cables, connect the control unit to the tube head. Place the control unit as far away as possible from the tube head (opposed to the beam direction).
- Step 3 Verify the control unit is in the off and locked position, connect the power cable to the unit and to the power supply (line voltage). Make sure the unit is grounded.

Warm Up

Following proper warm-up procedures can extend the lifetime of X-Ray tubes
Prior to operation

Length of Operational Break	Voltage Increase by 10 kv After Warm-up Time
1 – 2 hours	3 seconds
2 – 8 hours	10 seconds
1 – 2 days	30 seconds
2 days – 2 weeks	2 minutes
More than 2 weeks	5 minutes

The warm-up shall be performed in the following manner:

- Step 1 The equipment shall be started only at 30% of its maximum voltage, or according to the manufacturer's warm-up recommendations.
- Step 2 Increase the voltage to the maximum tube voltage in 10 kv increments after each 15 minutes of operation.
- NOTE: During warm-up procedures, the operator shall observe the control unit's meters. If wide fluctuations are noted, reduce the KVP and MA, and continue with a slower warm-up
- Step 3 If the unit switches off during this warm-up cycle, reduce the tube voltage by at least 20 kv. Provided no further breaks occur, the running-up period can be continued as described.

Operation

- Step 1 Connect the line voltage cable to a grounded electrical outlet. If uncertain whether the outlet is grounded, the tube head and the control unit are to be grounded. This can be accomplished by connecting a wire to the grounding screws at the connection panel of the tube head and at the back of the control unit. The green pilot lamp indicates the correct power supply.
- Step 2 Select the exposure time by setting the timer to the desired exposure time.
- Step 3 Select the voltage using the stopping switch. If a voltage is selected that exceeds the rating of the unit, the yellow pilot will light up, indicating that the high voltage is blocked.
- Step 4 Key Switch: Energize the unit by turning the key to the right (clockwise). The unit is deactivated by turning the key to the left (counter-clockwise), this immediately cuts off the high voltage. When the unit is not in service, the key shall be removed from the key switch.
- Step 5 After the key switch has been switched on; depress the "start" button for a short period. This will activate an acoustic alarm signal for 5 seconds, and then the unit will automatically switch on the high voltage. The warning pilot lamp located at the radiating unit flashes during the exposure, and the acoustic alarm continues until the pre-selected tube voltage and tube current have been set by the automatic system of the control.

Step 6 Observe the current indicator to assure that it illuminates and the acoustic current of the X-Ray tube is correct, otherwise a defect has occurred and no radiation is being generated.

Step 7 After termination of the exposure time, an acoustic signal is produced and the high voltage is controlled down to zero within 5 seconds (maximum). Then the high voltage will switch off and the signal will extinguish.

NOTE: If the yellow pilot lamp is illuminated, the following operational conditions may exist:

- a. KV pre-selection is not in accordance with the operation range of the connected radiating unit.
- b. The temperature of the radiating unit has reached the upper limit value. The high voltage switching is blocked until the switching threshold of the thermo-control in the radiating unit has gone down below the threshold. To avoid overheating of unit, a rule of thumb to follow for "Operation-break-through" relation for normal operating is: 5 minute exposure time = 5 minute break

NOTE: A separate cooling system (such as water) operated via the standard cooling coil of the equipment, can avoid such a condition to a large extent.

Completion of Radiographic Assignment

At the conclusion of the final exposure, the machine shall be locked and the key removed. The X-Ray unit shall then be disassembled and properly stored.

Emergency Procedures

In the event an emergency situation occurs with an x-radiation producing machine, the power supply to the unit shall be disconnected immediately.

(3) INSPECTION AND MAINTENANCE OF AMERSHAM (AEA) MODEL 660 AND 880 EXPOSURE DEVICE

This procedure shall be followed when performing inspection and maintenance of the Amersham (AEA) model 660 and 880 exposure device. All 660's and 880's shall be returned to (AEA) for complete maintenance every (2) years.

Personnel shall wear all required personnel monitoring devices when performing inspection and maintenance of exposure devices or source changers.

All requirements of SEI NDE-RS-01, Sections A and B shall be strictly adhered to when performing inspection and maintenance of exposure devices or source changers.

Periodic (Quarterly) Maintenance

Drive Cable Assembly (Check condition of unique serial number)

- | | |
|--------|---|
| Step 1 | Disconnect the drive control unit from the exposure device |
| Step 2 | Straighten out the drive control housings; pull out the drive cable (gloves are recommended for this operation) from the housing until it stops (there is a stop on the end of control cable). Do not use excessive force. The cable should be coiled in no less than 3" radius and secured. |
| Step 3 | Disconnect the cable housing from the retract side of the control, remove the stop spring from the cable and pass the cable through the crank. Pull the remaining drive cable out through the safety connector and secure. |
| Step 4 | Remove both housings from the safety connector and disconnect the other end of the housing from the crank. LABEL THE HOUSINGS FOR PROPER REASSEMBLY |
| Step 5 | Thoroughly clean and drive cable with a brush and 1:1:1 trichloroethane degreaser, or equivalent. |
| Step 6 | Flush the housings with trichloroethane degreaser, or equivalent. Blow them out thoroughly with compressed air, in a well ventilated area. |
| Step 7 | Wipe the cable housings with a degreaser soaked cloth and check for damage. <ul style="list-style-type: none">- Internal rust manifests itself as a crunching feeling when the housings are flexed- Rusting, dents or flattened portions mean that the housing must be replaced- Cuts in the outer casing should be repaired with vinyl tape to prevent ingress of dirt or moisture,- Check the housing for damage where it joins the housing connectors,- Replace any cable ties as necessary |
| Step 8 | Clean the male connector of the drive cable with degreaser. Check for wear with the NO-GO gauge. If the ball of the connector goes through the |

hole or if the ball shank fits into the smaller slot in the gauge, the connector **must** be replaced. Refer to Section D(10) for proper use of the NO-GO gauge.

- Step 9 Check the joint of the cable and the male connector for damage. Check the cable for rust, kinks, or unusual stiffness. Light rust may be removed with a hand held wire brush. Lightly grease the drive cable using a type MIL-G-23827 B grease, or equivalent.

Source Guide Tubes (Check condition of unique serial number)

- Step 1 Check the threads on all couplings, lubricate with the light lubricating oil if required.
- Step 2 Check the tubes for dents or crushing
- Step 3 The tubes may be cleaned by running a degreaser-soaked swab, attached to the end of a drive cable, through them. Repeat until the swab emerges clean. Make sure that no bits of swab are left inside the terminal tube.
- Step 4 Check for binding by holding the tube vertical and dropping a dummy source through

Exposure Date

- Step 1 Clean and inspect the exposure device for wear or obvious damage. Report any defect which might affect safe operation and **withdraw it from service** until repairs can be effected.
- Step 2 Verify that "DANGER" or "CAUTION", "RADIOACTIVE MATERIAL, SPECIAL FORM, N.O.S." labels are secure, legible and un-obscured by other labels. Replace any defaced or illegible labels.
- Step 3 Check that the source outlet/shipping plug is in place and that the screw and nut turn freely, but are not loose, lubricate with a light lubricating oil, if required.
- Step 4 Check for wear in the cable connector using the NO-GO gauge. There are four NO-GO tests – ball diameter; ball shank; slot width; and connector gap width. Refer to Section D(10) for proper use of the NO-Go gauge.
- Step 5 Check that the selector ring and lock mechanism operates freely. If operation is faulty, the exposure device shall be removed from service until a complete servicing can be performed.

Final Step: Run through the normal operating sequence of the device several times to ensure smooth operation of all components. If the exposure device does not contain a source, a dummy source shall be utilized for the operational test of the equipment.

Document results of the inspection and maintenance on the Periodic Inspection and Maintenance Report. If all components are found to be functioning properly, a PM Sticker shall be completed and attached to the device.

Complete Service Inspection and Maintenance

Complete service maintenance should be performed on radiographic equipment that has been subjected to severe conditions (i.e., immersed in water or mud, dropped, in a sandstorm, etc.) Complete service maintenance includes those items outlined for Periodic (Quarterly) Inspection and Maintenance, and in addition, the connector, the lock mechanism, and crank mechanism assembly must be stripped for maintenance. Properly trained Radiographers or Qualified Persons shall perform this maintenance

Complete Service Inspection and Maintenance requires removal of the source prior to beginning the complete maintenance. Refer to Section D (8) through (10) for instructions on transferring the source to a source changer, prior to commencing this maintenance.

- | | |
|--------|--|
| Step 1 | After source is verified to be secured in the changer, and the exposure device is verified to be empty, the source must be replaced by a test connector (jumper) (found inside the cover) so that when the drive cable is returned to the exposure device storage position, the drive cable can be removed from the exposure device. |
| Step 2 | After removal of the source assembly, carry out a wipe test on the inside of the "S" tube to check for uranium contamination. Send the wipe test to the appropriate laboratory for processing. If the wipe test results demonstrate the presence of uranium contamination, it would indicate wear through of the "S" tube, and require removal of the exposure device from service until repair could be effected. |
| Step 3 | Clean the "S" tube with a swab soaked in 1:1:1 trichloroethane solvent, or equivalent |
| Step 4 | Cover plate removal – remove the Danger Tag (secured with rivets) from the bottom of the rear plate. Remove the rear plate by unscrewing the six Phillips head screws securing it to the exposure device body. |
| Step 5 | Refer to figure 5.1 and dismantle the selector assembly, taking care not to lose the spring loaded parts. |

Remove the lock (2) from the lock retainer (3) by undoing screw (4) and turning the key through 90 degrees.

Step 6 Remove the four screws securing the front end plate. Remove the guide tube connector nut (17) and retaining ring (18)

Step 7 clean all parts with trichloroethane, or equivalent, and inspect for wear. Replace as necessary. When ordering parts from the manufacturer, it is necessary to provide the exposure device serial number as well as the component number to ensure correct replacement.

Step 8 Lightly grease the inside surfaces of the selector ring (10) and the lock retainer (3) using type MIL-G-23827 B grease, or equivalent.

NOTE: Other types of grease may form tars when exposed to radiation

Step 9 Lubricate the lock barrel (2) with 2 drops of light lubricating oil

Step 10 Attach the lock assembly to the mounting plate with two socket screws (1). All screws should be treated with vibratite.

