Appendix F - NUCLEAR GAUGE & SEALED SOURCE SAFETY PLAN

I. General

This Safety Plan covers the procedures for the safe and proper use and possession of radioactive materials as contained in portable moisture/density gauges and other instruments. When handled in accordance with this plan, exposures to the licensee's employees or the general public will be as low as reasonably achievable. The University has implemented, and will maintain the "Operating, Emergency, and Security Procedures" in the errata sheet of Appendix G of NUREG-1556, Volume 1, Revision 2. Copies of this Plan will be provided to all gauge users and at each job site.

II. Organization and Responsibilities

A. Nuclear Regulatory Commission (NRC) Materials License:

The University of Wyoming is under license by the NRC to use limited quantities of radioactive materials, both as unsealed and sealed sources. As pertaining to sealed sources, the license specifies the following:

1. Sealed sources associated with or incorporated into measuring instruments for field experiments and projects may be used anywhere in the State of Wyoming provided such use is approved by the Radiation Safety Committee.

2. Licensed material shall be used by, or under the supervision of, individuals designated by the Radiation Safety Committee.

3. Sealed sources: shall not be opened by the licensee.

4. All sealed sources, for which it is required under 10 CFR 31.5, will be leak tested at least every six months.

5. In the absence of a certificate from a transferor indicating that a leak test has been performed within 6 months prior to the transfer, a sealed source shall not be put into use until tested.

6. The licensee is authorized to transport licensed material only in accordance with the provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."

7. RSO shall conduct a physical inventory every 6 months to account for all sources and/or devices possessed under the license.

8. If sealed sources are in storage and not being used, they must be inventoried but need not be leak tested. The sources shall be leak

tested if taken out of storage for use or transfer to another person.

9. When not in operation and under the direct supervision of an authorized user, each sealed source shall be secured with at least two separate sets of locking devices. This includes:

    a. A lock on the device or outer locked container designed to prevent unauthorized or accidental removal of the sealed source from its shielded position and;

    b. The source or its container must be secured from unauthorized access when in transport or storage.

B. Radiation Safety Committee

For a full description of the membership and duties of the Radiation Safety Committee, refer to the Radioactive Materials Safety Plan. As pertaining to nuclear gauging devices, the committee has the following duties:

1. Establish criteria for evaluating potential users and uses of ionizing radiation.

2. Develop procedures and criteria for training and testing each category of worker, and for evaluating the effectiveness of the training program.

3. Periodically review and update the Radiation Safety program, and periodically distribute information in order to ensure compliance with the program and applicable regulations.

4. The committee may delegate some of its functions to the RSO, RSO staff, or to subcommittees, but is responsible for the ultimate performance of these functions.

C. Radiation Safety Officer (RSO)

For a full description of the qualifications and duties of the RSO, refer to the UW Radioactive Materials Safety Plan. Pertaining to sealed sources, the RSO shall have the following duties:

1. To ensure compliance with all terms and conditions of the license and that the program is up-to-date and accurate.

2. To ensure that the equipment is inventoried and leak-tested every six months, as required by the license.

3. To ensure that the equipment is only used by authorized operators and that they receive the training in order to use the equipment in accordance with all relevant regulations.

4. To issue the proper monitoring devices and see that users wear them.

5. To maintain records as required by the license and regulations, including:

    a. Personnel and general public monitoring

    b. Leak tests

    c. Training

    d. Inventory

6. To ensure that all equipment is properly secured against unauthorized removal at all times.

7. To serve as a point of contact and give assistance in case of an emergency such as equipment damage, theft, or fire, and to notify the proper authorities in case of an emergency.

8. To arrange proper training for authorized users.

9. To post all required signs and notices at source storage locations.

10. To see that receipt and shipments of all sealed sources by commercial carrier are in accordance with applicable regulations.

D. Authorized Users

1. Principal User is responsible for:

    a. Maintenance of the device, including keeping files on operating manuals, calibrations and repairs.

    b. Deciding what persons can use the device, and seeing that these persons obtain monitoring and training and/or authorization from the RSO.

    c. Providing training for authorized users in the operation and maintenance of the device.

2. All Authorized Users should:

    a. Know the operating instructions

    b. Complete a training course given or approved by the RSO and know the health and safety rules

    c. Use safety equipment and monitoring devices properly

d. Know emergency reporting procedures.

