D E T R O I T T E S T I N G L A B O R A T O R Y, Inc.

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OPERATING AND EMERGENCY PROCEDURES

NRC License Number 21-18302-01

TABLE OF CONTENTS

I. DAILY OPERATING PROCEDURES

This section contains instructions for the daily use of radiographic exposure devices and source changers to be followed at Detroit Testing Laboratory, Inc. The object of these procedures is to ensure that radiographic operations are carried out in the safest manner possible.

It should be pointed out from the beginning that the responsibility for performing radiographic operations safely lies with the radiographer. By definition, "Radiographer means any individual who performs or who, in attendance at the site where the sealed source or sources are being used, personally supervises radiographic operations and who is responsible to the licensee for assuring compliance with the requirements of the commission's regulations and the conditions of the license". Also by definition, "Radiographer's Assistant means any individual who, under the direct supervision of a radiographer, uses radiographic exposure devices, sealed sources, or related handling tools, or radiation survey instruments in radiography". This means that sources are to be manipulated only under the direct supervision of a radiographer. "Direct supervision" means that the radiographer must be physically present. During long exposures, the radiographer may leave the site <u>after</u> appointing an assistant radiographer to maintain surveillance over the radiation area and the controls.

All radiographic personnel must have TLD badges and pocket dosimeters on their persons while conducting radiographic operations. The pocket dosimeter reading should be monitored frequently. Radiographic personnel must recharge (set to zero) their pocket dosimeters and record this initial reading in the Daily Utilization Log before beginning operations. Survey meters must be checked for calibration date, battery condition, and signs of damage before operations may commence.

During radiographic operations, radiographic personnel should be constantly aware of their survey meter reading. Any unusuallly high or unexplainable readings, or any readings that exceed the limits set forth in Section III of the Operating and Emergency Procedures indicates that an emergency situation exists. Radiographic operations must cease and the appropriate actions as outlined in Section V of the Operating and Emergency Procedures must be taken.

The following is a set of step-by-step procedures to be followed when conducting radiographic operations:

A. In-House Operations

1. Make sure all personnel have TLD badges and charged pocket dosimeters on their persons. Record dosimeter readings in Daily Utilization Log. Check your dosimeters frequently during radiographic operations.

2. Check the survey meters for calibration date, battery condition, and any signs of damage.

3. Unlock and enter the gamma cell while observing the survey meter reading.

4. Survey the storage cabinet and record the readings on the Isotope Radiography Survey Form.

5. Obtain the proper exposure device from the storage cabinet

6. Survey the exposure device and record the readings on the Isotope Radiography Survey Form.

7. Perform the daily maintenance checks and fill out the checklist on the Isotope Radiography Survey Form.

8. Locate the control cables through the maze outside of the cell.

9. Remove the safety plug from the exposure device and attach the source guide tube.

10. Adjust the collimator to project the radiation downward as much as possible.

11. Unlock the device.

12. Exit the cell, close the door.

13. To expose the source, turn the controls quickly and smoothly as far as possible. DO NOT FORCE THE CONTROLS.

14. Survey the perimeter of the radiation area (outer walls) and check the operation of the warning lights. Record the radiation levels on the Isotope Radiography Survey Form.

15. If any radiation level exceeds 2 mR/hr, interrupt the exposure and readjust the collimation.

16. When re-entering the cell between exposures, pay careful attention to your survey meter readings. Survey the maze as you enter, the camera and the guide tube to determine that the source is fully retracted in its shielded position.

17. After the last exposure:

    a) Lock the device.

    b) Survey the camera and record the readings on the Isotope Radiography Survey Form.

    c) Disconnect the guide tube and insert the safety plug.

    d) Return the device and its controls to the storage cabinet and lock it.

    e) Survey the storage cabinet and record the readings on the Isotope Radiography Form.

    f) Exit and lock the cell.

    g) Record the final dosimeter readings in the Daily Utilization Log and the total doses on the Isotope Radiography Survey Form.