NOTE: All screws were treated with "vibratite" coating when assembled new. If screw and coating are in good condition they can be reused. If new screws are used, they must be treated with vibratite.

Step 11 Begin reassembly of the selector assembly by lightly coating the components with type MIL-G-23827 B grease, or equivalent. See figure 5.1.

Step 12 Hold the rear end plate horizontally, face up and the lock in the 12 o'clock position.

NOTE: The face plate may be held carefully in a vise or other fixture to free both hands for this assembly procedure

Step 13 Insert the 5/8" diameter of the selector body (6) into the mating hole in the center of the rear plate. The narrow end of the slot opening is to be at the 3 o'clock position.

Step 14 Locate the locking slide (7) and return the spring (8) into the mating slot of the selector body.

- Step 15 Place the selector ring (10), with the word "CONNECT" at the 12 o'clock position, over the selector body. Push the locking slide so the selector ring will clear and rest the selector ring on the top surface of the selector body.
- Step 16 Insert springs (14) into holes at the top and bottom of the selector body. Place the anti-rotation lugs (13) over the springs.
- Step 17 Place the sleeve (12), with the large diameter facing down, on the center of the locking slide. Place the spring (11) over this sleeve.
- Step 18 Install the selector ring retainer (9) into the selector ring. Ensure that the three non-threaded holes line up under the word "CONNECT". See figure 5.1. Depress the selector ring retainer into the selector ring until its top is flush with the top of the selector ring.
- Step 19 While holding the assembly firmly against the end plates, turn it over to expose the back side. Install the four socket head screws (15) and the lock washers (16) to secure the connector assembly to the rear plate.
- Step 20 Insert the "U-tool" into the top and bottom holes of the selector assembly. Rotate the selector ring toward the "OPERATE" position. Push the locking slide until the sleeve snaps into place.
- Step 21 While still in the "OPERATE" position, wind out a short length of the drive cable and pass it through the front of the selector assembly. Couple the cable to the test jumper connector and withdraw it into the selector assembly.
- Step 22 Pull on the cable and confirm that the locking slide snaps shut to lock the connector in the safe position. Push in the locking slide and repeat to assure smooth operation. If smooth operation is not attained, disassemble and selector assembly and thoroughly inspect components for rough edges, burrs, etc., which could cause jamming or irregular selector assembly action.
- Step 23 Use the following misconnect test to check simultaneously all the operating tolerances of the exposure device and of the cable drive unit normally used with it:
- Turn the selector ring to CONNECT, then uncouple the cable and attempt to recouple the connector without engaging the male-female connection, but simply touching them together in line. A gap of at least 0.021" should be visible between the drive cable collar and the selector ring and it should be impossible to rotate the ring. Do not use excessive force. See figure 5.1.

NOTE: If the selector ring can be rotated, this indicates unacceptable wear, distortion, or damage in the connector, lock mechanism or drive cable connector which must be corrected before using the equipment again.

- Step 24 Secure the rear end plate to the exposure device and handle using the six attaching Phillips head screws and replace the protective plate over the bottom two rear plate screws using pop rivets (.125" diameter x .294" long).
- Step 25 Lightly grease the guide tube connector nut hub with type MIL-G-23827 B grease, or equivalent. Reassemble to the front mounting plate. Ensuring that the retaining ring is seated in the inner slot.
- Step 26 Secure the mounting plate to the exposure device
- Step 27 Inspect the shipping plug, making sure that the lead insert is present
- Step 28 Run through the normal operating sequence several times, using the test connector or a dummy source assembly (non-radioactive), to ensure smooth operation.

The exposure device is now ready for reinstallation of the source as described in Section D(11).

Crank Mechanism Maintenance

- Step 1 Refer to the appropriate figure (5.3) for the crank mechanism model you are servicing. Remove the crank arm from the control box by removing the 5/16" hex bolt and 5/16" washer.
- Step 2 While wearing safety glasses, carefully remove the control box from the frame by unscrewing the four binder head screws from the elastic stop nuts.
- Step 3 Separate the two halves of the control box housing.

CAUTION

Make sure that the cable adapters stay in the lower control box housing during separation. Care should be taken to avoid possible injury by losing control of the tensioned wear strip – *which may fly out!* Wear safety glasses!

- Step 4 Disassemble and degrease the drive wheel, wear strip, two cable adapters, two brake jaws, brake arm and brake bearing.

Step 5 The drive wheel bearings may be left in place but care should be taken not to lose the spacer rings (if used) that fit between them and the drive wheel. Inspect all parts for damage or wear and replace as necessary.

Step 6 Grease the sides of the drive wheel. Light rust may be removed from the wear strip with fine sand paper and machine oil.

Step 7 Place one of the cable adapters in the lower control box housing. Place one end of the wear strip against the cable adapter then fit the rest in the track of the housing. Fit the other cable adapter in place.

CAUTION

Insert the wear strip with care. It will be under tension and *could suddenly fly out*

Step 8 Place the drive wheel in the lower control box housing, making sure that the spacer rings are between it and the drive wheel bearings if used.

Step 9 Assemble the two brake jaws, brake bearing and brake arm. The angled sides of the brake jaws should be toward the retract side.

Step 10 Place the upper control box housing over the assembly while keeping them level, and press them together.

Step 11 Check the control box for proper reassembly by turning the shaft, it should spin freely. Check the operation of the friction brake while holding the control box housings together. If it does not function correctly, check for faulty assembly or damaged parts.

Step 12 After reassembly, check that the crank will turn freely. Run the drive cable through the control box and see that the crank turns easily with no snags.

Step 13 Set the brake to "ON" and attempt to turn the crank. It should not turn with moderate pressure. Do not apply excessive force. If the unit does not function correctly, check for improper assembly or damaged parts.

Drive Cable Reassembly

Step 1 Lay the housings out straight or in a wide loop. Feed the drive cable into the housing as far as it will go. As the cable is being fed in, feel the resistance to the cable to detect any binding which might indicate damage.

- Step 2 Turn the hand crank in the retract direction until the drive cable is protruding.
- Step 3 Retract the drive cable fully, watching for any binding that may indicate damage to the housing.
- Step 4 Replace the rubber storage cover on the end of the cable connector.

(4) PERIODIC INSPECTION AND MAINTENANCE OF AMERSHAM (AEA) MODEL 773 INSTRUMENT CALIBRATOR

This procedure shall be followed when performing inspection and maintenance of the Amersham (AEA) model 773 instrument calibrator.

Personnel shall wear all required personnel monitoring devices when performing inspection and maintenance of exposure devices or source changers.

All requirements of SEI NDE-RS-01, Sections A and B shall be strictly adhered to when performing inspection and maintenance of exposure devices or source changers.

- Step 1 Inspect device for obvious physical damage
- Step 2 Inspect storage cover for damage and ease of movement
- Step 3 Inspect attenuators for damage and ease of movement
- Step 4 Verify the exposure rod moves freely
- Step 5 Verify that "DANGER, RADIOACTIVE MATERIAL, SPECIAL FORM, N.O.S." labels are secure, legible and unobscured by other labels. Replace any defaced or illegible labels.
- Final Step: Run through the normal operating sequence of the device several times to ensure smooth operation of all components.

Document results of the inspection and maintenance on the Periodic Inspection and Maintenance Report. If all components are found to be functioning properly, a PM Sticker shall be completed and attached to the device.

Company personnel may perform very limited maintenance. Usually all maintenance items required, due to malfunction, shall be performed by the manufacturer. Contact the Corporate Radiation Safety Officer prior to performing any maintenance.

(5) PROPER USE OF THE "NO-GO" GAUGE DURING INSPECTIONS OF AMERSHAM (AEA) MODEL 660 AND 680 RADIOGRAPHIC EXPOSURE DEVICES

This procedure shall be followed when utilizing the NO-GO gauge during inspection of drive cable connectors on Amersham (AEA) model 660 and 680 radiographic exposure devices.

Without using excessive force, check the following four positions (see Figure 10.1):

- (i) The ball connector on the end of the drive cable must **NOT GO** into the hole
- (ii) The ball connector shank must **NOT GO** into the smaller of the two notches in the gauge side
- (iii) The gauge must **NOT GO** into the female slot in the source connector

Assemble the male and female parts of the connector and check that the larger notch in the side of the gauge will **NOT GO** in the gap shown.

(6) **OPERATING INSTRUCTIONS FOR SOURCE EXCHANGE USING THE AMERSHAM (AEA) MODEL 650L AND 771 SOURCE CHANGERS**

This procedure shall be followed when performing source exchanges utilizing the Amersham (AEA) model 650L and 771 source changers. Source changer/exposure device combinations shall be in accordance with license conditions.

Personnel shall wear all required personnel monitoring devices when performing source exchanges.

All requirements of SEI NDE-RS-01, Section A and B shall be strictly adhered to when performing source exchanges.

Equipment Required:

- Source changer
- Exposure device
- Control cables
- Source guide tube
- Survey meter
- ½" and 3/8" wrench for 650L and 771 source changer

Transfer: Exposure Device to Changer

Step 1 Survey the exposure device and source changer to ensure the sources are in the proper shielded position. Check to ensure that there is no visible damage to the changer or exposure device.

Step 2 Position the changer and exposure device close together so that one section of source guide extension tube will connect them with no sharp bends. The bend radius of the guide tube should never be less than about 20 inches. Smaller bend radii can restrict movement in the guide tube.

WARNING

KEEP THE CHANGER UPRIGHT TO RETAIN THE SOURCE INSIDE THE SHIELD. DO NOT LAY THE SOURCE CHANGER ON ITS SIDE.

Step 3 Remove the cover from the source changer by unlocking the padlock and breaking the seal wire and removing the bolts.

Step 4 Remove the source hold down cap that covers the source by breaking the seal wire and unthreading

Step 5 Open the lock above the empty chamber of the source changer by inserting key, turn key clockwise until it releases, pull slide out. Connect one end of the guide tube extension to the exposure device and the other end to the outlet fitting above the empty chamber.

Step 6 Set the radiographic exposure device as for an exposure

Step 7 Assure no unauthorized personnel are in the restricted area and all access points are secured.

Step 8 Position survey meter close to the operation control point so as to continuously monitor dose rate to which operator is exposed.

Step 9 At the exposure device controls, crank the source rapidly from the exposure device to the source changer. The radiation intensity should greatly increase when the source is first exposed, decrease slightly as the source is being cranked out from the exposure device to the source changer and then drop to background when the source is in the source changer.

