ARIZONA DEPARTMENT OF TRANSPORTATION * MATERIALS GROUP

1221 NORTH 21ST AVENUE PHOENIX, ARIZONA 85009-3740 PHONE (602) 712 - 7231

POLICY AND PROCEDURE DIRECTIVE

TO: ALL MANUAL HOLDERS	PPD NO. 16c
SUBJECT: ADOT RADIATION SAFETY PROGRAM	EFFECTIVE DATE: February 7, 2013

1. TABLE OF CONTENTS

SECTION #	TITLE	PAGE #
2	Terms and Definitions	1
3	General	5
4	Training	8
5	Personnel Monitoring Equipment	10
6	Public Dose	11
7	Embryo/Fetus	12
8	Radioactive Materials Inventories and Leak Testing	12
9	Audits	14
10	Radiation Survey Equipment	14
11	Posting and Labels	15
12	Operating Procedures	15
13	Emergency Procedures	17
14	Transportation and Transfer of Radioactive Sources	19
15	Storage Facilities	21
16	Maintenance, Repair and Calibration	23
17	Records	24
Attachments	Attachments #1 through #12	-

2. TERMS AND DEFINITIONS

2.1 AAC:

Arizona Administrative Code

2.2 ALARA (As Low As Reasonably Achievable):

Making every reasonable effort to maintain exposures to radiation as far below the regulatory dose limits as is practical, consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to the utilization of licensed materials in the public interest.

2.3 ARRA:

Arizona Radiation Regulatory Agency

2.4 ATTI:

Arizona Technical Testing Institute

2.5 Authorized User:

Employees who use, or supervise others who use radioactive material. Authorized users are qualified, by training and experience, to assure radioactive material is used for its intended purpose in a manner that protects health and minimizes danger to life or property.

2.6 Background Radiation:

The ambient radiation fields to which humans are exposed daily, originating from cosmic rays, naturally-occurring radionuclides and human endeavors.

2.7 Contamination:

The deposition of radioactive material on accessible surfaces of structures, objects, equipment, or personnel.

2.8 Declared Pregnant Woman:

A woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception.

2.9 DRSO:

The Department Radiation Safety Officer is the person named on the radioactive material license who is responsible for compliance with license conditions and radiation safety regulatory requirements. The DRSO is responsible for administering the Department's Radiation Safety Program.

2.10 Extremity:

The hands, elbow, arm below the elbow, foot, knee, or leg below the knee.

2.11 IAEA:

International Atomic Energy Agency

2.12 IATA:

International Air Transport Association

2.13 May:

The word "may" is to be understood as permission, neither a requirement nor a recommendation.

2.14 Member of the Public:

Members of the public include persons who live, work, or may be near locations where portable gauges are used or stored. This includes employees whose assigned duties do not involve using or handling portable gauges or radioactive source

2.15 NRC:

Nuclear Regulatory Commission

2.16 Nuclear Gauge Containment System:

A safety containment box which is an enhanced field security system for nuclear gauges. The system when properly used helps prevent theft, damage, back injuries, misuse of equipment, improper or unauthorized access to equipment or other misguided actions.

2.17 NVLAP:

National Voluntary Laboratory Accreditation Program

2.18 Occupational Dose:

The dose received by an individual in a restricted area or in the course of employment in which the individual’s assigned duties involves exposure to radiation and to radioactive material from licensed or unlicensed sources of radiation.

2.19 Public Dose:

The dose received by a member of the public from exposure to radiation and to radioactive material released by the licensee, or to another source of radiation either within a licensee's controlled area or in unrestricted areas.

2.20 Radiation Area:

Any area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of five (5) millirem in one hour at thirty (30) centimeters [twelve (12) inches] from the radiation source or from any surface that the radiation penetrates.

2.21 Radioactive Material Storage Area:

A restricted area where radioactive materials are secured from unauthorized removal or access, or where control and constant surveillance over the materials is maintained.

2.22 Restricted Area:

Any area accessible to individuals whose access is limited by ADOT for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials.

2.23 RRSO:

Regional Radiation Safety Officers who assist the DRSO in performing his/her responsibilities.

2.24 RSO:

A Radiation Safety Officer, either the Department Radiation Safety Officer (or designated alternate) or a Regional Radiation Safety Officer (or designated alternate).

2.25 Sealed Source:

Any device containing radioactive material that is permanently bonded, fixed, or encapsulated so as to prevent release and dispersal of the radioactive material under the most severe conditions which are likely to be encountered in normal use and handling.

2.26 Shall:

The word "shall" is to be understood as a requirement.

2.27 Should:

The word "should" is to be understood as a recommendation.

2.28 TLD:

Thermo Luminescent Dosimeter

2.29 Unrestricted Area:

Any area to which access is neither limited nor controlled by the licensee for purposes of controlling exposure to radiation. The licensee may control access to these areas for other purposes, such as security. Unrestricted areas may include offices, shops, laboratories, and areas outside buildings.

3. GENERAL

3.1 This Policy and Procedure Directive was developed to ensure compliance with the provisions of the Department's Radioactive Materials License, issued by the Arizona Radiation Regulatory Agency (ARRA) as license number 7-31, in conformance with Title 12, Chapter 1, of the Arizona Administrative Code (AAC).

3.1.1 In the event of conflict, state or federal regulation and license conditions shall take precedence over any statements in this directive.

3.1.2 Any questions on the interpretation of the requirements should be directed to the Department Radiation Safety Officer or a Regional Radiation Safety Officer.

3.2 A copy of the ARRA radioactive material license shall be kept on file and a notice shall be posted stating where employees can view copies of the regulations and the license. The original license application, all letters and information submitted along with the license application or in response to licensing agency information request, and all amendments to the license shall be maintained with the license.

3.2.1 License renewals shall be submitted at least thirty (30) days prior to the expiration date to ensure “timely renewal” status will be granted.

3.2.2 License amendment requests shall be submitted whenever any change is contemplated which could affect the license or any information contained in the original application or letters referenced in the license changes, e.g., facilities, equipment, procedures, or personnel.

3.2.3 Before using a nuclear gauge in another state, ensure that reciprocal license recognition (“reciprocity”) has been requested and received from the appropriate licensing agency for that state.

3.3 The Department Radiation Safety Officer (DRSO) is the person named on the radioactive material license who is responsible for compliance with license conditions and radiation safety regulatory requirements. The DRSO is responsible for administering the Department's Radiation Safety Program. The Regional Radiation Safety Officer (RRSO) assists the DRSO in performing this responsibility. The duties and responsibilities of the DRSO are shown below.

3.3.1 Ensure the license is maintained current and amendment/renewal requests are submitted in a timely manner. Make certain radioactive materials possessed and used by the Department conform to the terms and conditions of the ARRA license No. 7-31 and applicable regulations of the AAC Title 12, Chapter 1 concerning radioactive materials.

3.3.2 Ensure all authorized users are properly trained, have read and understand the licensee's (ADOT) emergency, operating, and radiation safety procedures. Train individuals to use nuclear gauges as described in the ADOT Radiation Safety Training Course.

3.3.3 Maintain records listing those individuals who have received the approved training and are qualified to use or supervise the use of nuclear gauges.

3.3.4 Ensure the sealed sources are leak tested in a timely manner and as prescribed in applicable instructions.

3.3.5 Ensure radioactive materials are used only by individuals who are authorized by the license and these individuals wear required personnel monitoring devices required by ARRA and/or ADOT regulations.

3.3.6 Ensure the ADOT Radiation Safety Program content and implementation is reviewed, at intervals not exceeding twelve (12) months, for compliance with ARRA rules, requirements, and license conditions.

3.3.7 Ensure all aspects of the ADOT Radiation Safety Program are being adhered to.

3.3.8 Ensure the safe usage of radioactive materials.

3.3.9 Maintain all records required by the license and applicable regulations, including personnel monitoring records, leak test records, inventory records, training records for authorized users, and receipt, transfer, and disposal records.

3.3.10 Serve as a point of contact and give assistance in case of emergency and to ensure that proper authorities are promptly notified in case of accident or damage to gauges.

3.3.11 Perform an annual audit of the radiation safety program at all locations statewide and ensure corrective actions are taken as needed.

3.3.12 Perform the duties and responsibilities as outlined and included herein.

3.4 The Arizona Department of Transportation management is committed to the ALARA philosophy of maintaining occupational and public radiation doses **A**s **L**ow **A**s **R**easonably **A**chievable. All personnel using nuclear gauges will be made aware of this commitment and will be instructed in the procedures for keeping all exposures ALARA.

3.4.1 Management has delegated authority to the Department Radiation Safety Officer (DRSO) to ensure adherence to ALARA principles and will provide all necessary and reasonable resources to implement this policy.

3.5 Radioactive material shall be used only by individuals who have satisfied the following requirements. The requirements are based on authorized user classification.

3.5.1 All employees shall adhere to the requirements of all applicable regulations, license conditions, and this directive. All employees shall conduct activities and operations in a manner consistent with ALARA principles. All employees shall notify an RSO immediately of the loss or theft of radioactive material or an incident involving radioactive contamination, leaking sources, unmonitored exposure to radiation, or other hazardous condition involving radioactive materials.