B. Field Operations

1) Make sure that all radiographic personnel have TLD badges and pocket dosimeters on their persons. Dosimeter readings should be checked frequently. Zero the pocket dosimeters and record the initial readings in the Daily Utilization Log.

2) Check the survey meters for calibration date, battery condition, and signs of damage.

3) Unlock and enter the gamma cell while observing your survey meter reading.

4) Survey the source cabinet and record the readings on the Isotope Radiography Survey Form.

5) Obtain the proper exposure device from the storage cabinet

6) Survey the exposure device and record the readings on the Isotope Radiography Survey Form.

7) Perform the daily maintenance checks and fill out the checklist on the Isotope Radiography Survey Form.

8) Secure the exposure device and its controls in the truck so that any vibration of bumps will not cause it to shift.

9) Survey the exterior of the truck as indicated on the Isotope Radiography Survey Form and record the readings. Install any necessary shielding to reduce the readings to a level below 2 mR/hr at any outer surface.

10) Check for sufficient safety equipment:

    a) "Radiation Area" signs
    b) "High Radiation Area" signs
    c) "Radioactive Materials" signs
    d) Rope (magenta and yellow)
    e) Batteries
    f) Safety flares

11) Upon arrival at the job site, survey the exposure device to determine that a safe condition exists.

12) Establish a radiation area perimeter:

    a) Using time-distance-shielding relationships, set up post the radiation area barricade at the calculated 2mR/hr line.

    b) Post "High Radiation Area" signs at about half way between the source position and the radiation area perimeter.

13) Remove the exposure device from the truck and place it at the desired location.

14) Locate the controls behind any available shielding or as far as possible from the exposure device.

15) Remove the safety plug and connect the source guide tube.

16) While observing your survey meter closely, unlock the camera.

17) Make sure the area is clear.

18) Expose the source by turning the handle smoothly and quickly. DO NOT FORCE THE CONTROLS.

19) Survey the perimeter of the radiation area and adjust it, if necessary. No reading may exceed 2mR/hr. Record the perimeter readings and position on the Isotope Radiography Survey Form.

20) During exposures, maintain a constant surveillance of the radiation area and controls.

21) When approaching the set up between exposures, pay close attention to your survey meter. Survey the camera and the guide tube to determine that the source is fully retracted into its shielded position.

22) After the last exposure, lock the device.

23) Replace the safety plug.

24) Secure the device and the controls in the truck as before.

25) Survey the truck as indicated on the Isotope Radiography Survey Form and record the readings.

26) Upon return, remove the device from the truck and return it to the storage cabinet.

27) Survey the device and record the readings of the Isotope Radiography Survey Form.

28) Place the camera and its controls in the storage cabinet and lock it.

29) Survey the storage cabinet and record the readings on the Isotope Radiography Survey Form.

C. Key Security

1) Key security is one means of ensuring against inadvertant entry into a radiation area, or accidental exposure of a radiographic source by someone who does not have sufficient training to deal with such an emergency. The importance of key security should be recognized by all radiographic personnel.

2) Keys for the gamma cell, storage cabinet, NDT lab door and all exposure devices are located in the NDT lab manager's office. They should be obtained only immediately prior to use and returned immediately after use. Duplicates are available from the NDT lab manager or the Radiation Safety Officer.

RESTRICTED AREA DISTANCES

Activity (curies)	Distance to 2mR/hr	
	Ir192	Co60
1	54	86
5	121	191
10	172	271
15	210	332
20	243	383
25	272	429
30	297	469
35	321	507
40	344	542
45	364	575
50	384	606
55	408	635
60	421	664
65	438	691
70	454	717
75	470	742
80	486	767
85	501	790
90	515	813
95	529	835
100	543	857

II. TRANSPORTATION OF SEALED SOURCES

Before a sealed source can be transported, the vehicle to be used must be placarded according to Department of Transportation and NRC rules and regulations. All four sides of the vehicle must have the word "RADIOACTIVE" on them in black letters 5" high on a yellow background. In addition, each side must be posted with "CAUTION: Radioactive Area" signs meeting the requirements of 10 CFR 20.203(b). A "CAUTION: Radioactive Materials" sign meeting the requirements of 10 CFR 20.203(e) must be posted on the rear door. Since the outside of the vehicle will be an unrestricted area, all of the outer surfaces must be surveyed to assure that no radiation levels exceed 2mR/hr. This survey must be recorded on the Isotope Radiography Survey Form. To make sure the radiation levels do not change while the truck is moving, the exposure device container must be secured to prevent shifting.