Step 10 Approach the exposure device with a survey meter; survey the exposure device on all sides, survey the guide tube and survey the source changer on all sides to assure the source has been properly transferred and stored. The maximum radiation level should be less than 200 mR/hr at the surface of the source changer and less than 10 mR/hr at the surface of the source changer on all sides to assure the source has been properly transferred and

stored. The maximum radiation level should be less than 200mR/hr at the surface of the source changer and less than 10 mR/hr at one meter from the surface of the source changer.

- Step 11 When you have assured the source is in the fully shielded position, lock the spent source in the source changer by push in the lock slide in, rotating the key counter clockwise and depressing the lock. Disconnect and pull back the guide tube to expose the source/drive cable connection. Disconnect the drive cable from the source assembly by moving the lock pin of the source connector down towards the source and slide the drive cable out through the keyway.
- Step 12 WITHOUT UNLOCKING THE SOURCE, couple the drive cable to the new source by depressing the lock pin, sliding the drive cable connector into the keyway and releasing the lock pin. Assure that the connection is secure before continuing.
- Step 13 Connect the guide tube to the outlet fitting of the lock. Unlock new source by inserting key, turn key clockwise until it releases, pull slide out. Assure that no unauthorized personnel are in the restricted area.
- Step 14 At the exposure device controls, crank the new source from the source changer to its storage position in the exposure device. Observe the survey meter operation. The radiation intensity should steadily increase as the source exits the source changer. The radiation intensity should steadily increase as the source travels to the exposure device and drop to background when the source is properly stored in the exposure device.
- Step 15 Approach the exposure device with the survey meter, survey the exposure device on all sides, survey the length of the guide tube, and survey the source changer on all sides to assure the source has been properly transferred to its storage position in the exposure device. Radiation levels should be less than 200 mR/hr at the surface and less than 10 mR/hr at one meter from the surface for storage container, and less than 200 mR/hr at the surface and less than 2 mR/hr at one meter from the surface of the exposure device.
- Step 16 When the source is determined to be properly stored, lock the exposure device and remove the guide tube and controls. Disconnect the guide tube from the source changer.
- Step 17 Attach a source hold down cap over the old spent source in the source changer. Attach the identification plate of the old source to the hold down cap. Attach a hold down cap to the empty chamber.

Step 18 Affix the identification plate of the new source to the exposure device.

Step 19 Bolt the source changer cover in place and seal wire

Step 20 Return source changer to Amersham in accordance with D.O.T. regulations.

(7) LEAK TEST SWAB PROCEDURE FOR EXPOSURE DEVICES AND SOURCE CHANGERS

This procedure shall be followed when performing leak test of sealed sources contained in exposure devices and source changers.

Personnel shall wear all required personnel monitoring devices when performing leak tests of exposure devices or source changers.

All requirements of NDE-RS-01, Sections A and B shall be strictly adhered to when performing leak tests of exposure devices or source changers.

Additional Safety Precautions

- wash hands after performing leak test
- do not smoke while performing leak test

Test Area

Exposure Devices – The storage plug shall be removed from the exposure device and the inner area of the outlet port shall be the swab test location.

Source Changers – The source hold down cover shall be removed and the inner area of the outlet port shall be the swab test location

Procedure

Step 1 Place a survey meter, set on its most sensitive range, in a low background area away from the source.

Step 2 Thoroughly dissolve the detergent provided in the leak test kit in a small amount of water.

Step 3 Remove the swab (A) from the plastic container and dip it into the detergent solution.

Step 4 Remove the storage plug from the exposure device or the hold down cover from the source changer. Swab the inner area of the device with swab (A) and replace swab (A) into the plastic container.

Step 5 Remove swab (B) from plastic container. Using dry swab, wipe the inner area of the device. Replace swab (B) into the plastic container.

Step 6 Replace the storage plug or hold down cover.

Step 7 Take the swabs, in their plastic containers, to the survey meter and note the readings when the container is in contact with the meter. If the radiation levels detected on the swabs are less than 2mR/hr above background, complete the leak test information on the leak test kit return envelope, place the swabs inside the mail to the leak test vendor.

NOTE: If the survey detects more than .2 mR/hr (above background) during the swab survey, DO NOT MAIL THE SWAB. Attach a completed Red Tag to the exposure device to source changer and return the exposure device or source changer to storage. Immediately notify the Division and Corporate RSO.

Step 8 this procedure shall be completed twice. One leak test kit will be labeled for the source leak test, and the other kit will be labeled for the exposure device, or changer to check for depleted uranium contamination.

Step 9 Source leak tests are required every six (6) months, and exposure device or changer leak tests are required annually.

(8) LEAK TEST SWAB PROCEDURE FOR AMERSHAM (AEA) MODEL 773 INSTRUMENT CALIBRATOR

This procedure shall be followed when performing required leak tests on the Amersham (AEA) model 773 Instrument Calibrator.

Personnel shall wear all required personnel monitoring devices when performing leak tests on the model 773 instrument calibrator.

All requirements of SEI NED-RS-01, Sections A and B shall be strictly adhered to when performing leak tests on the model 773 instrument calibrator.

Additional Safety Precautions

- wash hands after performing leak test, and
- do not smoke while performing leak test

Step 1 After posting the restricted area, unlock the calibrator and remove the shipping cover.

- Step 2 Place a survey meter, set on its most sensitive range, in a low background area away from the source
- Step 3 Thoroughly dissolve the detergent provided in the leak test kit in a small amount of water.
- Step 4 Remove the swab (A) from the plastic container and dip it into the detergent solution
- Step 5 Wipe around the knob of the source rod, and then place the swab (A) in its plastic container
- Step 6 Remove swab (B) from plastic container. Using dry swab, wipe knob of the source rod. Replace swab (B) into the plastic container.
- Step 7 Take the swabs, in their plastic containers, to the survey meter and note the reading when the container is in contact with the meter. If the radiation levels detected on the swabs are less than .2 mR/hr above background, proceed with the next step.
- NOTE: If the survey detects more than .2 mR/hr (above the background) during the swab survey, DO NOT CONTINUE. Return the calibrator to storage and immediately notify the Corporate RSO.
- Step 8 Standing away from the beam port, raise the source rod to the exposing position and wipe the exposed source rod with first the wet swab (A) then the dry swab (B). Replace the source rod. Return the swabs to their plastic containers.
- Step 9 Replace the shipping cover and lock the calibrator.
- Step 10 Take the swabs, in their plastic containers, to the survey meter and note the reading when the container is in contact with the meter. If the radiation levels detected on the swabs are less than .2 mR/hr above background, complete the leak test information on the leak test kit return envelope, place the swabs inside and mail to the leak test vendor.
- NOTE: If the survey detects more than .2 mR/hr (above background) during the swab survey, DO NOT MAIL THE SWAB. Attach a completed Red Tag to the calibrator and return the calibrator to storage. Immediately notify the Corporate RSO.

(9) OPERATING INSTRUCTIONS FOR USE OF OPL-660 WITH 660 EXPOSURE DEVICES

This procedure shall be followed when the use of the OPL-660 is required to transport

Amersham (AEA) exposure device 660 series.

This procedure is designed to supplement transport procedures, not supersede.

All requirements of SEI NDE-RS-01, Section A and B shall be strictly adhered to when transporting radioactive materials.

The OPL-660 is a new type B(U) container for transporting Amersham (AEA) 660 exposure devices. The OPL-660 (Black Metal Box) gives protection to the exposure device and provides sufficient shielding to allow DOT yellow II's labeling, thereby eliminating the need to placard vehicles. The box provides better storage of the equipment and is more convenient for tie down and shipping. Each box is furnished with a tie down device, Amersham (AEA) part #FM-98, which must be used each time the box is shipped with an exposure device inside. Prior to use, there are two (2) Type B (U) labels on the 660 which must be removed or covered from sight. The type B(U) certification then reverts to the OPL-660 itself.

Inspection Prior to Shipment

- | | |
|--------|---|
| Step 1 | The source assembly is secured within the 660 and the dust cover and shipping plugs are installed |
| Step 2 | Assure the lock plunger is secured with the key removed |
| Step 3 | Inspect the foam inserters of the OPL-660. If pieces are missing, replace prior to shipment. |
| Step 4 | Inspect the overpack for excessive rust, cracked welds or holes. Notify the DRSO if present. |
| Step 5 | Assure the lid fits securely and the latches can be secured. |
| Step 6 | Assure all required labels are legible, to include a label with the company name, address, and telephone number, affixed to the outside of the container. |
| Step 7 | Place the 660 in the box and place the lid on the box. Secure the lid using the two latches on the side. Attach a security seal through each latch. |
| Step 8 | Survey the exterior surfaces to determine maximum radiation level on the surface and at 1 meter. Notify the FRSO if unusually high readings are present. |
| NOTE: | When transporting the OPL-660 by – company vehicle, the tie down device Amersham (AEA) part #98 must be installed to prevent movement of the package. |

Place the OPL-660 in the tie down device and secure in place. A lock or wire/plastic seal can now be used to prevent tampering of the package.

Ensure to make note on the Receipt/Transfer/Disposal log as appropriate, and complete a Survey/Transfer Record.

(10) **OPERATING INSTRUCTIONS FOR USE OF 680-OP TRANSPORT PACKAGE WITH 680 EXPOSURE DEVICE**

This procedure shall be followed when the use of the 680-OP is required to transport (AEA) exposure device 680 series.

This procedure is designed to supplement transport procedures, not supersede.

All requirements of SEI NDE-RS-01, Sections A and B shall be strictly adhered to when transporting radioactive materials

The 680-OP consists of a model 680 exposure device contained within a protective carbon steel container of welded construction with dimensions of approximately 32" in length, 19" in width, and 18.5" in height. Together the exposure device and the steel container constitute the type B(U)-85 transport package. The ends of the steel container have sliding doors that permit attachment of the control and guide cables. The 680 must be within the steel container during all modes of transportation, and while in use at temporary job sites. A cart which includes a four-point lifting frame is provided for mobility. This modification is effective December 1, 1999 and thereafter.

MODIFYING DEVICE LABELS

Remove USA/9035/B(U) Type B from the 680 exposure device. Grinding may be employed ensuring no indentation of the printing remains.