3.5.2 Class 1: The individual is a full time employee of the Department.

3.5.2.1 The individual is required to take and successfully complete the Department's Radiation Safety Training Course.

3.5.2.2 In addition to the requirements of Subsection 3.5.2.1, individuals operating nuclear gauges must have a current and appropriate ATTI certification. ("Field Technician" certification for field gauges or "Asphalt Technician" certification for laboratory asphalt content gauges.)

3.5.3 Class 2: The individual is a part time, seasonal, temporary, or contracted employee and has never completed an approved radiation safety training course.

3.5.3.1 The individual is required to take and successfully complete the Department's Radiation Safety Training Course.

3.5.3.2 In addition to the requirements of Subsection 3.5.3.1, individuals operating nuclear gauges must have a current and appropriate ATTI certification. ("Field Technician" certification for field gauges or "Asphalt Technician" certification for laboratory asphalt content gauges.)

3.5.4 Class 3: The individual is a part time, seasonal, temporary, or contracted employee and has completed an approved radiation safety training course.

3.5.4.1 The individual shall provide a certificate stating the completion of an approved radiation safety training course. The individual shall take and obtain a passing score on the Department's Radiation Safety Training Course exam.

3.5.4.2 In addition to the requirements of Subsection 3.5.4.1, individuals operating nuclear gauges must have a current and appropriate ATTI certification. ("Field Technician" certification for field gauges or "Asphalt Technician" certification for laboratory asphalt content gauges.)

4. TRAINING

4.1 Employees (including contracted technicians) handling and/or transporting Department nuclear gauges must take and successfully complete the ADOT Radiation Safety Training Course at least every twenty-four (24) months. Employees without current and appropriate ATTI certification and proper training and instruction on the use of the nuclear equipment may transport but shall not operate nuclear gauges.

4.1.1 "Appropriate ATTI certification", as used in Subsections 4.1 through 4.4, is defined as "Field Technician" certification for field gauges or "Asphalt Technician" certification for laboratory asphalt content gauges.

4.2 Employees (including contracted technicians) may utilize “hands on” training on the handling, transport, use, and operation of Department nuclear gauges after the successful completion of the ADOT Radiation Safety Training Course and under the supervision of an authorized user. These individuals shall not operate a nuclear gauge without supervision from an authorized user until they receive appropriate ATTI certification or DRSO approval.

4.3 Employees (including contracted technicians) must successfully complete the ADOT Radiation Safety Training Course within the last twenty-four (24) months in addition to possessing the appropriate ATTI certification before they are authorized to operate Department nuclear gauges. This employee will also be authorized to handle and transport Department nuclear gauges.

4.4 A new employee (including contracted technicians) who has completed an approved radiation safety training course prior to ADOT employment shall provide a certificate stating successful completion of the course. Additionally the employee shall take and obtain a passing score on the ADOT Radiation Safety Training Course exam and have the appropriate ATTI certification before authorization is granted to operate Department nuclear gauges. This employee will also be authorized to handle and transport and operate Department nuclear gauges.

4.5 In addition, all new employees (including contracted technicians) who may potentially use Department nuclear equipment shall be instructed in the requirements of the ADOT Radiation Safety Program as contained in this directive and the radiation safety procedures which must be observed in performing assigned duties.

4.6 All employees involved with packaging, preparing shipping papers, or transporting Department nuclear gauges shall receive refresher hazmat training at least every three (3) years (per US DOT regulations) if gauges are shipped only by highway. The training must be received every two (2) years (per IATA regulation) if gauges are shipped by air.

4.7 Documentation of all training shall include the employee's name, Employee Identification Number (EIN) or Social Security Number, description of training, date trained, employee's signature, and instructor's name.

4.8 DRSO Responsibilities

4.8.1 The DRSO shall be responsible for training individuals in the Department's radiation safety and emergency procedures, and in the use of the Department's nuclear gauges. Training shall be given by the DSRO or his/her designated representative.

4.8.2 The DRSO shall maintain records listing those employees who have received the required training and are authorized to handle and transport nuclear gauges. The DRSO will also maintain records listing those employees who have the required certification and training to handle, transport, and operate nuclear gauges. The DRSO will provide the RRSOs with a copy of these records.

4.9 RRSO Responsibilities

4.9.1 The RRSO shall serve as a point of contact and give assistance to individuals transporting or using radioactive materials within their Region.

4.9.2 The RRSO shall be responsible for coordinating with the DRSO regarding the training needs of individuals within their Region.

4.10 RSO Requirements

4.10.1 The individual RSOs shall have completed an approved nuclear gauge training course.

4.10.2 The individual RSOs shall have completed an approved 8-hour radiation safety officer training course.

5. PERSONNEL MONITORING EQUIPMENT

5.1 Occupational dose shall be monitored and controlled to maintain exposure as far below the applicable annual regulatory dose limits shown below as practical:

- Whole body deep dose 5 rem
- Skin dose 50 rem
- Extremity dose 50 rem
- Lens of the eye dose 15 rem

5.2 Each authorized user working in a restricted area or handling nuclear gauges shall be assigned a whole-body radiation monitoring device or TLD (**T**hermo **L**uminescent **D**osimeter) capable of measuring gamma and neutron radiation.

5.2.1 As a condition of being eligible for gauge assignment, all individuals assigned a TLD will be held responsible for actively participating in the Radiation Safety Program, including wearing the TLD assigned to them and returning the TLD to the RRSO when it is due.

5.3 All individuals transporting or using radioactive materials must be on the authorized user list prior to receiving a TLD.

5.4 All individuals performing maintenance, repair or calibration of radioactive devices must wear the TLD assigned to them.

5.5 The assigned TLD shall be worn at all times while working with or around nuclear gauges. TLDs are assigned to specific individuals and shall not be used by any other employee.

5.6 The TLD shall be worn on the upper torso. Ideally, the TLD should be worn on the chest area.

5.7 When the TLD is not being worn, it shall be stored in a relatively radiation-free location.

5.8 DRSO Responsibilities

5.8.1 The DRSO is responsible for arranging, through ADOT Procurement, a vendor to provide personnel monitoring equipment (TLDs) and services.

5.8.2 The DRSO shall coordinate with the vendor regarding all ordering, cancellation, and distribution of TLDs to each Region.

5.8.3 TLDs shall be processed and read at least quarterly by a NVLAP (National Voluntary Laboratory Accreditation Program) accredited processor.

5.8.4 The DRSO shall review all personnel monitoring equipment (TLD) reports to determine compliance with regulatory occupational exposure limits and to confirm personnel

exposures are ALARA. The DRSO shall alert the radiation worker in the event of a high or unusual exposure and notify the ARRA of any high or unusual exposure incidents. The DRSO shall initiate a review of the safety procedures with regards to the employee's work, investigate all such exposures, and take any corrective action required to prevent other such occurrences.

5.8.5 The DRSO shall maintain a record for each employee of their periodic and cumulative exposure levels.

5.8.6 Employees shall be kept informed of their radiation exposure monitoring results.

5.8.7 Upon written request, former employees are entitled to receive a report of the radiation exposure received during their employment. Immediately forward such requests to the DRSO for response.

5.9 RRSO Responsibilities

5.9.1 The RRSO shall be responsible for the distribution of TLDs within their respective Regions.

5.9.2 The RRSO shall make all requests for additions or deletions of TLDs with the DRSO.

5.9.3 The RRSO shall be responsible for complying with the vendor's instructions regarding storage, inventory, completion of the packing list, and return of TLDs to the vendor.

5.9.4 The RRSO shall review and forward a copy of TLD documentation to the DRSO.

5.9.5 The RRSO shall serve as a point of contact and give assistance to employees handling, transporting, or using nuclear gauges within their Region.

5.9.6 The RRSO shall be responsible for coordinating with the DRSO regarding the training needs of employees within their Region.

6. PUBLIC DOSE

6.1 Dose to members of the public from the use, transport, or storage of all licensed radioactive material shall be kept below one hundred (100) millirem in any one (1) year and less than two (2) millirem in any one (1) hour in any unrestricted area.

6.2 The DRSO shall maintain documentation demonstrating by calculation, measurement, or a combination of both that aforementioned limits are met. See Attachment #6 for further guidance.

6.3 After making changes affecting the gauge storage area (e.g., changing the location of gauges within the area, removing shielding, adding 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 gauges. The DRSO shall maintain documentation of these changes and reevaluations.

7. EMBRYO/FETUS

7.1 Dose to an embryo/fetus of a declared pregnant woman shall not exceed five hundred (500) millirems during the entire pregnancy. If a woman does not declare pregnancy, she will be subject to the normal occupational exposure limits.

7.2 Employees should notify supervision upon becoming pregnant, however, declaration of pregnancy is voluntary and implies a willingness to abide by lower dose limits for the protection of the embryo/fetus and accept possible temporary changes in work schedules, location, or assignments.

7.3 All declarations of pregnancy shall be made in writing to the DRSO and shall include the estimated date of conception. The form for declaring pregnancy is contained in Attachment #8. A doctor's statement is not required. A woman may withdraw a declaration of pregnancy at any time by providing written notice.