The vehicle can be used as a temporary storage facility providing it is properly placarded and surveyed as before and the camera is surveyed prior to storage. These must be recorded on the Isotope Radiography Survey Form.

III. METHODS AND OCCASIONS FOR CONDUCTING RADIATION SURVEYS

Because ionizing radiation cannot be seen or felt, the use of the survey meter is the radiographer's only real means of radiation detection. If the instrument is not used or is used improperly, the value of the instrument as a protective device is lost. Therefore these procedures have been established to ensure that radiation surveys are performed and performed properly.

These survey procedures are to be followed to the letter. Record the results of the appropriate forms where necessary.

A. Survey the exposure device and the guide tube after each exposure to determine that the source is fully retracted to its shielded position. Radiation levels should not exceed 50mR/hr at 6" from any surface. These surveys need not be recorded.

B. Survey of the perimeter of the radiaton area. Radiation levels must not exceed 2mR/hr. Record these readings on the Isotope Radiography Survey Form.

C. Survey of the exposure device prior to securing it in a storage facility. Radiation levels must not exceed 50mR/hr at 6" from any surface. Survey all surfaces as indicated on the back of the Isotope Radiography Survey Form. Record this survey in the space provided on the front of the Isotope Radiography Survey Form.

D. Survey of the storage facility after securing. Radiation levels must not exceed 10mR/hr at three (3) feet from any surface and 200mR/hr at any surface. Survey all accessible surfaces and record the maximum readings on the Isotope Radiography Survey Form in the spaces provided.

E. Survey any vehicle used to transport a sealed source. This survey must include several points on each exterior surface as well as inside the cab as indicated on the Isotope Radiography Survey Form. Record this survey on the form in the space provided. Radiation levels are not to exceed 2mR/hr at any surface.

F. Survey all containers prepared for shipment. Radiation levels are not to exceed 10mR/hr at three (3) feet from any surface. Record the maximum readings on the shipper.

G. Survey the maze of the gamma cell when entering. Readings should not exceed 2mR/hr. DO NOT ENTER THE CELL if the readings exceed this level. Inform the Radiation Safety Officer. This survey need not be recorded.

IV. EQUIPMENT MAINTENANCE

A. Radiographic Exposure Devices

Radiographic exposure devices, control cables, and related handling equipment are to be serviced on a quarterly basis by the senior radiographer or Radiation Safety Officer. The following services are to be performed on each exposure device or container:

With an operable survey meter in use:

1) Disconnect control cables.

2) Remove the safety plug and inspect the outlet nipple. Lubricate the quick-disconnect mechanism and check its operation. Replace safety plug.

3) Remove the safety cap and check the source tail connector for wear or damage.

4) Remove lock box, lock cap, and lock plunger. Clean all parts and lubricate with a dry film lubricant. Reassemble the lock mechanism and check operation.

5) Clean all guide tubes, connectors and snouts. Check the guide tubes for cuts, bruises, or other signs of damage.

6) Remove the drive cable from the control cable and clean it. Inspect the drive cable for burrs or wear.

7) Disconnect the control cables from the control box assembly. Clean the cables and inspect them for cuts, bruises, or other signs of damage.

8) Dismantle the control box assembly. Clean and lubricate all parts with low-temperature grease.

9) Reassemble the control box and connect the control cables.

10) Insert the drive cable into the control cables while lubricating lightly with low-temperature grease.

11) Thread the drive cable through the control box.

12) Check the drive cable connector for wear or damage.