OPERATING INSTRUCTIONS WITH 680 INSTALLED

Step 1 Perform a 360 degree radiation survey of the 680-OP and record the dose rate for the surface and a lot at (1) meter (TI). Keep in mind company procedures prohibit shipping of Yellow III containers.

Step 2 If required unlock the two pad locks and open the lid. Open sliding doors on both ends of the container. Remove materials to obtain access to the locking mechanism and the outlet port as required. Remove the locking mechanism cover plate

Step 3 Remove the shipping plug and attach the source guide tube.

Step 4 Unlock the lock mechanism, perform an inspection of the source assembly connector and drive cable connector using the model 550 no-go gauge. Attach the source and drive cable connector, and then the control plug assembly.

Step 5 Replace blocking material above and around the device, close the lid and secure the pad locks.

Step 6 Reach into the control housing sliding door and push the locking mechanism lock slide into the expose position.

Step 7 After an exposure ensure the automatic locking mechanism is engaged

Step 8 Perform a 360 degree survey verifying the source is fully shielded and secured

AFTER RADIOGRAPHIC OPERATIONS

Step 1 Unlock and open the contain lid.

Step 2 Remove the controls, replace the protective cap, engage the lock and remove the key. Install the cover plate over the locking mechanism.

Step 3 Remove the source guide tube, and insert the shipping plug.

Step 4 Replace all blocking materials, close the lid of the container and lock

Step 5 Close the sliding doors and perform a 360 degree radiation survey of the container

NOTE: The container should remain bolted to the model 974-transport cart, for ease of operation and maneuverability. The cart is equipped with a detachable handle for shipping. The maximum weight of the container including cart is approximately 711 pounds. Ensure lifting devices used to lift the container are certified for the weight to be lifted.

RADIOGRAPHIC OPERATING AND EMERGENCY PROCEDURES

SECTION E: CALIBRATION PROCEDURE FOR SURVEY INSTRUMENTS

1. Sealed source(s) used for calibrating survey instruments should:
 - A. Approximate a point source
 - B. Have its exposure rate at a given distance traceable by documented measurements to a standard certified to be within $\pm 5\%$ accuracy by NIST
 - C. Approximate the same photon energy (Ir-192, Co-60) as the source to be used in the radiographic device
 - D. Be of sufficient strength to give an exposure rate of about 0.3 mSv/hr (30 mrem/hr) at 100 cm (85 millicuries of Cs-137 or 21 millicuries of Co-60)
2. Use the inverse square and radioactive decay law to correct changes in exposure rate due to source decay or different distances from the source.
3. Record survey meter calibration data and maintain written records for each instrument being used to satisfy regulatory requirements. Survey meter calibration reports should indicate the procedure used and the data obtained. Calibration records should contain the following information and must be maintained 3 years from date of calibration of each instrument:
 - A. Owner or user identification, including name, address and person to be contacted
 - B. Instrument description that includes manufacturer, model number, serial number and type of detector
 - C. Calibration source description that includes exposure rate, the indicated exposure rate at a specified distance on a specified date and the calibration procedure
 - D. Each calibration point identifying the calculated exposure rate, the indicated exposure rate, the deduced correction factor and the scale selected on the instrument
 - E. Exposure reading indicated with the instrument in the "battery check" mode, if available
 - F. Angle between the radiation flux field and the detector (parallel/perpendicular)
 - G. For detectors with removable shielding, note whether the shielding was in place or removed during the calibration procedure
 - H. Include the person's name who performed the calibration and the date on which the calibration was performed
4. A single point on a survey meter scale can be considered satisfactorily calibrated if the indicated exposure rate differs from the calculated exposure rate by less than 10%
 - A. Linear Scale: Meters on which the user selects a linear scale must be calibrated at no less than two points on each scale. The points should be at approximately $1/3$ and $2/3$ of the decade
 - B. Multidecade Logarithmic Scale: Meters that have a multidecade logarithmic scale must be calibrated at no less than one point on each decade and no less than two points on one of the decades. Those points should be approximately $1/3$ and $2/3$ of the decade
 - C. Automatically Ranging Digital Display: Meters that have a device for indicating rates must be calibrated at no less than one point on each decade and at no less than two points on one of the decades. Those points should be at approximately $1/3$ and $2/3$ of the decade
5. Scales in excess of 10 mSv/hr (1000 mrem/hr) need not be calibrated. However, such scales should be checked for operation and approximately correct response
6. The following information should be attached to the instrument as a calibration sticker or tag:
 - A. Source that was used to calibrate the instrument
 - B. A calibration chart or graph for each scale or decade of a survey meter that is greater than $\pm 20\%$ of the actual values identifying the average correction factor, or a note indicating that the scale was checked only for function or is inoperative
 - C. Date of calibration
 - D. Date survey instrument is due calibration
 - E. Name or initials of individual calibrating the instrument

ADMINISTRATIVE ORGANIZATION AND RESPONSIBILITY

NDE-RS-02

ADMINISTRATIVE ORGANIZATION AND RESPONSIBILITY

Procedure Number: NDE-RS-02

Revision: 1

Effective Date: 02/27/2004

Approved By:

Jackie C. Riggs, JR/CRSO

Date

ADMINISTRATIVE ORGANIZATION AND RESPONSIBILITY

1. PURPOSE

The purpose of this procedure is to outline individual responsibilities for the administration and implementation of Schnabel Engineering Inc.'s Radiation Safety Program.

2. MANAGER OF BUSINESS OPERATIONS

The Manager of Business Operations of Schnabel Engineering Inc., shall ensure that all segments of the Radiation Safety Program are properly enacted, and shall provide the necessary support to facilitate the implementation of the Radiation Safety Program.

3. EHS/QA PROGRAM MANAGER

The EHS/QA Manager is responsible for the overall management of the Radiation Safety Program.

4. QUALITY ASSURANCE MANAGER

The Quality Assurance Manager shall ensure the proper execution of all segments of the Radiation Safety Program.

5. CORPORATE RADIATION SAFETY OFFICER (CRSO)

The Corporate Radiation Safety Officer shall be responsible for the overall administration of the Radiation Safety Program.

The Corporate RSO shall possess sufficient authority to enforce all aspects of the Radiation Safety Program.

Specific responsibilities of the CRSO include, but are not limited to:

- Act as the liaison between Schnabel Engineering Inc. and regulatory agencies on matters pertaining to radiation safety.
- Establish and review Operating, Emergency, and ALARA procedures to ensure conformance to applicable Federal and State regulations.

ADMINISTRATIVE ORGANIZATION AND RESPONSIBILITY

- Establish and administer the radiation safety training and testing program and ensure that only trained and qualified individuals are assigned to radiographic activities.
- Conduct administrative and field audits to ensure compliance with Schnabel Engineering Inc.'s Radiographic Operating and Emergency Procedures, Agency regulations, and license conditions.
- Investigate emergency situations, off-scale dosimeters, and personnel radiation exposure in excess of ALARA limits.
- Notify applicable Federal or State regulatory agencies of reportable incidents as outlined in SEI NDE-RS-01.

6. RADIATION SAFETY REVIEW COMMITTEE

The Radiation Safety Review Committee shall consist of personnel so designated by the EHS Manager. However, the personnel assigned should be senior management personnel with a good knowledge of Radiation Safety.

The Radiation Safety Review Committee shall review the radiation safety program annually to ensure compliance with regulatory and license conditions, seek ways to reduce exposure to radiographic personnel, and address areas of concern involving the radiation safety program.

7. PRODUCTION SUPERVISOR AND DIVISION MANAGERS

The Production Supervisor and Division Managers shall be responsible for notifying the appropriate Facility RSO of transfer of radioactive materials from state to state, and shall ensure arrangements are made to pick up or receive radioactive materials packages in accordance with SEI 01.

The Production Supervisor and Division Managers shall be responsible for ensuring that individuals assigned to radiographic operations meet the training, testing and experience requirements of the state where the radiographic operations are being performed.

ADMINISTRATIVE ORGANIZATION AND RESPONSIBILITY

8. FACILITY RADIATION SAFETY OFFICER (FRSO)

The Facility RSO shall be responsible for maintaining records of the calibration of all company owned pocket dosimeters, alarm ratemeters, and survey meters, in accordance with the applicable provisions of SEI NDE-RS-01, Radiation Safety Record Keeping.

The Facility RSO shall also be responsible for maintaining records of the leak testing of sources, and inspection and maintenance of exposure devices and source changers, owned by Schnabel Engineering Inc., in accordance with the applicable provisions of SEI NDE-RS-01.

The Facility RSO shall be responsible for the overall radiation safety program for that division of Schnabel Engineering Inc.

The Facility RSO shall possess sufficient authority to enforce all aspects of the Radiation Safety Program.

Specific responsibilities of the FRSO include, but are not limited to:

- Maintain control over the procurement, use the disposal of radioactive material assigned to the division
- Ensure that surveys and leak tests of radioactive material are performed and documented in accordance with SEI NDE-RS-01.
- Ensure that personnel monitoring devices are assigned to and properly used by radiographic personnel and that records of monitoring results are maintained and reviewed.
- Conduct a quarterly physical inventory to account for all sources of radiation received or possessed by the division.
- Ensure the performance of maintenance inspections on exposure devices, transport containers, and source changers assigned to the division.

ADMINISTRATIVE ORGANIZATION AND RESPONSIBILITY

- Ensure the availability of operable, calibrated survey meters for use during radiographic operations.
- Conduct field audits to ensure compliance with Schnabel Engineering Inc.'s Radiographic Operating and Emergency Procedures, Agency regulations, and license conditions.
- Ensure required permanent exposure cell interlock switches and warning signals function properly
- Provide training to personnel as directed by the Corporate Radiation Safety Officer.
- Investigate personnel radiation exposure in excess of ALARA limits

9. RADIOGRAPHERS, RADIOGRAPHER TRAINERS, RADIOGRAPHER INSTRUCTORS

Specific responsibilities of these individuals include, but are not limited to:

- Ensure that all radiographic operations to which he is assigned are performed in accordance with SEI's Radiographic Operating and Emergency Procedures, applicable regulatory requirements, and license conditions.
- Assume responsibility for all sources of radiation, exposure devices, source changers, x-ray machines, and related handling equipment in his custody
- Provide personal supervision to Radiographers Assistants and Trainee

10 RADIOGRAPHERS ASSISTANTS/TRAINEES

Radiographers Assistant/Trainees shall be responsible for adhering to the requirements SEI NDE-RS-01, applicable Federal or State regulations, and license conditions while performing radiographic operations under the personal supervision of a Radiographer, Radiographer Trainer, or Radiographer Instructor, as appropriate.