7.4 Upon declaration of pregnancy, an evaluation shall be performed to determine the potential for the employee to exceed the regulatory exposure limit during the nine month gestation period. If the potential for exposure in excess of the dose limits exists, the employee may be transferred to a different job assignment.

7.5 Declared pregnant women with the potential to exceed fifty (50) millirem during the course of pregnancy shall be assigned a TLD.

7.6 If the dose to an embryo/fetus is found to have exceeded four hundred fifty (450) millirem by the time the woman declares the pregnancy, additional dose to the embryo/fetus shall not exceed fifty (50) millirem during the remainder of the pregnancy.

8. RADIOACTIVE MATERIALS INVENTORIES AND LEAK TESTING

8.1 A physical inventory and leak test of all licensed radioactive material shall be conducted by the Standardization Unit (Annex) staff at least semi-annually.

8.1.1 A physical inventory of all licensed radioactive materials in each Region shall be conducted by the respective RRSO, or their designated alternate, in March and September. This physical inventory will be documented on the "Semi-Annual Nuclear Gauge Inventory" form (Attachment #12) and a copy forwarded to the DRSO as soon after the conclusion of the inventory as possible.

8.2 Individuals performing inventories and leak tests of radioactive devices shall wear the TLD assigned to them.

8.2.1 Individuals shall perform leak testing in accordance with the leak test kit provider's instructions.

8.3 The inventory records shall include the following information:

- Make, model, state identification number (if applicable), and serial number of each gauge
- Serial number, radionuclide, and activity of each sealed source
- The physical location of each gauge
- The date the inventory was conducted
- The signature of the person conducting the inventory

8.4 DRSO Responsibilities

8.4.1 The DRSO shall be responsible for coordinating physical inventories. The "Six-Month Leak Test / Inventory Report" form can be found in Attachment #10.

8.4.2 As needed, the DRSO shall send the RRSO a packet containing instructions and leak test kits for radioactive sources within their Region.

8.4.3 The DRSO shall be responsible to have the completed leak test packets analyzed by Arizona State University.

8.4.4 The DRSO shall maintain records of physical inventories and leak testing for a minimum of five (5) years.

8.5 RRSO Responsibilities

8.5.1 The RRSO shall assist the DRSO in performing physical inventories and leak testing within their Region.

8.5.1.1 Upon receipt of the leak test packet and instructions, the RRSO or their designated alternate shall perform the physical inventory and leak test for all radioactive materials within their Region or specific sources as identified by the DRSO.

8.5.1.2 The RRSO shall return the completed leak test(s) to the DRSO on or before the deadline indicated in the instructions received with the test packet(s).

9. AUDITS

9.1 An audit of the content and implementation of the radiation safety program shall be performed annually.

9.1.1 The audit shall be performed by the DRSO or other individual designated by the DRSO. The "ADOT Radiation Safety Program Audit Checklist" may be found in Attachment #7.

9.2 Problems identified by the audit shall be corrected in a timely manner.

10. RADIATION SURVEY EQUIPMENT

10.1 All radiation detection instruments (survey meters) used for purposes of demonstrating compliance with regulatory requirements shall be calibrated at least annually by an organization licensed by the NRC or an Agreement State to perform such calibrations.

10.1.1 The DRSO shall coordinate the scheduling for calibration of survey meters with each RRSO.

10.1.2 The DRSO shall maintain a record of survey meter calibrations. A copy of the calibration shall accompany each survey meter upon its return to the respective RRSO.

10.2 Each RRSO shall be assigned a survey meter (Geiger counter).

10.3 The following checks shall be performed on each survey meter prior to its use:

- Battery check
- Calibration date check
- Response check using a gauge or check source

11. POSTING AND LABELING

11.1 Each area in which nuclear gauges are used or stored shall be posted with a sign bearing the radiation symbol and the words "Caution – Radioactive Materials" similar to Attachment #2. (Posting legends and background must meet NRC specifications.)

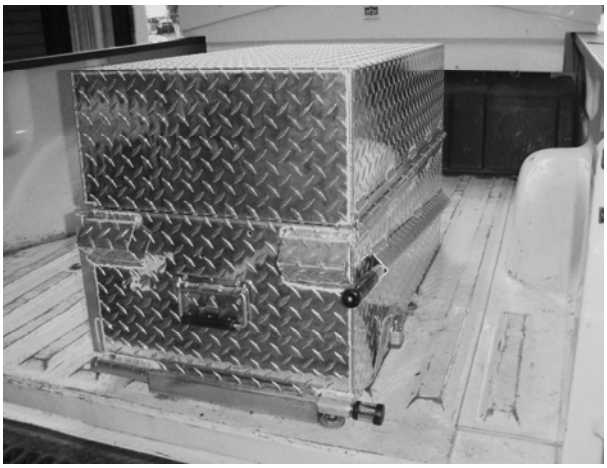
11.2 Each area in which nuclear gauges are used or stored shall be posted with a "Title 12, License No. 7.31, Notice Form" similar to Attachment #3, and a copy of the most current "Emergency Contact List" similar to the format of Attachment #4.

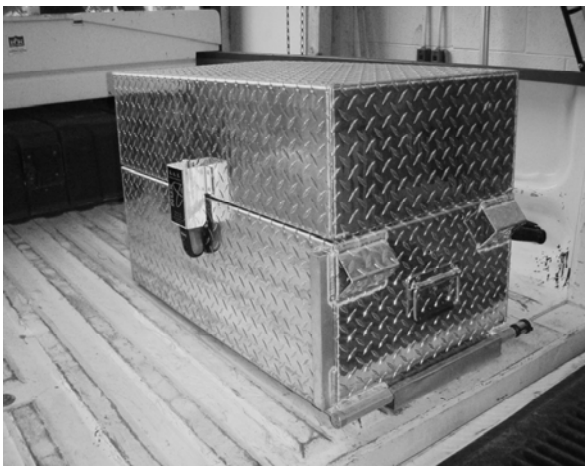
11.3 Posting of caution signs is not required in areas or rooms containing radioactive materials for periods of less than eight (8) hours if the materials are under constant surveillance and control.

12. OPERATING PROCEDURES

12.1 Radiation Safety Officers shall perform periodic field inspections to ensure only authorized individuals transport or use field nuclear gauges or laboratory nuclear gauges, they are on the authorized user list, and they wear the personnel monitoring device (TLD) assigned to them. Nuclear gauge operators failing to follow all provisions of this policy may be removed from the listing of authorized users and may be subject to ADOT's Progressive Discipline Policy.

12.2 The operator of the field nuclear gauge shall maintain surveillance and control over the gauge at all times when removed from the nuclear gauge containment system (see illustrations below). At job sites, the employee shall not walk away from the gauge when it is left on the ground. The operator must take action necessary to protect the gauge from danger of moving construction equipment.





Nuclear Gauge Containment System

12.3 All employees shall wear a TLD when handling or using a nuclear gauge. Employees shall not wear another person's TLD and shall not store the TLD with or near the gauge. If the TLD is lost or damaged, the RSO must be notified immediately.

12.4 When a field nuclear gauge is not in use, the handle shall be locked in the shielded position (radioactive source shielded) and the gauge placed, secured, and locked in its nuclear gauge containment system, which is secured and locked to the bed of a pick-up truck. No radiation labels shall be applied to the outside of the nuclear gauge containment system. When the gauge is not in use at a temporary job site, and with prior approval by an RSO, it may be stored and secured in the locked trunk of a car, stored and secured in a van, or stored and secured in a locked storage shed. (All storage locations shall meet two levels of security criteria. See Subsection 15.5)

12.5 Before removing a gauge from its place of storage, ensure it is in the fully shielded position and the source rod is locked. Place the gauge in the transport case (if applicable) and lock the case.

12.6 Complete the "Radioactive Materials Unit Transportation/Transfer Receipt Form", Attachment #11, whenever a gauge is checked out to be transported for use at a temporary job site or returned to storage.

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

12.8 Return the gauge to its proper locked storage location at the end of the work shift. The storage location shall meet the two independent physical controls criteria stated in Subsection 15.5.

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

12.10 Individuals operating gauges shall practice the ALARA concept at all times and shall keep unauthorized individuals out of the operating area a minimum distance of fifteen (15) feet.

12.11 The operator shall never unnecessarily be exposed to, touch, or directly handle the unshielded source.

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

12.13 After completion of each measurement in which the source is unshielded, immediately return the source to the shielded position.

12.14 Individuals operating gauges shall keep the Department Radiation Safety Officer and Regional Radiation Safety Officer informed of the assigned storage location for each gauge. If a gauge is not returned to its assigned storage location at the end of the day, the DSRO and RRSO shall be notified of the location and provisions for storing the gauge.

12.15 In the event a gauge is lost or stolen, immediately notify an RSO.

13. EMERGENCY PROCEDURES

13.1 In the event of an accident:

13.1.1 Locate the gauge and/or source(s).

13.1.2 Immediately secure the area and keep all unauthorized personnel away from the nuclear source(s) until the situation is assessed and radiation levels are known. A radius of fifteen (15) feet will be sufficient. Do not leave the area unattended. However, perform first aid for any injured individuals and remove them from the area only when medically safe to do so.