III. Operating Procedures

A. If personnel dosimetry is provided:

1. Always wear your assigned dosimeter when using the portable gauge. Never wear another person's dosimeter;

2. Never store your dosimeter near the portable gauge.

B. Before removing the portable gauge from its place of storage, ensure that, where applicable, each portable gauge sealed source is in the fully shielded position and that in portable gauges with a movable rod containing a sealed source, the source rod is locked (e.g., keyed lock, padlock, mechanical control) in the shielded position. Place the portable gauge in the transport case and lock the case.

C. Use the portable gauge according to the manufacturer's instructions and recommendations.

D. Always maintain constant surveillance and immediate control of the portable gauge when it is not in storage. At job sites, do not walk away from the portable gauge when it is left on the ground. Take action necessary to protect the portable gauge and yourself from danger of moving heavy equipment.

E. Do not touch the unshielded source rod with your fingers, hands, or any part of your body. Do not place hands, fingers, feet, or other body parts in the radiation field from an unshielded source.

F. Unless absolutely necessary, do not look under the portable gauge when the source rod is being lowered into the ground. If you must look under the portable gauge to align the source rod with the hole, follow the manufacturer's procedures to minimize radiation exposure.

G. If portable gauges are used for measurements with the unshielded source extended more than 3 feet beneath the surface, use piping, tubing, or other casing material to line the hole from the lowest depth to 12 inches above the surface. If the piping, tubing, or other casing material cannot extend 12 inches above the surface, cap the hole liner or take other steps to ensure that the hole is free of debris (and it is unlikely that debris will re-enter the cased hole) so that the unshielded source can move freely (e.g., use a dummy probe to verify that the hole is free of obstructions).

H. After completing each measurement in which the source is unshielded, immediately return the source to the shielded position.

I. When not being used for field measurements, portable gauges will be locked and returned to their storage/transportation case.

J. When field operations are complete, portable gauges will be returned to their permanent storage locations as soon as possible.

K. While the source is in the operator's possession, the operator will have:

1. A copy of this Radioactive Materials Safety Plan

2. A copy of the instrument operating manual

3. A copy of the current leak test certificate

IV. Storage

A. Posting. Signs with the approved radiation symbol and the appropriate wording are posted on storage and usage areas as follows:

CAUTION RADIOACTIVE MATERIAL: for accessible areas in which radioactive materials are stored in combined quantities greater than or equal to ten times the activity for the radionuclide from column 3, Appendix C of the Radioactive Materials Safety Plan, or areas where doses are likely to exceed 2 millirem/hour or 100 millirem/year.

CAUTION RADIATION AREA: for accessible areas in which an individual could receive an equivalent dose in excess of 5 millirem/hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

CAUTION HIGH RADIATION AREA: for accessible areas in which an individual could receive an equivalent dose in excess of 100 millirem/hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

B. Security

1. When the portable gauge is not in use, place the portable gauge in a secured storage location with two independent physical controls. Examples of two independent physical controls are:

a. Securing the portable gauge in a locked storage facility located in a separate secured area in a warehouse;

b. Securing the portable gauge inside a locked van and secured to the vehicle with a steel cable;

c. or storing the portable gauge inside a locked, nonremovable box and further securing the box with a steel cable or chain.

2. If chains or cables are used as a method of providing security, one of the two chains or cables used, should be substantially more robust and more difficult to cut than the other. Simply having two chains or cables with locks would not satisfy the security rule unless each chain and lock combination were physically robust enough to provide both a deterrence and a reasonable delay mechanism.

3. While transporting a portable gauge, a licensee should not modify the transportation case if it is being used as the Type A container for transporting the device. This includes, but is not limited to, drilling holes to mount the case to the vehicle or to mount brackets or other devices used for securing the case to the vehicle. In order to maintain its approval as a Type A shipping container, the modified package must be re-evaluated by any of the methods described in 49 CFR Part 178.350 or 173.461(a). The reevaluation must be documented and maintained on file in accordance with DOT regulations.

C. Safety

1. Portable nuclear gauge devices should be stored no closer than 15 feet from the nearest workstation.

2. Always keep unauthorized persons away from the portable gauge.

3. Members of general public shall not receive an equivalent dose more than: 2 millirem in any one hour or 100 millirem per year.

4. After making changes affecting the portable gauge storage area (e.g., changing the location of portable gauges within the storage area, removing shielding, adding portable gauges, changing the occupancy of adjacent areas, moving the storage area to a new location), reevaluate compliance with public dose limits and ensure proper security of portable gauges.