ADMINISTRATIVE ORGANIZATION AND RESPONSIBILITY

11. QUALIFIED PERSON

Qualified Persons shall assume responsibility for all sources of radiation, exposure devices, source changers, x-ray machines, and related handling equipment in his custody.

Qualified Persons shall perform only those operations to which he is specifically authorized.

With the exception of instrument calibration units, Qualified Persons not meeting the experience requirements of Radiographer shall not expose a sealed source unless the individual is under the personal supervision of a Radiographer, Radiographer Trainer, or Radiographer Instructor, as appropriate.

Qualification of a Qualified Person shall only be performed under the direct supervision of the Corporate Radiation Safety Officer (CRSO).

TRAINING, TESTING, AND QUALIFICATION OF RADIOGRAPHIC PERSONNEL

NDE-RS-03

**TRAINING, TESTING, AND QUALIFICATION OF RADIOGRAPHIC
PERSONNEL**

Procedure Number: NDE-RS-03

Revision: 2

Effective Date: 11/18/2004

Approved By:

Jackie C. Riggs, JR./ CRSO

Date

TRAINING, TESTING, AND QUALIFICATION OF RADIOGRAPHIC PERSONNEL

1. PURPOSE

The purpose of this procedure is to outline the training and testing of those individuals responsible for the radiation safety program, otherwise referred to as Radiation Safety Officer (RSO) or Facility Radiation Safety Officer (FRSO), those who perform radiographic operations in the capacity of a Radiographer and Radiographer Assistant and the qualifications thereof.

2. RADIATION SAFETY OFFICER

The minimum qualifications, training, and experience for RSO's for industrial radiography are that the individual has received training in:

- a. Fundamentals of radiation safety [Ref. 10 CFR 34.43 (g)(1)(i)(ii)(iii)(iv)(v)]
- b. Radiation detection instruments [Ref. 10 CFR 34.43 (g)(2)(i)(ii)(iii)]
- c. Equipment to be used [Ref. 10 CFR 34.43 (g)(3)(i)(ii)(iii)]
- d. The requirements of pertinent Federal regulations
- e. Case histories of accidents in radiography
- f. 2000 hours of hands-on experience as a qualified radiographer in industrial radiographic operations; and
- g. Formal training in the establishment and maintenance of a radiation protection program.

3. FACILITY RADIATION SAFETY OFFICER

The minimum qualifications, training, and experience for Facility RSO's for industrial radiography are that the individual has received training in:

- a. Letters a. through f. from number 2
- b. Is certified through a radiographer certification program by a certifying entity such as ASNT or its equivalent; and
- c. Received specific training relating to Schnabel's Operating and Emergency Procedures.

4. RADIOGRAPHER

The minimum qualifications, training, and experience for radiographers for industrial radiography are that the individual has received training in:

- a. Letters a. through e. from number 2
- b. Letters b. and c. from number 3
- c. Has received copies of and instruction in the requirements described in NRC regulations 10 CFR parts 19, 20, 21, 30, 34, and 71.
- d. Has received copies of and instruction in company Operating and Emergency Procedures

- e. 4 hours of specific training relating to company radiation equipment
- f. 4 hours of refresher training relating to radiation safety
- g. Passed a written test of 40 questions with an 80% grade; and
- h. Has demonstrated understanding of the use of radiographic exposure devices, sources, survey instruments and associated equipment by successfully completing a practical examination covering this material.

5. RADIOGRAPHER ASSISTANT

The minimum qualifications, training, and experience for radiographer assistants for industrial radiography are that the individual has received training in:

- a. 8 hours of basic radiation safety
- b. Has received copies of and instruction in the requirements described in NRC regulations 10 CFR parts 19, 20, and 71
- c. Has received copies of and instruction in company Operating and Emergency Procedures
- d. Passed a written test of 25 questions with an 80% grade; and
- e. Has demonstrated understanding of the use of radiographic exposure devices, sources, survey instruments and associated equipment under the direct supervision of a qualified radiographer by successfully completing a practical examination covering this material.

6. ANNUAL REFRESHER TRAINING

Schnabel Engineering Inc. shall provide annual refresher safety training for each radiographer and radiographer assistant (8 hours minimum) at intervals not to exceed 12 months.

7. PERIODIC AUDIT INSPECTIONS

The RSO or designee shall conduct quarterly audit inspections of the job performance of each radiographer and radiographer assistant to ensure that NRC regulations, license requirements and company operating and emergency procedures are being followed. Provided that, if a radiographer or a radiographer assistant has not participated in an industrial radiographic operation for more than 6 months since the last audit, the radiographer or radiographer assistant must demonstrate knowledge of the training requirements by a practical examination before these individuals can next participate in a radiographic operation.

RADIATION SAFETY INTERNAL INSPECTION PROCEDURE

NDE-RS-04

RADIATION SAFETY INTERNAL INSPECTION PROCEDURE

Procedure Number: NDE-RS-04

Revision: 1

Effective Date: 02/27/2004

Approved By:

Jackie C. Riggs, JR./ CRSC

Date

RADIATION SAFETY INTERNAL INSPECTION PROCEDURE

1.0 PURPOSE

- 1.1 The purpose of this procedure is to provide an internal inspection program of radiographic records and field operations to verify compliance with Schnabel Engineering Inc., Radiographic Operating and Emergency Procedures, applicable Agency regulations, and license conditions.

2.0 DEFINITIONS

- 2.1 Radiographic Personnel – For the purpose of this procedure, the term “radiographic personnel” shall encompass radiographers, radiographer trainers, radiographer instructors, radiographer trainees, and radiographer assistants.
- 2.2 Qualified Person – An individual who has met the training and experience requirements to be authorized to perform specific operations as defined in SEI NDE-RS-03.
- 2.3 Specific Operation – For the purpose of this procedure, the term “specific operations” relates to the limited, specialized tasks for which a Qualified Person has been trained and authorized.

3.0 FREQUENCY OF INSPECTION

- 3.1 Audits of all radiographic personnel shall be performed during the actual radiographic operations at intervals not to exceed 90 days.
- 3.2 Audits of all Qualified Persons shall be performed during their assigned specific operations at intervals not to exceed 90 days
- 3.3 Audits of Division required records shall be performed at least annually. Division Managers/Facility RSO's should complete the self-assessment audit prior to the scheduled date of the records audit.
- 3.4 If an individual has not participated in any type of radiographic activities for a three-month interval (90 days), that individual's performance shall be observed and recorded the first time the individual participates in radiographic activities.

RADIATION SAFETY INTERNAL INSPECTION PROCEDURE

- 3.5 If an individual has not participated in any type of radiographic activities for a six (6) month interval, that individual's performance shall be observed by demonstrating a practical exam prior to participating in further radiographic operations.

4.0 AUDITORS

- 4.1 Audits shall be performed by the Corporate RSO, Qualified Lead Auditor, Facility RSO, or a designated senior Radiographer authorized by the Corporate RSO who meets the requirements of SEI NDE-RS-03. .

5.0 CONDUCT OF AUDIT

- 5.1 Audits, as much as possible, shall be performed on an unannounced basis. Auditors shall verify the following:

- Proper use of personnel monitoring devices
- Personnel monitoring devices in calibration
- Restricted Area and High Radiation Area boundaries properly posted
- Visual surveillance of operation maintained by radiographer
- Operable and calibrated survey meter utilized
- Radiation surveys performed after each exposure
- Restricted Area boundary properly surveyed
- Exposure device locked after each exposure
- Assistant/Trainee under personal supervision
- Proper documentation of surveys and utilization available
- Storage area(s) properly placarded and surveyed
- Required documents on site
- Proper packing and marking of packages for transportation
- Daily maintenance inspection performed
- Possession of regulatory Wallet Card
- Radiographic personnel's knowledge of safety rules (ascertained by oral questions).

INSPECTION PROCEDURE

- 5.2 During an inspection by an auditor, the auditor may cease work if operations are not performed in accordance with SEI NDE-RS-01, applicable Federal or State rules and regulations, applicable radioactive material license conditions, or if the auditor determines that other unsafe conditions exist
- 5.3 Non-conforming conditions shall be immediately corrected prior to the continuance of radiographic activities.

6.0 DOCUMENTATION

- 6.1 Results of the inspection and any corrective action shall be documented on the Radiographic Field Operations Inspection Report (Attachment 1)
- 6.2 Results of Division record audits, shall be documented on attachment (2)
- 6.3 Results of Division self-assessment audits shall be recorded on attachment (3).

INSPECTION PROCEDURE

RADIATION SAFETY INTERNAL AUDIT INSPECTION REPORT

DIVISION _____

RSO _____

AUDITOR _____

RSO _____

AUDIT PURPOSE AND SCOPE

THE PURPOSE AND SCOPE OF THE AUDIT WAS TO DETERMINE THE ACCEPTABILITY AND VERIFY THE EFFECTIVE IMPLEMENTATION OF SCHNABEL ENGINEERING INC. RADIATION SAFETY PROGRAM, IN ACCORDANCE WITH COMPANY, STATE AND NRC RULES AND REGULATIONS.

SUMMARY OF AUDIT RESULTS

THE AUDIT WAS PERFORMED USING SEI RADIATION SAFETY INTERNAL AUDIT INSPECTION REPORT CHECK-LIST. ALL APPLICABLE SECTIONS WERE EXAMINED.

THE AREA EXAMINED DURING THE AUDIT AND RESULTS ARE DOCUMENTED BELOW:

SOURCE RECEIPT/TRANSFER/DISPOSAL	SAT__ UNSAT__
SOURCE LEAK CHECKS	SAT__ UNSAT__
QUARTERLY INVENTORY	SAT__ UNSAT__
TRANSPORT/SURVEY RECORDS	SAT__ UNSAT__
RADIATION SURVEYS	SAT__ UNSAT__
EXPOSURE DEVICE PLANNED MAINTENANCE	SAT__ UNSAT__
PERSONNEL CERTIFICATION RECORDS	SAT__ UNSAT__
PERSONNEL EXPOSURE RECORDS	SAT__ UNSAT__
TRAINING	SAT__ UNSAT__
FIELD AUDITS	SAT__ UNSAT__
SPARE FILM BADGE LOG	SAT__ UNSAT__
CALIBRATION	SAT__ UNSAT__
POSTING	SAT__ UNSAT__

(ATTACHMENT 2)

Page 5 of 9

RADIATION SAFETY INTERNAL

INSPECTION PROCEDURE

RADIATION SAFETY INTERNAL SELF-AUDIT INSPECTION REPORT

Division _____

RSO _____

Auditor _____

Date _____

The attached self-audit outline is to be used by the division prior to the regularly scheduled Internal Audit. All self-assessment audit discrepancies should be corrected prior to the actual internal audit. Forward the completed self-assessment results to the QA Department, (attn: Jackie Riggs) for review.