13.1.3 Perform a visual inspection of the nuclear gauge to determine if the radioactive source housing and/or shielding has been damaged.

13.1.4 **PROCEDURE 1 -** If the gauge is damaged but is intact, and the source is obviously in place and not damaged (superficial damage, dented, dropped, minor damage):

13.1.4.1 Place the gauge in its transport case and return the gauge to its storage location. Contact the Regional Radiation Safety Officer (or their designated alternate) and/or the Department Radiation Safety Officer (or their designated alternate) and make arrangements for returning the gauge to the Materials Group Standardization Unit (Annex).

13.1.5 **PROCEDURE 2 -** If the gauge is severely damaged (fire, major run-over, torn apart), or is not in a condition to determine the source integrity:

13.1.5.1 Stop all access to and from the site. If a vehicle/equipment is involved, it must not be moved until the extent of the contamination, if any, of the vehicle/equipment and its operator is determined. Do not walk through the damage site. Quarantine a minimum fifteen (15) feet radius around the damage site. The operator shall attempt to prevent themselves and others from exposure.

13.1.5.2 Gauge users and other potentially contaminated individuals should not leave the scene until emergency assistance arrives.

13.1.5.3 At the earliest possible time, after the situation has been stabilized and is under control, contact the Regional Radiation Safety Officer (or their designated alternate) and/or the Department Radiation Safety Officer (or their designated alternate). Describe the present conditions and follow the instructions given.

13.1.5.4 The RSO shall arrange for a radiation survey to be conducted as soon as possible by a knowledgeable person using appropriate radiation detection instrumentation. The survey is to assess the integrity of the source encapsulation and shielding to determine the extent of contamination, if any, of personnel, equipment, facilities, or areas.

13.1.5.5 Notify the local authorities and regulatory agencies as required within the time frames specified by the regulations.

13.2 Notifications

13.2.1 The following occurrences must be reported to the ARRA authorities in accordance with the time frames and methods specified in the applicable regulations.

- Lost, stolen, or missing sources
- Events that cause, or threaten to cause, exposures to individuals in excess of regulatory limits
- Leaking or contaminated sealed sources

13.3 When initial reports are made by phone, written reports must be submitted within thirty (30) days.

13.4 In the event that a nuclear gauge is lost or stolen:

13.4.1 Immediately notify the Regional Radiation Safety Officer (or their designated alternate) and/or the Department Radiation Safety Officer (or their designated alternate).

13.5 Emergency Contacts

13.5.1 The Regional Radiation Safety Officer and/or the Department Radiation Safety Officer should be the first individuals contacted. In the event that they cannot be reached, their designated alternate should be contacted.

13.5.1.1 An example of the format for the “Emergency Contacts” list is given in Attachment #4. The list of emergency contacts shall be maintained to reflect current information.

13.5.2 The Department Radiation Safety Officer shall be the primary contact with the Arizona Radiation Regulatory Agency, and other local authorities, as appropriate in accordance with R12-1-445.

13.5.3 In the event that contact cannot be made with a Radiation Safety Officer or a designated alternate, the following should be contacted.

13.5.3.1 Arizona Radiation Regulatory Agency (602-255-4845).

13.5.3.2 Department of Public Safety, Watch Commander (602-223-2212).

14. TRANSPORTATION AND TRANSFER OF RADIOACTIVE SOURCES

14.1 Any individual transporting a nuclear gauge shall be on the authorized user list, and wear the personnel monitoring device (TLD) assigned to them, before being issued a gauge.

14.2 The “Radioactive Materials Unit Transportation/Transfer Receipt Form” (see Attachment #11) shall be completed prior to transporting a gauge. When transporting any radioactive source, the yellow copy (or photo copy) of the completed form shall be within arm's length of, and visible to, the driver in the front seat or cab of the vehicle.

14.2.1 The white and pink copies of the “Radioactive Materials Unit Transportation/Transfer Receipt Form” shall be distributed as indicated on the form.

14.3 All transfers require the signature of the DRSO or an RRSO, or an individual authorized by the DRSO to approve the transfer of gauges.

14.4 When transporting any radioactive source, a copy of this Materials Policy and Procedure Directive shall be within arm's length of, and visible to, the driver in the front seat or cab of the vehicle.

14.5 All possible means shall be provided to ensure that the nuclear gauge is as far away from the passenger compartment as possible. Transportation of nuclear gauges is to be in accordance with one of the following methods. No exceptions are allowed.

14.6 Follow all applicable requirements when transporting the gauge. See checklist in Attachment #5.

14.7 When transporting a field nuclear gauge, the handle shall be locked in the shielded position (radioactive source shielded), and the shutter (sliding block) fully closed. Place the gauge in the transport case and lock the case. Block and brace the gauge to prevent movement during transport and lock the gauge in or to the vehicle. This shall be achieved by placing the gauge in the locked transport case which is secured to the nuclear gauge containment system that is fastened to the transport vehicle. Ensure all mechanisms are in the locked position. No radiation labels shall be applied to the outside of the nuclear gauge containment system.

14.8 When transporting laboratory nuclear gauges, the gauge shall be locked in its approved transport case. The transport case containing the laboratory nuclear gauge shall be so blocked and braced in the transportation vehicle such that it cannot change position during conditions normally incident to transportation. The laboratory nuclear gauge shall never be unattended during transport.

14.9 Two levels of security shall be maintained at all times. Nuclear gauges shall be securely locked in the transportation vehicle as shown below.

14.9.1 Pick-up truck: In the extreme rear of the vehicle.

14.9.2 Sedan: In the trunk of the vehicle.

14.9.3 Van: In the rear of the vehicle as far from the occupants as possible.

14.9.4 Gauges shall not be transported in the passenger area of the vehicle.

14.9.5 The Department Radiation Safety Officer shall be contacted for approval of any other method of transportation utilized.

14.10 The DRSO shall maintain records that indicate the location of all Department gauges statewide.

14.11 The RRSO shall maintain records that indicate the location of all Department gauges currently being utilized within their Region. Following gauge transfers by an RRSO within their region, the DRSO shall be immediately notified via fax or email. A corresponding copy of the "Radioactive Materials Unit Transportation/Transfer Receipt Form" shall be promptly sent to the Materials Group Standardization Unit (Annex).

14.12 The DRSO may transfer gauges directly to construction offices. In such cases, the RRSO shall be notified.

14.13 The DRSO may transfer gauges to the RRSO for distribution to construction offices.

14.14 The RRSO may only transfer gauges to construction offices within their Region.

14.15 Gauges shall not be transferred from construction office to construction office.

14.16 Gauges not scheduled for use for extended periods [approximately ninety (90) days] shall be returned to the Materials Group Standardization Unit (Annex).

15. STORAGE FACILITIES

15.1 Nuclear gauges (field and laboratory) shall be properly secured against unauthorized removal at all times when they are not in use.

15.2 When not in use on the job site, each field nuclear gauge shall be stored at all times in its approved, locked transport case which is attached inside the locked nuclear gauge containment system (ensure all locking mechanisms are in the locked position).

15.3 A field nuclear gauge stored at a temporary job site away from Central or Regional storage facilities shall be stored as specified below:

15.3.1 If within a fenced-in or otherwise secured ADOT vehicle storage/parking area, a field nuclear gauge may be stored up to sixty-six (66) hours in the locked transport case which is attached inside the locked nuclear gauge containment system which is bolted to the bed of the truck with all locking mechanisms in the locked position.

15.3.1.1 When an operator is in travel status, overnight storage of the gauge must be pre-approved by the DRSO and/or RRSO. If either the DRSO or RRSO grants approval, the DRSO or respective RRSO shall be notified promptly.

15.3.2 If it is anticipated the storage will exceed sixty-six (66) hours, the gauge must be stored in a locked and fixed (non-portable) storage unit, or in a locked storage room, within a secured office, laboratory, warehouse, or storage building. The truck shall not be used on public roadways without removing the empty gauge containment system from the truck; or placing the gauge back in the containment system, with all locking mechanisms in the locked position (ensure vehicle operator is on the authorized user list).

15.3.3 Residential home storage of a gauge is prohibited.

15.4 Storage areas for all nuclear gauges shall be inspected and approved by the DRSO and/or RRSO prior to its use for actual storage.

15.5 The storage area shall be designed to prevent unauthorized access. A minimum of two independent physical controls that form tangible barriers shall be used to secure nuclear gauges from unauthorized removal or theft while in storage.

15.6 The storage area shall be located no closer than fifteen (15) feet from a permanent work station, such as a desk or work table.

15.7 The unrestricted area surrounding each storage unit throughout the state shall not exceed two (2) millirem/hr. 15.8 Storage areas shall be conspicuously posted with the following information:

15.8.1 ARRA-6 NOTICE TO EMPLOYEES. (An illustration is provided in Attachment #1.)

15.8.2 CAUTION-RADIOACTIVE MATERIALS. (An illustration is provided in Attachment #2.)

15.8.3 TITLE 12, LICENSE NO. 7-31, NOTICE FORM. (An illustration is provided in Attachment #3.)

15.8.4 EMERGENCY CONTACTS LIST. (A sample of the format for the "Emergency Contacts" list is provided in Attachment #4.)

15.9 DRSO Responsibilities

15.9.1 The DRSO shall be responsible for the main storage facility located at the Materials Group Standardization Unit (Annex).