D. Temporary Storage

1. If the portable sealed source will not be returned to the permanent storage area at the end of the day, the temporary storage location should follow the same rules for posting, security and safety.

2. The NRC must be notified if temporary storage will be longer than 30 days.

V. Check-Out Procedures

For security and safety reasons, sealed radioactive sources should be put into storage at the Regulated Materials Management Center (RMMC) while not in use. This room is specifically designed and labeled for storage of radioactive materials and is kept locked at all times. In order to ensure that these sealed sources are only released to persons who are authorized to handle them, the following checkout procedures must be followed.

A. Call the RMMC at 766-3698 as far in advance as practical to make arrangements.

B. Bring some form of identification (and a letter from the Principal User, if necessary).

C. Wear the film badge issued to you by the RSO. If you do not have a film badge you must first go to Hill Hall room 351 to be issued one first.

D. When you arrive at the RMMC you will sign a checkout form, giving the source identification, date checked out and the estimated date of return to RMMC storage. Your signature will be compared to the signature page for that device.

E. No source shall be checked out without a proper shipping container and a copy of the operator's manual. A copy of the emergency response information and the proper shipping papers will be issued, and must be located on the driver's door or on the seat next to the driver when transporting the device in a vehicle.

F. When not in use, the radioactive device shall be kept securely locked in its case and otherwise locked (in a vehicle or room) so that unauthorized personnel cannot gain access. The storage area must be posted with one or more **CAUTION RADIOACTIVE MATERIAL** signs.

G. When finished with the source, you shall make arrangements to have someone receive it at the RMMC. **DO NOT SIMPLY DROP IT OFF UNATTENDED!** The device has to be checked in and returned to the storage room by authorized RSO personnel.

H. For instruments not stored at the RMMC, a check-out log shall be attached to the storage cabinet, including the serial number of the gauge, operator checking it out, date checked out, destination, estimated return date, and actual date of return.

VI. Transportation

A. Labeling

All shipping cases shall have the following labels and markings:

1. Radioactive white I or yellow II square-on-point DOT label:

   a. Two on opposite sides, describing the radioactive material isotope, activity (in international units) and transport index (TI) if required.

   b. Yellow II is applicable if the dose rate on the surface of the package is 0.5 to 5.0 mrem/hr (including neutron dose).

   c. The transport index is the dose rate in mrem/hr at one meter from the surface of the package (including neutron dose).

   d. Vehicles in which white I or yellow II labeled cases are transported do not need to be placarded.

2. Package markings and description:

   a. R.Q., RADIOACTIVE MATERIAL, SPECIAL FORM N.O.S., UN 2974

   b. USA DOT 7A, TYPE A PACKAGE

3. DANGER - CARGO ONLY label, if transported by air:

B. Security

1. Transport the sealed source only in the manufacturer's carrying case (Type A package)

2. Locate the case as far away from passengers as possible.

3. In enclosed vehicles (car, van) the vehicle shall be locked while moving.

4. In the back of a pickup truck, the case shall be securely attached, locked, blocked and braced.

5. When left in the vehicle, the instrument shall be locked. Ignition keys should be removed and the driver's compartment locked.

C. The following documentation, carried at all times, shall be accessible to the driver (on the vehicle seat or side pocket, not in instrument carrying case).

1. Shipping papers or bill of lading for each gauge

2. Type A Package certificate (provided by manufacturer)

3. Sealed Source Certificate (provided by manufacturer)

4. DOT Emergency Procedures.

D. Reciprocity

Ordinarily, licensees are not allowed to use portable nuclear gauging devices outside of their licensed territories without permission of the state agency or USNRC region in which they intend to work. Reciprocity is granted for periods up to 180 calendar days. If this limit is exceeded, a Radioactive Materials License for that state or USNRC jurisdiction is required. Requirements to obtain reciprocity include:

1. Approval by the UW Radiation Safety Committee

2. At least 5 days written notification: of intent to transport and use gauge, sent by the RSO to the affected jurisdiction.

3. Copy of the latest leak test for the gauge.

4. Temporary address of use/storage area.

VII. Maintenance Procedures

A. Perform routine cleaning and maintenance according to the manufacturer's instructions and recommendations.

B. Periodic maintenance includes cleaning the gauge. The operator will have received proper instruction on how to clean the gauge and will wear the monitoring device assigned.