(ATTACHMENT 3)

Page 6 of 9

RADIATION SAFETY INTERNAL

INSPECTION PROGRAM

A. Receipt of Radioactive Material, Source Utilization Log, Area Survey and Leak Tests

1. Receipt, Transfer, Disposal Record

- a. All sources inventoried are listed on record yes___ no___
 b. All exposure devices and source changers are listed yes___ no___

2. Source Leak Test

- a. Sources have current leak tests yes___ no___
 b. No sources were used or transported
 with expired leak test yes___ no___

3. Source Transport Records

- a. All blanks are filled in or N/A yes___ no___
 b. No symbols were used yes___ no___

4. Survey Records Maintained

- a. Vault surveys on Transport sheets and UT
 logs are completed and within limits yes___ no___
 b. lock out survey complete yes___ no___
 c. Radiation boundaries surveyed yes___ no___
 d. Vehicle surveys complete yes___ no___
 e. Package surveys complete yes___ no___

5. Exposure Devices Maintenance

- a. Maintenance current on all exposure devices, if
 not red tagged: yes___ no___
 b. Survey meters info complete on maintenance records yes___ no___
 c. Maintenance expiration date proper yes___ no___

6. Quarterly Inventory

- a. Inventory performed and up to date yes___ no___
 b. Inventory matches, Receipt Transfer Disposal log yes___ no___
 c. X-ray machines (if applicable) are listed on the
 inventory n/a___ yes___ no___

7. Exposure Devices Leak Checks

- a. Leak tests performed and current (annually) yes___ no___

B. Dosimetry Records Personnel Quarterly Audits and Training Records

1. Individual Exposure Records Maintained

- a. Daily report yes___ no___
 b. Monthly report yes___ no___
 c. Annual report yes___ no___
 d. Landauer report yes___ no___

INSPECTION PROCEDURE

2. Personnel Individual Certification Record Maintained

- | | | |
|---|--------|-------|
| a. Training | yes___ | no___ |
| b. Testing/min. grade 80% | yes___ | no___ |
| c. Previous exposure | yes___ | no___ |
| d. X-Ray Certifications (if applicable) | yes___ | no___ |
| e. Qualified personal status | yes___ | no___ |
| f. Practical | yes___ | no___ |
| g. DRSO Certification | yes___ | no___ |

3. Training/Field Audits

- | | | |
|--|--------|-------|
| a. Quarterly training performed | yes___ | no___ |
| b. Refresher training performed | yes___ | no___ |
| c. Quarterly field audits within 90 days
of previous audits | yes___ | no___ |
| d. Practical performed if audits exceed 6 month | yes___ | no___ |
| e. Letter status no RT performed if field audit
was not performed | yes___ | no___ |

4. Spare Film Badge

- | | | |
|--|--------|-------|
| a. Spare film badge log up to date | yes___ | no___ |
| b. Proper entries in log | yes___ | no___ |
| c. Proper storage of spare film badges | yes___ | no___ |
| d. Reports of spare film badge use reported to
Landauer | yes___ | no___ |
| e. Film badge turned in for processing
the first week of each month | yes___ | no___ |

C. Calibration Records, Signs, Labels**1. Instruments**

- | | | |
|--|--------|-------|
| a. Survey meters calibration records available
(6 months) | yes___ | no___ |
| b. Dosimeter/Rate meter calibration records
available (annual) | yes___ | no___ |
| c. Individual files available for each item
requiring calibration | yes___ | no___ |
| d. Number of items out of calibration or repair
requested | | |
| Survey Meters_____ | | |
| Dosimeters_____ | | |
| Rater Meters_____ | | |

INSPECTION PROCEDURE

2. Regulation

a. The following items posted:

License

yes___ no___

NDE-RS-01

yes___ no___

NDE-RS Series

yes___ no___

Notice to employees

yes___ no___

Regulations

yes___ no___

b. If the above items are not posted; a memo posted stating
where the items can be reviewed

yes___ no___

3. Radioactive Material Signs Utilized

a. Storage vault posted (Radioactive Material)

yes___ no___

b. Building outside posted (Radioactive Material)

yes___ no___

c. Exposure vault (High Radiation Area)

yes___ no___

d. Transport/Survey Sheets radiation area signs
and distances properly listed

yes___ no___

e. Signs available at temporary job sites

yes___ no___

RADIATION SAFETY RECORD KEEPING

NDE-RS-05

RADIATION SAFETY RECORD KEEPING

Procedure Number: NDE-RS-05

Revision: 1

Effective Date: 02/27/2004

Approved By: Jackie C. Riggs, JR. / CRSO

Date

RADIATION SAFETY RECORD KEEPING

1.0 PURPOSE

- 1.1 The purpose of this procedure is to provide guidelines for the distribution and maintenance of documents generated in relation to the radiation safety program.

2.0 RETENTION OF RECORDS

- 2.1 All records generated in relation to SEI's Radiation Safety Program shall be retained until disposal is authorized by the Corporate Radiation Safety Officer
- 2.2 Prior to granting authorization for disposal of records, the Corporate RSO shall verify the requirements of the appropriate Federal or State regulations to ensure compatibility.

3.0 RADIATION SAFETY TRAINING

- 3.1 A record containing the following documents shall be maintained for all radiographic personnel.

3.1.1 Radiation Safety Training/Certification Record

This document indicates the job classification of the individual and shall be generated by the instructor upon successful completion of training in accordance with SEI NDE-RS-03. The record shall be maintained at Corporate and the division to which the individual is assigned.

3.1.2 Radiation Safety Training Certificate

The certificate shall be generated to certify successful completion of each segment of training in accordance with SEI NDE-RS-03. The original certificate shall be given to the student and a copy maintained at Corporate and the division to which the individual is assigned.

3.1.3 Written Examination

The written examination(s) verifies comprehension of the classroom instruction. All completed examinations shall be maintained at SEI Corporate Office.

3.1.4 Radiation Safety Training Record

This document indicates the periodic and refresher training received by an individual in accordance with SEI NDE-RS-04. Within 7 days after the end of each calendar quarter, the Facility RSO shall submit a Quarterly Audit/Training Summary to the Corporate RSO. The summary shall reflect the radiographic field audits performed for each individual assigned to his division within that quarter.

4.0 DOSIMETRY RECORDS

- 4.1 Records documenting exposure shall be maintained for each individual assigned to radiographic activities.

RADIATION SAFETY RECORD KEEPING

4.1.1 Occupational External Radiation Exposure History

An individual's previously accumulated occupational exposure history shall be documented by the Division RSO on an NRC-4 or NRC-5 (or equivalent). The exposure shall be verified and documented prior to allowing an individual to engage in radiographic activities. Previous occupational exposure must be obtained from the individual's most recent employer or acquire a written, signed statement from the individual.

Reasonable efforts shall be made by the Facility RSO to obtain reports of previous exposure. If unable to obtain a complete record of an individual's current and previous accumulated occupational dose, SEI shall, for the current year, reduce the allowable dose limit for the individual by 1.25 rems for each quarter for which records are unavailable. The individual is also not available for planned special exposures.

4.1.2 Radiation Dosimetry Report (Landauer Report)

This report indicates the exposure received to an individual's assigned LUXEL badge. The Facility RSO shall review this report monthly, and discuss any unusual exposures with the individual.

4.1.3 Current Cumulative Occupational Exposure History

An individual's current occupational radiation exposure shall be logged monthly on this form. The Facility RSO shall record the exposure taken from the dosimetry report for each individual assigned to his division.

In the event of a lost or damaged LUXEL badge, an estimate of the individual's exposure will be taken from the Radiation Survey/Shipping Records. The record shall reflect that this is an estimate.

The record shall be maintained at the division office to which the individual is assigned. Instructions for completion and a sample form are included as Attachment 2.

4.1.4 ALARA Investigation Report

The Facility RSO shall document the results of ALARA investigations performed on this form. All ALARA investigations shall be performed in accordance with SEI NDE-RS-7. The ALARA report shall be forwarded to the Corporate RSO within 7 days after completion. The report shall be maintained at the Corporate office and the division office to which the individual is assigned.

4.1.4 Daily Occupational Exposure Record

A daily exposure record shall be maintained at each division and shall list occupational exposures obtained from Radiation Survey/Shipping Records. This is an important ALARA tool designed to prevent any worker from being over exposed.

5.0 CALIBRATION RECORDS

- 5.1 A record containing calibration certificates shall be maintained for each of the following units. The Facility RSO and the Division Equipment Manager shall maintain calibration records on all company owned survey instruments, pocket dosimeters, and alarm rate meters.

RADIATION SAFETY RECORD KEEPING

5.1.1 Survey Meter Calibration Record

The Facility RSO or a Qualified Person shall verify certification of proper calibration of survey instruments. The Facility RSO shall maintain calibration certificates on those units assigned to his division, or borrowed from another Division.

5.1.2 Pocket Dosimeter Calibration Record

The Facility RSO or Qualified Person shall verify certification of proper calibration of pocket dosimeters. The Facility RSO shall maintain calibration certificates on those units assigned to his division, or borrowed from another Division.

5.1.3 Alarm Rate meters

The Facility RSO or Qualified Person shall verify certification of proper calibration of alarm rate meters. The Facility RSO shall maintain calibration certificates on those units assigned to his division, or borrowed from another Division.

6.0 SOURCE ACCOUNTABILITY

- 6.1 The Facility RSO shall maintain accurate records reflecting the receipt, utilization and disposal of all sources of radiation received or possessed by his division in accordance with SEI NDE-RS-01.

6.1.1 Receipt, Transfer, and Disposal Record

The Facility RSO shall ensure that an on-going Source Receipt, Transfer and Disposal Record is maintained in accordance with SEI NDE-RS-01. This document shall be maintained for all sources of radiation received or possessed by the division for the current calendar year. The receipt and transfer dates on this record shall correspond with the generation and close out of source files. The Facility RSO shall submit a copy of the most recent Record to the Corporate RSO within 7 days after the end of each calendar quarter.