13) Connect the control cables to the camera.

14) Check all labels and warning placards for damage and legibility.

On the following page is the Quarterly Maintenance Checklist used by DTL. This form must be filled out as each service is performed on any device.

B. Leak Testing

Leak testing of sources is performed every six (6) months by the Radiation Safety Officer or Senior Radiographer. Leak test smears are analyzed at Crittendon Hospital, Rochester, Michigan under the supervision of Dr. Michael Chopp, R.S.O.

The procedures to be followed when taking smears are listed below:

1) Verify that a charged pocket dosimeter and a TLD badge are on your person.

2) Obtain an operable, calibrated survey meter and the camera to be tested.

3) Verify that the camera is locked in the shielded position by surveying it as you would in normal radiographic operations.

4) Insert the swab into its handle.

5) Soak the swab in solvent.

6) Remove the safety plug.

7) Insert the swab into the outlet niple as far as possible.

8) Wipe the tube well with a turning, in-and-out motion.

9) Place the swab and the handle in the plastic bag.

10) Replace the safety plug.

11) Return the device to the storage container.

12) Measure the dose rate from the swab in a radiation-free area with your survey meter.

a) If the meter indicates any reading at all, DO NOT MAIL. Notify the personnel listed in section VI-F of the Operating and Emergency Procedures.

b) If no reading is indicated, mail the swab, handle, plastic bag to:

Department of Nuclear Medicine
Crittendon Hospital
Rochester, MI 48063
Attn: Michael Chopp

Distributors of sealed sources usually include a certificate with each source giving the results and date of the last leak test performed. If such a certificate is not received, the source is not to be used until a leak test is performed and the results received indicating that the source is not leaking or contaminated.

C. Daily Inspection

The following items must be checked daily before beginning radiographic operations. Any discrepancies must be reported to the Radiation Safety Officer or Senior Radiographer immediately. Radiographic operations may not commence unless all items are in compliance.

1) Visually inspect the control mechanism for signs of damage.

2) Inspect the guide tubes and control cables for cuts, bruises, or other signs of damage or wear.

3) Check to make sure that the snouts are clean and free from burrs and nicks.

4) Check the operation of the warning system (lights, audible alarms, interlocks, etc.). Check the trip level on the radiation monitor console (set to 2mR/hr).

5) Check the operation of the lock mechanism on the exposure device.

As each item is inspected, check the appropriate box on the Isotope Radiography Survey Form.

V. SHIPPING AND CHANGING SOURCES

A. Receiving Sources

1) Obtain a charged dosimeter, a calibrated and operable survey meter, and check your TLD badge. Check your TLD badge. Check your dosimeter frequently during operations.

2) Survey all surfaces of the container immediately upon arrival. Record the maximum surface reading on the shipper. If any reading exceeds 100mR/hr at any surface or 10mR/hr at three (3) feet from any surface, establish a radiation area and send for the Radiation Safety Officer. Maintain surveillance of the radiation area.

3) If the radiation levels are acceptable, move the barrel to the gamma cell. Be sure to watch your survey meter reading when you enter the cell. Remove the barrel lid.

4) Locate the leak test certificate and the approved design certification and deliver them, along with the shipper to the Radiation Safety Officer.

5) Remove the shipping container from the barrel and survey it.

6) Place the container in the storage cabinet. Lock the cabinet.

7) Survey the storage cabinet.

B. Exchanging IR192 Sources

1) Obtain a charged pocket dosimeter, a calibrated and inoperable survey, and check to make sure your TLD badge is on your person.

2) Unlock and enter the gamma cell. Watch your survey meter readings.

3) Survey the storage cabinet and record the readings on the Isotope Radiography Survey Form.

4) Open the storage cabinet and obtain the proper camera and the shipping container.

5) Survey both devices and record the readings on the Isotope Radiography Survey Form.

6) Locate the exposure controls through the maze.

7) Remove the safety plug from the camera.

8) Open the lower lock of the C-10 and remove the safety plug.