15.9.2 The DRSO shall maintain records of permanent and temporary site locations.

15.9.3 The DRSO shall be responsible for notification to ARRA concerning new storage locations of radioactive materials.

15.9.4 The DRSO, or designated representative, shall inspect each storage facility annually for compliance with the Department's Radioactive Materials License. The DRSO shall maintain the annual inspection records.

15.10 RRSO Responsibilities

15.10.1 The RRSO shall inspect all permanent and temporary storage sites within their Region annually for compliance with the Department's Radioactive Materials License. The inspection results shall be recorded on the "Radiation Materials Inspection Report" form (see Attachment #9) and a copy shall be forwarded to the DRSO.

15.10.2 All newly designated storage sites in a Region shall be inspected by the RRSO before radioactive materials can be stored at the new location. A copy of the inspection report, along with a plan drawing of the facility and the storage area within the facility shall be promptly forwarded to the DRSO.

16. MAINTENANCE, REPAIR, AND CALIBRATION

16.1 Each nuclear gauge shall be calibrated at least every twelve (12) months. A record of gauge calibrations shall be maintained by the DRSO or his/her designated representative.

16.2 All maintenance, repair, and calibration of gauges shall be performed by personnel authorized by the DRSO.

16.3 Individuals performing the maintenance, repair, or calibration of radioactive devices must wear the TLD assigned to them.

16.4 Calibration of nuclear gauges shall be performed in accordance with the applicable standard test procedure.

16.5 To ensure that calibrations are performed at the prescribed interval; the DRSO shall utilize a system for tracking when calibrations need to be performed.

16.6 The DRSO shall coordinate the required scheduling for gauge calibration with each RRSO and/or gauge user.

16.7 If any malfunction in a gauge is detected, the DRSO shall be contacted immediately.

17. RECORDS

17.1 The following records and documents shall be maintained for at least the minimum time period specified in the license, or applicable NRC or Agreement State regulations, unless permanent retention is specified below. In the absence of a specific requirement, retain for at least five (5) years.

- Current license
- Current copies of the applicable state and federal regulations
- Instrument calibration records (retain permanently)
- Personnel exposure records (retain permanently)
- Evaluation of dose to members of the public
- Records of receipt of radioactive materials
- Physical inventory of radioactive material
- Records of transfer of shipment of radioactive materials
- Gauge utilization log
- Radiation safety training documentation (initial and refresher)
- Hazmat training documentation (initial and refresher)
- Radiation and contamination surveys (retain permanently)
- Leak test records
- Audits of the radiation safety program
- Copy of the IAEA Certificate of Competent Authority for each source
- Type A package testing results
- Shipping papers

Bill Hurguy, P.E.
Assistant State Engineer
Materials Group

Attachments (12)

ARRA-6 (2012) R

ARIZONA RADIATION REGULATORY AGENCY

NOTICE TO EMPLOYEES

**STANDARDS FOR PROTECTION AGAINST RADIATION;
NOTICES, INSTRUCTIONS AND REPORTS TO WORKERS;
INSPECTIONS**

In Articles 4 and 14 of the Arizona Radiation Regulatory Agency (ARRA) rules for the Control of Radiation, the Arizona Radiation Regulatory Agency has established standards for your protection against radiation hazards. In Article 10 of the rules for the Control of Radiation, the Arizona Radiation Regulatory Agency has established certain provisions for the options of workers engaged in work under an ARRA license or registration.

YOUR EMPLOYER'S RESPONSIBILITY

Your employer is required to –

1. Apply these rules to work involving sources of radiation.
2. Post or otherwise make available to you a copy of the Arizona Radiation Regulatory Agency rules, licenses, and operating procedures which apply to work you are engaged in, and explain their provisions to you.
3. Post notice of violation involving radiological working conditions, proposed imposition of civil penalties, and orders.

YOUR RESPONSIBILITY AS A WORKER

You should familiarize yourself with those provisions of the Arizona Radiation Regulatory Agency rules and the operating procedures which apply to the work you are engaged in. You should observe their provisions for your own protections and protection of your co-workers.

WHAT IS COVERED BY THESE RULES

1. Limits on exposure to radiation and radioactive material in restricted and unrestricted areas;
2. Measures to be taken after accidental exposure;
3. Personnel monitoring, surveys, and equipment;
4. Caution signs, labels, and safety interlock equipment;
5. Exposure records and reports;
6. Options for workers regarding ARRA inspections; and
7. Related matters.

REPORTS ON YOUR RADIATION EXPOSURE HISTORY

1. The Arizona Radiation Regulatory Agency rules require that your employer give you a written report if you receive an exposure in excess of any applicable limit set forth in the rules or in the license. The basic limits for exposure to employees are set forth in Articles 4 and 14 of the Rules. These sections specify limits on exposure to radiation and exposure to concentrations of radioactive material in air and water.

2. If you work where personnel monitoring is required, and if you request information on your radiation exposures,
   (a) Your employer must give you a written report, upon termination of your employment, of your radiation exposures, and
   (b) Your employer must advise you annually of your exposure to radiation.

INSPECTIONS

All licensed or registered activities are subject to inspection by representatives of the Arizona Radiation Regulatory Agency. In addition, any worker or representative of workers who believes that there is a violation of the regulations issued thereunder, or the terms of the employer's license or rules with regard to radiological working conditions in which the worker is engaged, may request an inspection by sending a notice of the alleged violation to the Arizona Radiation Regulatory Agency. The request must set forth the specific grounds for the notice, and must be signed by the worker as a representative of the workers. During inspections, ARRA inspectors may confer privately with workers, and any worker may bring to the attention of the inspectors any past or present condition which he believes contributed to or caused any violation as described above.

INQUIRIES

Inquiries dealing with the matters outlined above can be sent to the:

**ARIZONA RADIATION REGULATORY AGENCY
4814 South 40th Street, Phoenix, Arizona 85040
(Office (602) 255-4845, Fax (602) 437-0705)
WWW.AZRRA.GOV**