C. No maintenance will be performed in which the radioactive source is removed from the gauge. The gauge will be returned to the manufacturer or an approved service center for this type or service.

VIII. Training

A. All operators shall either complete the training course provided by the University of Wyoming RSO, a manufacturer's training course, or the nuclear

gauge course approved by the RSO.

B. All operators shall be trained in the operation and maintenance of the device by the Principal User of the device, or a qualified Independent User designated by the Principle User.

IX. Emergency Procedures

A. If the source fails to return to the shielded position (e.g., as a result of being damaged, source becomes stuck below the surface), or if any other emergency or unusual situation arises (e.g., the portable gauge is struck by a moving vehicle, is dropped, is in a vehicle involved in an accident):

1. Immediately secure the area and keep people at least 15 feet away from the portable gauge until the situation is assessed and radiation levels are known. However, perform first aid for any injured individuals and remove them from the area only when medically safe to do so.

2. If any heavy equipment is involved, detain the equipment and operator until it is determined there is no contamination present.

3. From a safe distance that minimizes personal radiation exposure, visually inspect the gauge to determine the extent of the damage to the source, source housing and shielding.

4. Portable gauge users and other potentially contaminated individuals should not leave the scene until emergency assistance arrives.

5. At the earliest opportunity after the situation is under control, contact the RSO at 766-3277. After hours, contact the University Police at 766-5179. Never leave the instrument unattended. Describe the situation and follow the instructions of the RSO.

B. RSO and License Management

1. Arrange for a radiation survey to be conducted as soon as possible by a knowledgeable person using appropriate radiation detection instrumentation. This person could be a licensee employee using a survey meter located at the job site or a consultant. To accurately assess the radiation danger or potential contamination, it is essential that the person performing the survey be competent in the use of the survey meter.

2. If portable gauges are used for measurements with the unshielded source extended more than 3 feet below the surface, contact persons listed on the emergency procedures need to know the steps to be followed to retrieve a stuck source and to convey those steps to the staff on site.

3. Make necessary and timely notifications to local authorities as well as to NRC as required. (Even if it is not required, you may report any incident to NRC by calling NRC's Emergency Operations Center at (301) 816-5100, which is staffed 24 hours a day and accepts collect calls.) NRC notification is required when portable gauges containing licensed material are lost or stolen, when portable gauges are damaged or involved in incidents that result in doses in excess of 10 CFR Part 20.2203 limits, and when it becomes apparent that attempts to recover a sealed source stuck below the surface will be unsuccessful.

4. Reports to NRC must be made within the reporting time frames specified by the regulations (see table 8).

C. The RSO shall notify the NRC according to Table 8 below.

Table 8. Typical NRC Notifications and/or Reports (NUREG-1556, Volume 11, Appendix N)

Event	Telephone Notification	Written Report	Regulatory Requirement
Theft or loss of material	immediate	30 days	10 CFR 20.2201(a)(1)(I)
Whole body dose greater than 0.25 Sv (25 rems)	immediate	30 days	10 CFR 20.2202(a)(1)(I)
Extremity dose greater than 2.5 Sv (250 rems)	immediate	30 days	10 CFR 20.2202(a)(1)(iii)
Whole body dose greater than 0.05 Sv (5 rems) in 24 hours	24 hours	30 days	10 CFR 20.2202(b)(1)(I)
Extremity dose greater than 0.5 Sv (50 rems) in 24 hours	24 hours	30 days	10 CFR 20.2202(b)(1)(iii)
Whole body dose greater than 0.05 Sv (5 rems)	none	30 days	10 CFR 20.2203(a)(2)(I)
Dose to individual member of public greater than 1 mSv (100 mrems)	none	30 days	10 CFR 20.2203(a)(2)(iv)
Defect in equipment that could create a substantial safety hazard	2 days	30 days	10 CFR 21.21(d)(3)(I)
Event that prevents immediate protective actions necessary to avoid exposure to radioactive materials that could exceed regulatory limits	immediate	30 days	10 CFR 30.50(a)
Equipment is disabled or fails to function as designed when required to prevent radiation exposure in excess of regulatory limits	24 hours	30 days	10 CFR 30.50(b)(2)
Unplanned fire or explosion that affects the integrity of any licensed material or device, container, or equipment with licensed material	24 hours	30 days	10 CFR 30.50(b)(4)