9) Connect the short exchange tube to the camera and through the lower lock of the C-10.

10) Unlock the camera by retracting the controls 1/4 turn and turning the key.

11) Exit the cell and check the bolts on the outer doors. Exit the room and close the NDT lab door.

12) Expose the source as you would in normal radiographic operations. DO NOT FORCE THE CONTROLS.

13) Enter the cell while watching your survey meter readings.

14) Lock the C-10 lower lock by depressing the plunger.

15) Survey the camera, the exchange tube, and the C-10.

16) Transfer the source I.D. tag from the exposure device to the lower lock of the C-10.

17) Disconnect the exchange tube from the C-10.

18) Disconnect the drive cable from the source tail.

19) Test the source tail to make sure that the source is securely locked in position. Watch your survey meter reading carfully to be certain that the source remains in the shielded position.

20) Open the upper lock of the C-10 and remove the protective cap. Attach the cap to the lower lock.

21) Connect the change tube to the camera.

22) Unlock the camera and drive the cable out so that it protrudes about six (6) inches.

23) Connect the drive cable to the new source tail.

24) Retract the controls and connect the control cables to the C-10.

25) Unlock the lower lock of the C-10.

26) Exit the cell and close the cell door.

27) Retract the source as you would in normal radiographic operations.

28) Enter the cell while observing your survey meter readings.

29) Lock the camera by retracting the controls 1/4 turn and depressing the plunger.

30) Survey both devices and the exchange tube.

31) Transfer the proper I.D. tag from the C-10 to the camera.

32) Disconnect the source exchange tube from both devices.

33) Replace the safety plug in the camera.

34) Replace the safety plug in the upper tube of the C-10.

35) Lock the upper lock of the C-10.

36) Return both devices to the storage cabinet.

37) Lock and survey the storage cabinet. Record the readings on the Isotope Radiography Survey Form.

38) Exit the cell and lock it. Exit and secure the radiography.

39) Record the final dosimeter readings in the Daily Utilization Log and the total doses on the Isotope Radiography Survey Form.

C. Shipping Sources

IRIDIUM 192:

1) Place the C-10 and the exchange tube into the barrel in the same positions in which they were received.

2) Visually inspect the C-10 and the barrel for signs of damage. Record the result on the invoice. If the container or the barrel appear damaged, DO NOT SHIP. Notify the Radiation Safety Officer immediately.

3) If the device appears to be undamaged, place the lid on the barrel and secure it wih the locking ring.

4) Survey the barrel at each surface and at three (3) feet. Record the maximum readings on the invoice. (See table in Section VI C).

5) Attach a copy of the latest test results to the invoice and attach both to the barrel.

6) Attach two "Radioactive III" labels to the barrel. Measure the transport index and record it on the affixed labels.

7) A copy of all surveys, inspections, leak tests, and invoices must be delivered to the Radiation Safety Officer prior to shipment. No container may be shipped without the permission of the Radiation Safety Officer.

VI. EMERGENCY PROCEDURES

In the event of an emergency (such as fire, severe weather, or vehicle accident) it is important that prompt action be taken to reduce the possibility of unnecessary exposure.

All emergency situations are different and we cannot predict the nature of any given occurence. We can, however, classify emergency situations and set guidelines for handling them. Note that in each case the object of the procedure is to minimize personnel exposure. Note also that the emergency personnel in Section F of these procedures must be notified in each situation.

A. In-House Emergencies

In the event that an emergency occurs while radiographic operations are being performed in our permanent facility, the following procedures must be adhered to:

1) Retract the source.

2) Enter the cell while observing your survey meter reading.

3) Survey the camera and the source tube. Lock the camera.

4) Disconnect the source tube and replace the safety plug.

5) Place the device in the storage cabinet and lock, if time permits.

6) Exit and lock the gamma cell.

7) Inform the personnel listed in Section F of these procedures of the status of all devices.

B. In the event of an emergency occuring while radiographic operations are in progress at a field site:

1) Retract the source.

2) Survey the camera, the source tube and the snout. Lock the camera.