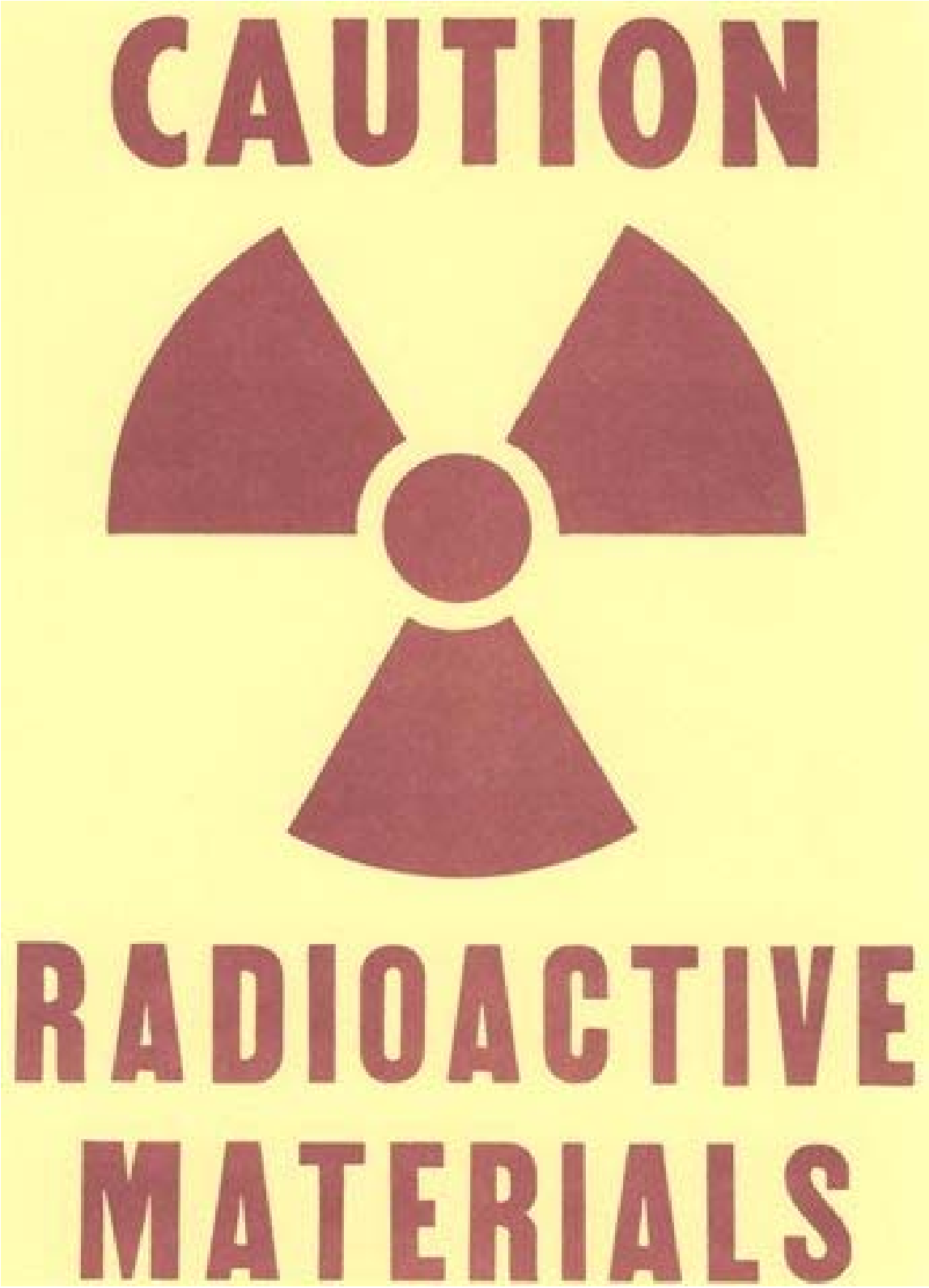
POSTING REQUIREMENT

IN ACCORDANCE WITH A.A.C. R12-1-1002, COPIES OF THIS NOTICE SHALL BE POSTED IN SUCH A MANNER TO PERMIT EMPLOYEES WORKING IN OR FREQUENTING ANY PORTION OF A RESTRICTED AREA, USED FOR ACTIVITIES LICENSED OR REGISTERED PURSUANT TO ARTICLE 2 OR ARTICLE 3, OF THE AGENCY'S RULES, TO OBSERVE A COPY OR COPIES ON THE WAY TO OR FROM THEIR WORK AREA.

NOTICE: ---------- PURSUANT TO R12-1-1002 B. ARIZONA ADMINISTRATIVE CODE, THE FOLLOWING DOCUMENT(S) REGARDING REGULATED USES OF RADIATION ARE LOCATED AS INDICATED AND ARE AVAILABLE DURING NORMAL DUTY HOURS.

License and/or Registration, any "Notice of Violation", or order issued by the ARRA : ORCBS or www.orcbs.arizona.edu Regulations relating to use : ORCBS or www.azrra.gov

Operating or Use Procedure : Contact Approval Holder/Approval Safety Coordinator Certified : Daniel Silvain, M.S., DABR., Radiation Safety Officer Date : September 24, 2012



(Red or magenta legend on yellow background)

ADOT
Intermodal Transportation

Janice K. Brewer, Governor
John S. Halikowski, Director
Jennifer Toth, State Engineer
Robert Samour, Senior Deputy State Engineer, Operations
Dallas Hammit, Senior Deputy State Engineer, Development

- NOTICE -

ARTICLES 4 AND **10** OF THE STATE OF ARIZONA, OFFICIAL COMPILATION OF ADMINISTRATIVE RULES AND REGULATIONS, TITLE 12; THE RADIOACTIVE MATERIALS LICENSE (NO. 7-31); AND RELATED CORRESPONDENCE; ARE ON FILE AT THE MATERIALS GROUP QUALITY ASSURANCE SECTION AND AT EACH MATERIALS GROUP REGIONAL LABORATORY.

EMERGENCY CONTACTS

The Regional Radiation Safety Officer and/or the Department Radiation Safety Officer should be the first person(s) contacted. In the event they cannot be reached, their designated Alternates should be contacted.

EMERGENCY CONTACT PERSONNEL				
RADIATION SAFETY OFFICER (RSO)	TITLE	LOCATION	WORK #	HOME/CELL#
CRAIG WILSON	DEPARTMENT RSO	MATERIALS CENTRAL LAB	602-712-7974	602-448-1549
ROBERT COBLE	ALTERNATE DEPARTMENT RSO	MATERIALS CENTRAL LAB	602-712-7741	623-826-5791
LIBRADO RAMIREZ	ALTERNATE DEPARTMENT RSO	MATERIALS CENTRAL LAB	602-712-7742	602-525-2700
SHANE LITTLE	REGIONAL RSO	PHOENIX REGIONAL LAB	602-712-6735	623-521-3013
JEREMY BARNES	ALTERNATE REGIONAL RSO	PHOENIX REGIONAL LAB	602-712-6575	602-390-6499
ABRAHAM MENDOZA	REGIONAL RSO	TUCSON REGIONAL LAB	520-388-4274	520-409-6215
MARIO CASTILLO	ALTERNATE REGIONAL RSO	TUCSON REGIONAL LAB	520-388-4270	520-820-1122
MARK HANNO	REGIONAL RSO	PRESCOTT REGIONAL LAB	928-777-5894	928-533-9083
PAUL BERRY	ALTERNATE REGIONAL RSO	PRESCOTT REGIONAL LAB	928-777-5902	928-300-1128
JON ULIBARRI	REGIONAL RSO	FLAGSTAFF REGIONAL LAB	928-779-7537	928-606-0553
DWIGHT DAY	ALTERNATE REGIONAL RSO	FLAGSTAFF REGIONAL LAB	928-779-7537	928-525-9344

The Department Radiation Safety Officer shall be the primary contact with the Arizona Radiation Regulatory Agency, and other local authorities, as appropriate in accordance with R12-1-445.

In the event that a Radiation Safety Officer or an alternate cannot be contacted from the above list, contact:

Arizona Radiation Regulatory Agency 602-255-4845

Department of Public Safety
Watch Commander 602-233-2212

ADOT Radiation Safety Shipping Checklist

Gauge Model _____ Serial Number _____

PACKAGE INSPECTION:

_____ Gauge locked in safety position
_____ Shipping case in unimpaired physical condition except for superficial marks
_____ Tamper-evident security seal applied to shipping case

PACKAGE MARKING AND LABELS:

_____ Proper shipping name (with RQ designation, if applicable)
_____ Correct label type (Yellow II, White I)
_____ Correct nuclide(s), activities in SI units (i.e. GBq)
_____ Correct Transport Index (dose rate at 1 meter in millirem/hour)
_____ Type A package label
_____ Ship-to address matches label, bill of lading
_____ Cargo Aircraft Only Label (for air shipments)

SHIPPING PAPERS:

_____ Reportable quantity designation (RQ) if package contains Am-241
_____ Proper shipping name, UN ID, Hazard Class (e.g., Radioactive material, Type A package, Special form, UN3332, 7)
_____ Nuclide(s) and activities in SI units (i.e., GBq)
_____ Type A package specification
_____ Label specification (e.g., Yellow II, White I)
_____ Transport index (TI)
_____ Package dimensions (with unit of measure)
_____ Emergency contact telephone number listed
_____ Shipper's certification signed
_____ Emergency response information sheet attached
_____ IAEA Certificates listed and attached (for air shipments)

Checked by (Initials): _____ Date : _____

2/7/13

ADOT Public Dose Calculation Worksheet

To demonstrate compliance, this document must show the maximum dose to any *member of the public* will be less than 100 millirems in a year and the maximum dose in any *unrestricted area* will be less than 2 millirems in any one hour. The typical limiting case involves the storage of gauges. Several simplifying and conservative assumptions are made in this calculation method. More realistic assumptions can be made or actual measured dose rates can be used if necessary to demonstrate compliance.

- No shielding other than the shielding in the gauge is assumed to be present.
- All gauges are assumed to be at the same distance as the closest gauge.
- Sources are assumed to remain in the shielded position within the gauge.
- Each gauge is assumed to be a point source and dose rates are assumed to decrease with the inverse square of distance from the gauge.
- Gauges are assumed to be in storage all of the time.

Step	Instruction	Result
	DOSE TO MEMBER OF PUBLIC IN ONE YEAR	
1.	Identify the individual member of the public likely to receive the highest dose from gauges in storage. This will be the person who spends the most time in the vicinity of the stored gauges or who is closest to the gauges. This individual will be the focus of the calculation.	
2.	Determine the maximum dose rate in millirem/hr at a distance of three feet (1 meter) for each gauge kept in the storage location. This value may be obtained from the radiation profile in the gauge operation manual, from the manufacturer, or from Transport Index on the Yellow II label on the transport case. Calculate the sum of the dose rate values for all of the gauges that may be stored at this location and enter the result. Remember to include both gamma and neutron dose.	
3.	Enter the distance in feet from the position occupied by the person identified in step 1 to the nearest gauge in the storage area.	
4.	Calculate the square of the distance from step 3 and enter the result.	
5.	Divide the value from step 4 by 9 and enter the result. This is a factor which accounts for the difference between the dose rate at 3 feet and the dose rate at the distance at which the person is located.	
6.	Divide the dose rate (millirem/hr) from step 2 by the result from step 5 and enter the result.	
7.	Enter the number of hours in a year that the individual will be present in the vicinity of the gauges. For example, an individual working full-time near the gauges, would be present approximately 2000 hrs in a year (8 hrs per day x 5 days per week x 50 weeks per year).	
8.	Multiply the result from step 6 by the result from step 7 and enter the result. This is the maximum dose in millirem the individual could receive in one calendar year. If this value is less than 100 millirem, the annual dose limit is met; continue with step 9 to determine if the unrestricted area dose rate limit is met.	