6.1.2 Quarterly Inventory

The Facility RSO shall ensure that a Quarterly Inventory is performed at the end of each calendar quarter to account for all sources of radiation received or possessed by the division. The Facility RSO shall submit a copy of the Quarterly Inventory to the Corporate RSO within 7 days after the end of each calendar quarter. Ensure x-ray machine equipment is included in inventory.

RADIATION SAFETY RECORD KEEPING

6.1.3 Source File

The Facility RSO shall maintain a source file for all radioactive material received or possessed by the division. The source file shall include:

- Shipper's Declaration of Dangerous Goods or an SEI Shipping Record, as applicable, to document the incoming shipment of the source,
- Documentation of package receipt surveys
- Documentation of use (Radiation Survey/Shipping Record) corresponding to Utilization Log locations
- Documentation of Intent to Perform Radiography, if applicable
- Decay chart
- Leak test, if applicable
- Documentation of disposal to authorized recipient (Shippers Declaration of Dangerous Goods or SEI Shipping Record, as applicable, to document transfer or disposal of source)
- Documentation of receipt by the recipient (Receiving Report or a copy of the Package Receipt Survey)

Source files shall remain active until receipt of the Receiving Report or Package Receipt Surveys, at which time the file shall be closed.

6.1.4 Shippers Declaration of Dangerous Goods

This document, generated by the shipper of dangerous goods, identifies the contents of a package submitted to a common carrier for shipment. Some common carriers may combine the Shippers Declaration of Dangerous Goods with their company airway bill. The appropriate Facility RSO for radioactive materials shipped or received within the division if the shipment involves a common carrier shall maintain the record. The Facility RSO shall forward a copy of the document to the Corporate RSO upon request.

6.1.5 Radiation Survey/Shipping Record

This record is a multi-purpose form utilized to document radiation surveys, dosimetry information, and shipping and receipt information in accordance with SEI NDE-RS-01. The Division RSO shall ensure source accountability.

A section of this record documents radiation surveys, dosimetry data, and equipment data for radiographic operations. The Facility RSO shall verify that the document is complete, accurate and corresponds with the location and date of use on the Utilization Log, if applicable.

This record shall be used to update the Daily Occupation Exposure Record. Radiographic personnel ensure when conducting radiography operations at other divisions, a copy is retained and delivered to your parent division RSO.

Another section of this record certifies that packages containing sources of radiation were properly packaged, marked and labeled. The Facility RSO shall verify that the document is complete and accurate.

RADIATION SAFETY RECORD KEEPING

The lower section of this record certifies that packages containing sources of radiation were surveyed upon receipt. The Facility RSO shall verify that the document is complete and accurate. This Record shall be forwarded to the CRSO upon request.

6.1.6 Decay Chart

This document charts the diminishing source activity and the date the initial leak test was performed. The Facility RSO shall maintain a decay chart for sources received or possessed by the division. A copy of the decay chart shall be forwarded to the Corporate RSO, upon request.

6.1.7 Leak Test Certificate

This document certifies the results of a leak test. The Facility RSO shall maintain leak test results in the form of a decay chart or certificate on all sources of radiation received or possessed by the division. The FRSO shall maintain leak test results on all sources of radiation within the Division, to include D/U leak tests and submit a copy to the Corporate RSO upon request.

6.1.8 Reciprocity Reporting Form

This document serves notice to states in which SEI does not hold a radioactive material license, of the Company's intent to perform radiography within that state's jurisdiction. The Facility RSO shall ensure that Reciprocity Reporting Forms are complete and accurate in accordance with SEI NDE-RS-01.

6.1.9 Utilization Log

The Facility RSO shall ensure that utilization of all sources of radiation, received or possessed by the division are documented on the Utilization Log in accordance with SEI NDE-RS-01.

Upon request, the Facility RSO shall submit to the Corporate RSO, copies of the Radiation Survey/Shipping Records and the most recent Utilization Log. This applies to all sources of radiation received or possessed by the division for the preceding month. Prior to submission, the Facility RSO shall ensure the proper correlation between utilization and transfer.

6.1.10 Periodic Inspection & Maintenance Report

This document contained in SEI NDE-RS-01 Section A, certifies proper inspection and maintenance of exposure devices, associated equipment, and source changers, and shall be generated by the Facility RSO or Qualified Person, or by an approved vendor performing the inspection and maintenance. The Facility RSO shall maintain Periodic Inspection and Maintenance Reports on those units assigned to the division, and shall submit copies of PM Reports to the Corporate RSO upon request.

RADIATION SAFETY RECORD KEEPING

7.0 MISCELLANEOUS RECORDS

7.1 Spare LUXEL Badge Log

The Facility RSO shall record issuance of spare LUXEL badges. Dose records on a spare LUXEL badge shall be added to the user's Current Occupational External Radiation Exposure Record. The Facility RSO shall submit a copy of the Division's Spare LUXEL Badge Log to the Corporate RSO monthly. Facility RSO's ensure when an individual receives a permanent LUXEL badge, that exposure received on any spare LUXEL badge used by the individual is reported to Landauer.

A month-to-month record of spare LUXEL badges shall be maintained. When no spare LUXEL badges are issued for a particular month, the following statement shall be entered: "No Spare LUXEL Badges Issued For The Month of _____".

7.2 Previous Occupational Radiation Exposure Request

Occupational radiation exposure history information from an employee's (or prospective employee's) previous employee(s) shall be obtained and filed as part of a personnel exposure history.

7.3 Occupational Radiation Exposure Report

An NRC-4 or NRC-5 (or equivalent) will be utilized to provide a former employee with documentation of their radiation exposure while employed with Schnabel Engineering Inc. This report (Termination Report) is provided by Landauer upon request, but can be generated by the Facility RSO, with a copy to the corporate office.

7.4 Annual Occupational Radiation Exposure Report

An NRC-5 (or equivalent) is furnished by Landauer, Inc. annually containing the worker's occupational exposure for the previous year. A copy will be given to each worker by the FRSO explaining exposure requirements. A copy shall be transmitted by the CRSO to the NRC and to any agreement state that requires a copy. Records of NRC agreement states and individuals receiving the report shall be maintained.

RADIATION STANDARDS, NOTICES, AND WORKER'S RIGHTS

NDE-RS-06

RADIATION STANDARDS, NOTICES, AND WORKER'S RIGHTS

Procedure Number: NDE-RS-06

Revisions: 1

Effective Date: 02/27/2004

Approved By: Jackie C. Riggs, JR. / CRSO

Date _____

RADIATION STANDARDS, NOTICES, AND WORKER'S RIGHTS

1.0 PURPOSE

- 1.1 The purpose of this procedure is to provide guidelines regarding radiation protection standards, equipment purchasing standards, posting of notices, notification and reports to individuals, and worker's rights relative to Schnabel Engineering Inc.'s, Radiation Safety Program.

2.0 PURCHASING OF EQUIPMENT

- 2.1 Purchases of radiation devices and safety related equipment shall conform to the requirements of Code of Federal Regulations, Title 10, Part 34.20.
- 2.2 Purchased equipment found to have defects, which would affect safety, shall be reported in accordance with Code of Federal Regulations, Title 10, Part 21.
- 2.3 Equipment calibration shall be performed in accordance with SEI NDE-RS-01, "Radiographic Operating and Emergency Procedures" and applicable federal or state regulations.

3.0 POSTING OF NOTICES

- 3.1 Current copies of the following documents shall be posted at all Schnabel Engineering Inc. licensed facilities:
 - 3.1.1 Regulations for protection against radiation for the applicable state.
 - 3.1.2 Radioactive material license, conditions or documents incorporated by reference and any amendments.
 - 3.1.3 Operating and Emergency Procedures (NDE-RS-01)
 - 3.1.4 Notice to employees for applicable state or NRC-3 form.
 - 3.1.5 Any notice of violation and any response from the licensee
- 3.2 If posting items 3.1.1, 3.1.2, or 3.1.3 is not practical, a notice may be posted which describes the document and specifies where it may be examined.
- 3.3 Documents pertaining to 3.1.5 shall be posted within two working days of receipt or submission to the department of agency and shall remain posted for 5 days or until the violation is corrected, whichever is later.
- 3.4 Documents, notices or forms posted in accordance with this section shall appear in a sufficient number of places to permit radiographic personnel to observe them on the way to or from radiographic operations. These documents shall be posted in a conspicuous manner and shall be replaced if defaced or altered.

4.0 OCCUPATIONAL DOSE LIMITS FOR ADULTS

- 4.1 Occupational radiation exposure dose to individual adults shall be controlled to the following annual limits:

RADIATION STANDARDS, NOTICES AND WORKER'S RIGHTS

REMS PER CALENDAR YEAR

1. Total effective dose equivalent (TEDE) equal to 5.00 Rem
 2. Eye dose equivalent to: 15.00 Rem
 3. Shallow dose equivalent to the skin or any extremity: 50.00 Rem
- 4.2 The dose that an individual can be allowed to receive in the current calendar year shall be reduced by the amount of occupational dose received while employed by another company in the same year.
- 4.3 An adult worker may be authorized to receive doses in addition to and accounted for separately from the above dose limits in accordance with the applicable regulatory requirements for a planned exposure. All regulatory requirements for a planned special exposure must be adhered to and authorized from the Corporate RSO must be obtained prior to the planned special exposure.

5.0 EXPOSURE TO MINORS

- 5.1 No individual who is under 18 years of age shall be allowed to participate in Schnabel Engineering's Radiation Safety Program.

6.0 NOTIFICATION AND REPORTS TO INDIVIDUALS

- 6.1 Radiation exposure data shall be reported to the individual as specified below:
- as an annual summary of exposure received during the previous calendar year,
 - upon termination of employment
 - when notifying of exposures in excess of the limits specified in 4.0 and,
 - at the written request of a former employee.

- 6.2 Each notification and report shall be in writing. Reports shall include appropriate identifying data such as the name of the company, the radioactive material license number under which the exposure was received, the name of the individual, the individual's social security number, the exposure information and shall contain the following statement:

"This report is furnished to you under the provisions of the (insert applicable federal or state agency and reference number). You should preserve this report for further reference".