3) Disconnect the source tube and replace the safety plug.

4) If time permits, remove the device from the endangered area.

5) Secure the camera in the vehicle or maintain constant surveillance over the camera and controls.

6) Inform the customer's shift supervisor or emergency personnel of the status of all devices.

7) Notify the personnel listed in Sectin F of these procedures.

C. Vehicle Accident.

In the event of an accident involving a vehicle being used for transport of a sealed source:

1) Give aid to any injured persons.

2) Check the operation of the survey meters. If the survey meter is not operable:

a) Establish a radiation perimeter by calculation using time-distance-shielding relationships (assume that the source is totally exposed).

b) Post guards to prevent accidental exposure.

c) Send for help (if necessary.

d) Notify the personnel listed in Section F of these procedures.

e) Check pocket dosimeter.

If a survey meter is operable:

a) Survey the vehicle to determine whether the source has shifted to become exposed.

i) If the source is exposed, establish a radiation perimeter and post guards to prevent accidental entry. Send for help if necessary and notifying the personnel listed in Section F of this procedure. Check your pocket dosimeter.

ii) If the camera has not been damaged, resecure it, if necessary, and resume transport.

D. Equipment Failure

The most common type of equipment malfunction is where the source "hang up" (becomes stuck) while cranking in or out. In any situation where control of the source is completely lost, NO ATTEMPT should be made by radiographic personnel to retrieve the source. As in other situations, your only responsibility is to establish and maintain surveillance over the radiation area and to contact the personnel listed in Section F of these procedures.

E. Dosimeter Off-Scale

If during radiographic procedures, a dosimeter is found to be off-scale, the emergency personnel in Section F must be notified and the individual's TLD badge must be returned for an emergency reading.

The dosimeter itself should be checked for leakage. This is accomplished by recharging it and leaving it in a radiation free area overnight. Report the reading to the Radiation Safety Officer.

F. Emergency Personnel

In the event of an emergency, the following personnel will be notified.

1. Joseph D. Wampler
   Manager, Radiation Safety Officer
   Home: (313) 437-4090 Work: (313) 398-2100

2. William Marquardt
   Assistant Radiation Officer
   Home: (313) 978-9365 Work: (313) 398-2100

21-18302-01
030-14814
8-3190

DETROIT TESTING LABORATORY, INC.
PURCHASE REQUISITION

DATE OF REQUEST: 4-10-86 DATE REQUIRED: ASAP

VENDOR: U.S. Nuclear Regulatory Commission

Name Materials Licensing Branch

Address 799 Roosevelt Road City Glen Ellyn, Ill. 60137

Person Contacted: Contacted By: (DTL Employee)

Phone Number Date:

TERMS: (Credit, etc.) Arranged By: (DTL Employees) P.O. NO. (DTL)

Payment Due: ☐ Net 30 ☐ Other (Describe)

F.O.B. ☐ Destination ☐ Other (Describe)

VIA: ☐ DTL Driver Pick-Up ☐ Other

Confirming ☐ Non-Confirming ☐

PURPOSE OF REQUEST: (Use of Item Purchased) check for License amendment NRC

JOB: (If Applicable) Description:

Number:

ITEM	Quantity	PART NO.	DESCRIPTION	DEPT.	DTL Acct. No.	UNIT PRICE	TOTAL
			Per 10 CFR 170.31			$	$ 230.00

'86 APR 21 A11:24
U.S. NUCLEAR REGULATORY COMMISSION
MATERIALS LICENSING BRANCH
RECEIVED

COMMENTS:

Sub-Total	$ 230.00
Sales Tax	$
Freight (if applicable)	$
Total Order	$ 230.00
PETTY CASH ☐ YES ☐ NO	$
CHECK ADVANCE ☒ YES ☐ NO	$

Requested By:

Approved (Mgr.)

Reviewed (G. Mgr.)

☐ Currency ☐ Check Advance Auth: (Controller)

RECEIVED
APR 18 1986
REGION III

APR 18 1986