	DOSE IN UNRESTRICTED AREAS IN ONE HOUR	
9.	Determine the minimum distance in feet to any unrestricted area outside the gauge storage area and record the value. This could be an area above, below, or adjacent to the storage area that is unrestricted for the purpose of radiation control. The area need not be occupied, just accessible to members of the public, which may include company employees.	
10.	Calculate the square of the distance from step 9 and enter the result.	
11.	Divide the value from step 10 by 9 and enter the result. This is a factor which accounts for the difference between the dose rate at 3 feet and the dose rate at the distance in step 9.	
12.	Divide the dose rate (millirem/hr) from step 2 by the result from step 11 and enter the result. This is the maximum dose in millirem that could be received in one hour in the closest unrestricted area. If this value is less than 2 millirem, the dose limit for unrestricted areas is met.	

Calculations performed by _____ Date _____

If either dose limit is exceeded, you should either recalculate that dose using more realistic assumptions and data or take steps to reduce the dose received by members of the public using the principles of time, distance, and shielding.

- Limit the time personnel spend in the vicinity of the gauges
- Increase the distance between the gauges and personnel
- Add shielding to reduce the dose rate

Occupancy Factors

The following occupancy data may be used when data for specific personnel are not available.

Area	Occupancy Factor (T)
Work areas such as offices, laboratories, shops, wards, nurses' stations; living quarters; children's play areas; and occupied space in nearby buildings.	Full Occupancy (T=1)
Corridors, rest rooms, elevators using operators, unattended parking lots.	Partial Occupancy (T=1/4)
Waiting rooms, toilets, stairways, unattended elevators, janitor's closets, outside areas used only for pedestrians or vehicular traffic.	Occasional Occupancy (T=1/16)

Reference: NCRP Report No. 49, Structural Shielding Design and Evaluation for Medical Use of X-Rays and Gamma Rays of Energies Up to 10 MeV, 1976

Shielding Half-Values*

Material	Cs-137 Gamma Radiation	AmBe Neutron Radiation
Lead	¼ in.	N/A
Concrete	2 in.	4 in.

*The half-value is the thickness of material that will reduce the dose rate by one-half.

ADOT Intermodal Transportation

ADOT RADIATION SAFETY PROGRAM AUDIT CHECKLIST

Licensee name _____ License No._____

Auditor's name (print) _____ Date of Audit _____

Auditor's signature _____

Audit Item	Yes	No	Comments
1. Audit History			
a. Last audit at this location (date)?			
b. Were previous audits conducted yearly?			
c. Were any deficiencies noted during the last two audits? Any deficiencies repeated?			
d. Were corrective actions taken?			
2. Organization and Scope of Program			
a. If the mailing address or place of use changed, was the license amended?			
b. If the RSO changed, was the license amended? Does the new RSO meet the training requirements?			
c. Does the license authorize all of the radionuclides in the gauges possessed?			
d. Are the actual uses of gauges consistent with the authorized uses on the license?			
e. Is the RSO fulfilling his/her duties?			
3. Training and Instructions to Workers			
a. Have all workers received initial radiation safety training? Refresher training?			
b. Have all workers received required Hazmat training? Refresher training?			
c. Are training records maintained for each individual?			
d. Did interviews/observations reveal gauge operators know emergency procedures? Leak testing procedures? Service procedures? Transportation procedures?			

4. Radiation Detection Instruments			
a. Is a survey meter available for radiation measurements? Frisker for contamination measurements?			
b. Have the instruments been calibrated within the last year?			
c. Are calibration records maintained?			
d. Are operation checks performed prior to use?			
5. Gauge Inventory			
a. Is a record kept showing receipt of each gauge?			
b. Are all gauges physically inventoried at least every six months?			
c. Are records of inventories maintained?			
6. Personnel Radiation Protection			
a. Are ALARA considerations incorporated into the radiation safety program?			
b. Are all personnel assigned TLD badges?			
c. Do all personnel wear their TLD badges in the restricted area and when handling gauges? Are badges properly stored when not in use?			
d. Are TLD badges exchanged at least quarterly and processed by a NVLAP accredited organization?			
e. Are dosimetry reports reviewed by the RSO when received?			
f. If a worker declared her pregnancy, were the applicable requirements met?			
g. Were radiation and contamination surveys in restricted and unrestricted areas performed quarterly?			
h. Are records of surveys maintained?			

Audit Item	Yes	No	Comments
7. Public Dose			
a. Are gauges used and stored in a manner to keep public doses below 100 millirem in a year?			
b. Has a survey or evaluation been performed to demonstrate public dose limits are met? (indicate the date)			
c. Have there been any changes in the use or storage of gauges or in the use of surrounding areas that would necessitate a new survey or evaluation?			
d. Are unrestricted area radiation levels less than 2 millirem in any one hour?			
e. Are gauges stored in a manner to prevent unauthorized use or removal?			
f. Are records maintained?			
8. Operating and Emergency Procedures			
a. Are current copies of operating and emergency procedures available to each individual?			
b. Did any emergencies occur? Were they properly handled?			
9. Leak Tests			
a. Was each customer gauge leak tested upon receipt?			
b. Are leak tests performed in accordance with procedures?			
c. Is each gauge in inventory leak tested at least every 6 months?			
d. Are records of leak test results maintained for each gauge?			
e. Were any sources found leaking?			
10. Maintenance of Gauges			
a. Are procedures followed for cleaning and lubrication of gauges?			
b. When the source rod is removed from the gauge is it stored in a shielded pig?			
c. Do personnel observe good ALARA practices?			

Audit Item	Yes	No	Comments
11. Transportation			
a. Are DOT 7A packages used for transport of gauges? Is documentation of package testing maintained?			
b. Is special form source documentation maintained?			
c. Packages have two labels (e.g. Yellow-II) on opposite sides with TI, nuclide, activity, and hazard class? Cargo only label?			
d. Packages are properly marked?			
e. Packages are inspected prior to shipment?			
f. Packages are sealed (cases locked)?			
g. Shipping papers are properly prepared for all gauges shipped?			
h. Bill of lading (shipping papers) and emergency instructions are within drivers reach during transport?			
i. Packages are not carried in passenger compartment of vehicle?			
j. Packages are secured against movement in vehicle?			
12. Notifications and Reports			
a. Was any radioactive material lost or stolen? Were reports made?			
b. Did any overexposures occur? Were reports made?			
c. If any events occurred, was the root cause determined and corrective actions taken?			
13. Posting and Labeling			
a. "Notice to Workers" posted?			
b. Notice posted stating where workers can read a copy of the regulations and license?			

14. Summary of Deficiencies Identified During Audit (attach additional sheets as necessary)	
Deficiencies	Proposed Corrective Actions/Planned Completion Date

15. Other Recommendations for Improvement (attach additional sheets as necessary)

ADOT Intermodal Transportation

DECLARATION OF PREGNANCY

I hereby voluntarily declare that I am pregnant.

My best estimate of the date of conception is _____ (mm/dd/yyyy)

While this declaration is in effect, I agree to abide by all restrictions deemed necessary by Arizona Department of Transportation to keep the occupational exposure to my unborn child below 500 mrem. This may include accepting reassignment to different job at equal pay for the duration of the pregnancy.

I understand that I may revoke this declaration at any time by providing written notification to the Department Radiation Safety Officer.

Name (print) _____ EIN or SSN _____

Signature _____ Date _____

TO BE COMPLETED BY DRSO

Received by _____ Date _____

Department Radiation Safety Officer

1. Dose estimate for period from conception to declaration: _____ mrem

2. Dose that may be received during remainder of pregnancy: _____ mrem
   (500 mrem - line 1) If line 1 > 450 mrem, enter 50 mrem.