The notification may be furnished utilizing the appropriate regulatory agency form or a form containing the same information as the agency's form.

RADIATION STANDARDS, NOTICES AND WORKERS RIGHTS

7.0 WORKER'S RIGHTS

7.1 All individuals involved in radiographic activities are entitled to sufficient training and information to safely accomplish their assigned tasks. Radiographic personnel frequenting any area where sources of radiation are used or stored are entitled to the following:

- Information pertaining to the storage, transfer or use of radioactive material or radiation in these areas,
- Instruction in the health protection problems associated with exposure to radioactive materials or radiation and the purpose and function of protective devices employed,
- Instruction in, and instruction to observe, to the extent within the company's control, the applicable provisions of federal and state regulations and licenses for the protection of personnel from exposure to radioactive materials or radiation.
- Instruction in the appropriate response to warnings made in the event of any unusual occurrence or malfunction that may involve exposure to radioactive material or radiation, and the proper methods to report such occurrences or malfunctions,
- Consultation with regulatory authorities, in the event of an inspection, concerning matters of occupational radiation protection, and
- Radiographic personnel, who believe that a violation of federal or state radiation protection regulations exists or has occurred, may request an inspection by the applicable regulatory authority. Such requests must be in writing and shall be in accordance with the procedure outline in the applicable federal or state regulations.

ALARA PROGRAM

NDE-RS-07

ALARA PROGRAM

Program Number: NDE-RS-07

Revisions: 1

Effective Date: 02/27/2004

Approved By: _____
Jackie C. Riggs, JR. – CRSO

Date

ALARA PROGRAM

Schnabel Engineering Inc.'s, Program for Maintaining Occupational Radiation Exposures As Low As Reasonably Achievable (ALARA).

1. MANAGEMENT COMMITMENT

We, the management of Schnabel Engineering Inc., are committed to the program described below form keeping radiation exposures (individual and collective) as low as reasonably achievable.

- A. It will be a management priority that all radiographic personnel be made aware of our commitment to the ALARA philosophy and that they be instructed in the procedures and precautions to be used to keep their radiation exposure as low as possible. Management has established three investigational Exposure Levels (IELs) below regulatory limits that, if reached, will initiate an investigation by the radiation safety officer (RSO) of the cause of the exposure and to determine what actions can be taken to reduce the probability of recurrence. The IELs are: (1) 400 millirems per month, (2) 800 millirems per quarter and (3) 4000 millirems per year. Once the individual reached the annual IEL he/she is removed from the Radiation Safety Program for the remainder of the year.
- B. Management has delegated authority to the Corporate RSO (CRSO) and the Facility RSO (FRSO) to enforce the ALARA program. Management will support the RSO in instances where this authority must be asserted.
- C. Management will make all reasonable modifications to procedures, equipment and facilities to reduce exposures. We will be able to demonstrate that improvements have been sought, that modifications have been considered, and that they have been implemented where reasonable. We will be prepared to describe the reasons for not implementing modifications that have been recommended.

2. RADIATION SAFETY OFFICER RESPONSIBILITIES

- A. The Corporate RSO will emphasize the ALARA philosophy in all training of radiographic personnel, and will encourage personnel to review current procedures and propose changes to reduce exposure levels.
- B. The Facility RSO will conduct weekly reviews of pocket dosimeter reports and monthly reviews of film badge reports for all radiographic personnel to determine if unnecessary exposures are being received.
- C. Investigational Exposure Levels (IEL)

<u>Monthly IEL</u>	<u>Quarterly IEL</u>	<u>Annually</u>
400 millirems	800 millirems	4000 millirems

The FRSO will investigate in a timely manner the causes of all personnel doses equaling or exceeding the IELs listed above. If warranted, the RSO, in conjunction with the Corporate RSO, will take corrective actions to ensure that all unnecessary exposures are halted and recurrence is prevented. A report of each investigation and the actions taken, if any, will be recorded (Attachment 1) and forwarded to the Corporate RSO. The individual who receives the ALARA violation will be removed from the Radiation Safety Program until the event has been investigated by the Corporate RSO, to include a telephone conference call examining all circumstances surrounding the violation. Results of investigations will be maintained at the Corporate and Division level for inspection purposes.

ALARA PROGRAM

Penalties will be imposed on individuals in the following manner. If an individual exceeds ALARA (2) times, he/she will be removed from the RT program for (1) week. During that time the DRSO will conduct training dealing with ALARA, for a minimum of (2) hours. Repeat violations, at the discretion of the CRSO, the individual will be required to completely retrain in Radiation Safety.

- D. At least annually, the Corporate RSO will conduct a formal ALARA audit of the company's radiation safety program. The audit will include reviews of the company's personnel exposure records, internal audits, and any incidents. The goal of the audit will be to assess trends in occupational exposure as an index of the ALARA program's success and to determine if modification of the company's radiation safety program is needed. The Corporate RSO will document a summary of the results of each ALARA audit, including a description of actions proposed and taken. A report on each audit will be maintained on file for inspection purposes for 3 years from the date of the audit.

The undersigned certify that the ALARA program set forth above has been implemented.

Jackie Riggs
CRSO

SCHNABEL ENGINEERING INC.
ALARA INVESTIGATION REPORT

REPORT DATE: _____

DIVISION: _____

Name of Individual Exceeding ALARA Limit: _____

Month or Quarter ALARA Limit Exceeded: _____

Exposure Received for Period of ALARA Violation: _____

Principle cause ALARA limit was exceeded: _____

Contributing Factors: _____

METHODS TO PREVENT RECURRENCE

Management: _____

Personnel: _____

RECOMMENDED CORRECTIVE ACTIONS:

FACILITY RSO'S COMMENTS:

Signature of Facility RSO

Date

PRENATAL RADIATION EXPOSURE

NDE-RS-08

PRENATAL RADIATION EXPOSURE

Procedure Number: NDE-RS-08

Revisions: 1

Effective Date: 02/27/2004

Approved By:

Jackie C. Riggs, JR. – CRSO

Date

PRENATAL RADIATION EXPOSURE

1.0 PURPOSE

- 1.1 The purpose of this procedure is to provide guidance concerning prenatal radiation exposure.

2.0 DEFINITIONS

- 2.1 EMBRYO/FETUS: The developing human organism from conception until the time of birth
- 2.2 DECLARED PREGNANT WOMAN: A woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception.
- 2.3 OCCUPATIONAL EXPOSURE: Exposure received in the course of employment in which the individual's duties involve exposure to radiation, excluding received for medical purposes.
- 2.4 DOSE: The quantity of radiation absorbed by the body or by a portion of the body

3.0 DECLARATION OF PREGNANCY

- 3.1 It is the woman's choice whether she will or will not declare pregnancy to the company. If the choice is to declare pregnancy a lower radiation dose limit will apply, possibly affecting the job assignments. If the choice is not to declare pregnancy, the same radiation dose limits of non-pregnant. The declaration of pregnancy or if pregnancy is terminated must be furnished to the company, in writing. Attachment 1 is provided for convenience in declaring pregnant woman status.
- 3.2 Work assignment could possibly be affected for a declared pregnant woman, according to the amount of occupational exposure already received. Normally the declared pregnant woman can continue to perform her job with no change and still meet the required exposure limits.
- 3.3 Documented medical proof is not required to declare pregnancy. However, intentionally declaring yourself to be a pregnant woman when you know you are not, may result in appropriate disciplinary action, up to and including termination.

4.0 OCCUPATIONAL DOSE LIMITS

- 4.1 The external occupational dose to a declared pregnant woman must be monitored with individual monitoring devices, if it is likely that the embryo/fetus will receive, from sources external to the body, a dose in excess of 50 millirem.
- 4.2 The dose to an embryo/fetus for the term of the pregnancy, due to occupational exposure, shall not exceed 500 millirem. Efforts must be made to avoid substantial variations above a uniform monthly dose rate so that the entire dose received does not occur during a particular time of pregnancy. If the dose to the embryo/fetus is found to have exceeded 500 millirem, by the time the woman declares the pregnancy, any additional dose to the embryo/fetus shall not exceed 50 millirem during the remainder of the pregnancy.

PRENATAL RADIATION EXPOSURE

- 4.3 The lower dose limit will remain in effect until the declared pregnant woman 1) is known to have given birth, 2) informed the company, in writing, that she is no longer pregnant, or 3) informs the company, in writing that she no longer wants to be considered a declared pregnant woman.

5.0 TRAINING

- 2.1 Instruction concerning prenatal radiation exposure and its risks to the embryo/fetus should be provided to female workers before they are allowed to work in a restricted area. Each supervisor of a female worker who will work in a restricted area should receive the same instruction. The instruction will be presented both orally and in written form and the workers will be given opportunity to ask questions.

6.0 RECORDS

- 6.1 Records shall be maintained to record the dose to an embryo/fetus with the records of dose to the declared pregnant woman. The declaration of pregnancy shall also be kept in the individuals personnel file. Records should be protected from public disclosure because of their personal nature. The records shall be retained until the disposal is authorized by the Corporate Radiation Safety Officer.

PRENATAL RADIATION EXPOSURE

DECLARATION OF PREGNANCY

TO: _____
(Name of Your Supervisor)

I am declaring that I am pregnant. I believe I became pregnant in _____ of 20____. (Only the month and year need to be provided)

I understand that my occupational radiation dose during my entire pregnancy will not be allowed to exceed 0.5 rem (5 millisieverts)(unless that dose has already been exceeded between the time of conception and submitting this letter). I also understand that meeting the lower dose limit may require a change in job or job responsibilities during my pregnancy.

If I find out that I am not pregnant, or if my pregnancy is terminated, I will promptly inform you in writing that my pregnancy has ended.

(Your Signature)

(Your Name Printed)

(Date)

This is to acknowledge the receipt of your letter/application dated

2/2/2005, and to inform you that the initial processing which includes an administrative review has been performed.

☒ Amend 45-19703-01 There were no administrative omissions. Your application was assigned to a technical reviewer. Please note that the technical review may identify additional omissions or require additional information.

☐ Please provide to this office within 30 days of your receipt of this card

A copy of your action has been forwarded to our License Fee & Accounts Receivable Branch, who will contact you separately if there is a fee issue involved.

Your action has been assigned Mail Control Number 136434.
When calling to inquire about this action, please refer to this control number.
You may call us on (610) 337-5398, or 337-5260.