3. Likely to receive > 50 mrem during pregnancy? Yes ____ No
   (If yes, monitoring required.)

ADOT Intermodal Transportation

ARIZONA DEPARTMENT OF TRANSPORTATION
RADIOACTIVE MATERIALS INSPECTION REPORT

CENTRAL LAB ☐ CONST. OFFICE ☐
REGIONAL LAB ☐ FIELD LOCATION ☐

Org. Number: _____

Facilty Name or Project #: _____

Facility Location or Vehicle #: _____

		Y	N	NA
1.	**STORAGE**			
a.	Is gauge stored in its transportation case?	☐	☐	☐
b.	Is gauge stored in locked storage unit?	☐	☐	☐
c.	Is storage unit within a locked building or facility?	☐	☐	☐
d.	Transport case is in an unimpaired physical condition?	☐	☐	☐
e.	Hinges, hasps, and latches are in good condition?	☐	☐	☐
f.	Plan or drawing of facility and location of gauge storage area within facility?	☐	☐	☐
2.	**SURVEYS AND MONITORING**			
a.	Has a radiation survey been performed outside the storage area?	☐	☐	☐
b.	Have there been any changes to the storage, security, or use of surrounding areas that would necessitate a new survey?	☐	☐	☐
c.	Survey equipment calibrated and operational?	☐	☐	☐
d.	Personnel monitoring devices used by only those individuals to whom the device has been issued?	☐	☐	☐
e.	Control badges stored in a non-radiation area?	☐	☐	☐
3.	**POSTING AND LABELING**			
a.	ARRA-6 NOTICE TO EMPLOYEES	☐	☐	☐
b.	CAUTION-RADIOACTIVE MATERIALS	☐	☐	☐
c.	TITLE 12, 7-31, NOTICE FORM	☐	☐	☐
d.	EMERGENCY CONTACT LIST	☐	☐	☐
e.	Transport case has required labels (1) DOT label and (2) Yellow II labels?	☐	☐	☐
f.	Utilization Log (standard count logbook)?	☐	☐	☐
g.	Radiation Safety Manual / Gauge Operating Procedures?	☐	☐	☐
4.	**TRANSPORTATION**			
a.	Is individual transporting a nuclear gauge on the approved operator's list?	☐	☐	☐
b.	Is individual transporting nuclear gauge wearing a TLD?	☐	☐	☐
c.	Is a Transportation/Transfer Receipt Form completed and visible to the driver in the cab of the vehicle?	☐	☐	☐
d.	Is nuclear gauge locked (padlock in handle) and in its approved transport case secured free from movement?	☐	☐	☐
e.	Is nuclear gauge as far away from the passenger compartment as possible?	☐	☐	☐
f.	If transporting nuclear gauge in a closed vehicle, is vehicle locked?	☐	☐	☐
g.	If transporting nuclear gauge in an open bed vehicle, is the gauge secured to the vehicle?	☐	☐	☐

		Y	N	NA
5.	**OPERATION**			
a.	Is individual operating nuclear gauge on the approved operator's list?	☐	☐	☐
b.	Is individual operating nuclear gauge wearing a TLD?	☐	☐	☐
c.	Does operator of nuclear gauge maintain control of gauge at all times?	☐	☐	☐
d.	When nuclear gauge is not in use, is gauge locked in safe position and returned to its transport case for storage?	☐	☐	☐
e.	Does operator practice the ALARA concept at all times?	☐	☐	☐
6.	**RECORDS**			
a.	ARRA License 7-31, Amendments and letters legible and on file?	☐	☐	☐
b.	Training records/Licensed Operators list current and on file?	☐	☐	☐
c.	Leak Test/ Physical Inventory records current and on file?	☐	☐	☐
d.	Dosimetry reports current and on file?	☐	☐	☐
e.	Accumulative Dosage records current and on file?	☐	☐	☐
f.	Transportation/ Transfer Receipt records current and on file?	☐	☐	☐
g.	Calibration and Maintenance records current and on file?	☐	☐	☐
h.	Audits and other reviews of program content and implementation current and on file?	☐	☐	☐
7.	**INSPECTION RESULTS**			
a.	Were all applicable conditions reviewed? (if no, describe under remarks)	☐	☐	☐
b.	Were any deficiencies identified? (if yes, describe under remarks)	☐	☐	☐
c.	Corrective actions planned or taken? (if yes, describe under remarks)	☐	☐	☐

8. REMARKS

_____

_____

_____

_____

INSPECTORS NAME: _____

INSPECTORS TITLE: _____

SIGNATURE: _____

DATE: _____

2/7/2013

ADOT Intermodal Transportation

ARIZONA DEPARTMENT OF TRANSPORTATION
SIX-MONTH LEAK TEST / INVENTORY REPORT

The ARRA Radioactive Materials License No. 7-31 requires ADOT to conduct a leak test and physical inventory every six months on all sealed sources of radioactive material covered by the referenced license. To assure compliance, complete this form for each sealed source in your respective region and return to the Department Radiation Safety Officer.

Fill in the blanks or circle the appropriate information.

Gauge Manufacturer: Troxler CPN Humboldt

Gauge Model No. 501 3241 4640 5001

Gauge Serial No. _____

Isotope: Cs-137 Am-241:Be
Activity: 8mCi 10mCi 40mCi 50mCi 100mCi

Gauge Location: _____ _____
Org. No. _____
Address

Leak Test / Inventory Date: _____

Taken By: (print name) _____

(signature) _____

Log Book Entry Dated and Signed or Initialed: Yes No

Date of Previous Leak Test: _____

DO NOT WRITE BELOW THIS LINE

This is to certify the above described smear has been assayed at our facilities for indication of source leakage.

Our findings show the leakage to be

ALPHA	BETA-GAMMA

Certified By: _____ Date: _____
Arizona State University

ARIZONA DEPARTMENT OF TRANSPORTATION

SIX-MONTH LEAK TEST / INVENTORY REPORT

LEAK TEST INSTRUCTIONS

1. Using a ball-point or permanent type ink pen, fill out the Six-Month Leak Test / Inventory Report as indicated on the form.

2(a) For 5001 series gauges, remove the front panel of the gauge. Looking into the gauge interior, wipe the label or cover areas of the Am-241:Be capsule with the Q-tip, as instructed in the ADOT Radiation Safety Training Course (or call the Department or Regional Radiation Safety Officer for instruction). After wiping the first source do not touch the cotton swab with any part of your hands.

2(b) With the gauge on its side and the base away form the operator, wipe the area around the metal wiper ring in the removable plate on the bottom surface of the gauge. This will complete the leak test for the 5001 series gauges.

2(c) Return the Q-tip to the plastic envelope and return the completed form and leak test kit to the Department Radiation Safety Officer.

3. For Model 4640 (Thin Layer Density), Model 3241 (Asphalt Content), and Model 501 (Down Hole Probe) gauges, leak testing shall be performed in accordance with the manufacturer's instructions. After wiping the source(s), complete step 2(c).

4. Enter date of leak test and sign or initial the entry into the log book for the gauge. Also, note the same on the front of this form; and note the date that the gauge was previously leak tested on the front of this form.

ARIZONA DEPARTMENT OF TRANSPORTATION

RADIOACTIVE MATERIALS UNIT
TRANSPORTATION/TRANSFER RECEIPT FORM

A copy of this form must be visible to the driver in the cab of the vehicle when transporting the device listed below.

IN CASE OF EMERGENCY CONTACT THE DEPARTMENT OF PUBLIC SAFETY (DPS) - (602) 223-2212

THREE PART FORM - PLEASE PRESS FIRMLY

TO: ADOT ORG: _____ FROM: ADOT ORG: _____

_____ CITY / TOWN _____ CITY / TOWN

HAZARDOUS MATERIAL

PROPER SHIPPING NAME: RQ, RADIOACTIVE MATERIAL, SPECIAL FORM, N.O.S.
HAZARD CLASS: RADIOACTIVE MATERIAL
IDENTIFICATION NUMBER: UN3332
TRANSPORT LABEL: YELLOW II
TRANSPORT INDEX: 0.4 mR/Hr.

MFR.	MODEL #	SERIAL #	TYPE	ISOTOPE	ACTIVITY (mCi)
				Cs.137	8, 10
				Am-241:Be	40, 50, 100, 300

MFR: C=CPN; H=Humboldt; T-Troxler. Type: MD = Moisture/Density; DP = Depth Probe; AC = Asphalt Content

_____ SHIPPING CASE	_____ OPERATOR/SAFETY MANUAL	_____ REMOTE CONTROLLER
_____ STANDARD BLOCK	_____ LOCK & GAUGE	_____ PRINTER
_____ HAMMER	_____ CHAIN W/LOCK	_____ SAMPLE PANS
_____ KEYS	_____ CABLE, _____	_____ CLEANING BRUSH
_____ SCRAPER PLATE	_____ CABLE CLAMP	_____ CABLE RS232C
_____ DRILL ROD	_____ CABLE COUPLING	_____ PLUG FIXTURE
_____ ROD EXTRACTION TOOL	_____ DUMMY PROBE W/CORD	_____ CHARGER
_____ LOG BOOK	_____ SCALER	_____ _____
_____ _____	_____ _____	_____ _____
_____ _____	_____ _____	_____ _____

By signing below I acknowledge receipt of the above nuclear device and accessories, and certify that I have received radiation safety training in accordance with the requirements of ARRA License No. 07-031.

TRANSFERRED BY:	RECEIVED BY:
Signature/ Date _____	Signature/ Date _____
Print Name/ Badge No.: _____	Print Name/ Badge No.: _____

44-0600 R9/02

WHITE : MATERIALS ANNEX YELLOW: USER PINK: REGIONAL RSO

ADOT Intermodal Transportation

SEMI-ANNUAL (MARCH, SEPTEMBER) NUCLEAR GAUGE INVENTORY

Region:_____

Gauge State Number	Gauge Serial Number	Gauge Model Number	Gauge Make	Location and Org	Regional Radiation Safety Officer or Alternate name coordinating gauge inventory	Date and time of physical inventory	Name and EIN of person performing physical inventory

INSTRUCTIONS: The Regional Radiation Safety Officer and/or their Alternate must first identify all radioactive materials (gauges) and their locations within the Region by review of Transfer/Receipt forms. Once radioactive materials (gauges) locations are identified the RRSO or Alternate will contact the user of the radioactive materials (gauges) and have those personnel perform a physical inventory of the radioactive materials. All columns above must be completed. Once all radioactive materials inventory is identified and documented send the completed copy to the Department Radiation Safety Officer as soon as possible.

2/7/13