



## CHANGE LETTER

James P. Delton  
Assistant State Engineer

POLICY AND PROCEDURE DIRECTIVES MANUAL	CHANGE LETTER NO. 13
SUBJECT:  Title Page; Table of Contents; Policy and Procedure Directives No. 16b, No. 21, and No. 22.	EFFECTIVE DATE:  January 6, 2011

### SUMMARY:

NOTE: Unless otherwise specified, changes issued under this Change Letter will be effective for projects with a bid opening date on or after January 6, 2011. Retain items removed from the Materials Policy and Procedure Directives Manual under this change letter for use, as necessary, on projects with a bid opening date prior to January 6, 2011.

1. TITLE PAGE - The Title Page has been revised to show the latest Change Letter number and revision date.
2. TABLE OF CONTENTS - The Table of Contents has been revised to reflect the changes made in this Change Letter.
3. The following Policy and Procedure Directive is revised by this Change Letter.

#### P.P.D. No. 16b, "ADOT RADIATION SAFETY PROGRAM"

The following Subsections of this PPD have been revised:

3.5.2.2  
3.5.3.2  
3.5.4.2  
4.1 through 4.4  
12.4  
12.8  
15.3  
15.3.1  
15.3.2

4. The following new Policy and Procedure Directives are issued by this Change Letter.

P.P.D. No. 21, "SAMPLING, TESTING, AND ACCEPTANCE  
OF GLASS BEADS (SPHERES) FOR STRIPING  
MATERIALS"

P.P.D. No. 22, "QUALIFICATION AND SPECIFICATION  
REQUIREMENTS FOR THE MANUFACTURING  
OF PRECAST/PRESS CONCRETE BRIDGE  
MEMBERS"

**Please note that the effective date of PPD No. 22 is May 3, 2011.**

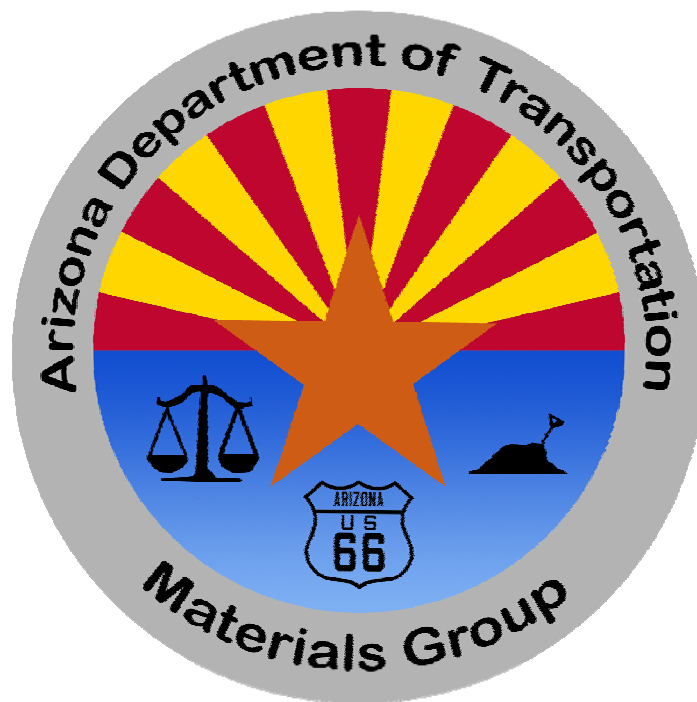
A handwritten signature in black ink, appearing to be 'J. Delton', written over a horizontal line.

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Assistant State Engineer  
Materials Group

# **MATERIALS**

## **POLICY AND PROCEDURE**

### **DIRECTIVES MANUAL**



PREPARED BY:  
ARIZONA DEPARTMENT OF TRANSPORTATION  
INTERMODAL TRANSPORTATION DIVISION  
MATERIALS GROUP

REVISED TO CHANGE LETTER NO. 13  
(January 6, 2011)





# **MATERIALS**

## **POLICY AND PROCEDURE**

### **DIRECTIVES MANUAL**

#### **TABLE OF CONTENTS**

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----	02/27/09	Introduction
1	02/27/09	Sampling, Testing, and Acceptance of Reinforcing Bars
2	02/27/09	Certification and Acceptance of Chemical and Air-Entraining Admixtures for Portland Cement Concrete
3a	04/14/10	Curing Compounds
4	02/27/09	Asphaltic Concrete Mix Design Proposals and Submittals
5a	04/14/10	Evaluation of Concrete Aggregate Sources
6	02/27/09	Provisional Seal Coat
7	02/27/09	Inspection of Concrete Batch Plants and Concrete Mixer Trucks
8	02/27/09	Sampling, Testing, and Acceptance of Emulsified Bituminous Materials
9	02/27/09	Guidelines for Inspection and Acceptance of Timber Guardrail Posts and Blocks
10	02/27/09	End Product Asphaltic Concrete Acceptance Testing – Procedure for Determination of Statistical Outliers

11	02/27/09	Approval of Laboratories to Perform Testing of Bearing Pads for the Department
12	02/27/09	Review of Test Results and Issuance of Test Reports
13a	04/14/10	Certification and Acceptance of Hydraulic Cements, Fly Ash, Natural Pozzolan, Silica Fume, and Lime
14	02/27/09	Testing and Certification of Bituminous Distributor Trucks
15	02/27/09	Submittal and Approval of Portland Cement Concrete Mix Designs
16b	01/06/11	ADOT Radiation Safety Program
17	02/27/09	Acquisition, Disposal, and Use of ADOT Licensed Materials Sources and Stockpile Sites
18	02/27/09	Determining Sample Times and Locations for End Product Asphaltic Concrete
19	04/14/10	ADOT System for the Evaluation of Testing Laboratories
20	04/14/10	Guidance on the use of Reclaimed Asphaltic Pavement (RAP) in Asphaltic Concrete
21	01/06/11	Sampling, Testing, and Acceptance of Glass Beads (Spheres) for Striping Materials
22	05/03/11	Qualification and Specification Requirements for the Manufacturing of Precast/Prestress Concrete Bridge Members



# POLICY AND PROCEDURE DIRECTIVE

James P. Delton  
Assistant State Engineer

TO: ALL MANUAL HOLDERS	PPD NO. 16b
SUBJECT:  ADOT RADIATION SAFETY PROGRAM	EFFECTIVE DATE:  January 6, 2011

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## 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 **As Low As Reasonably Achievable**. 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 DRSO 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            50 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 (Thermo Luminescent Dosimeter) capable of measuring gamma and neutron radiation.

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 afore mentioned 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 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.)

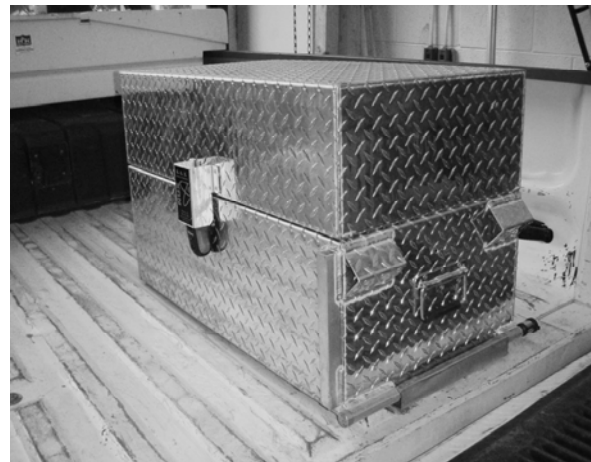
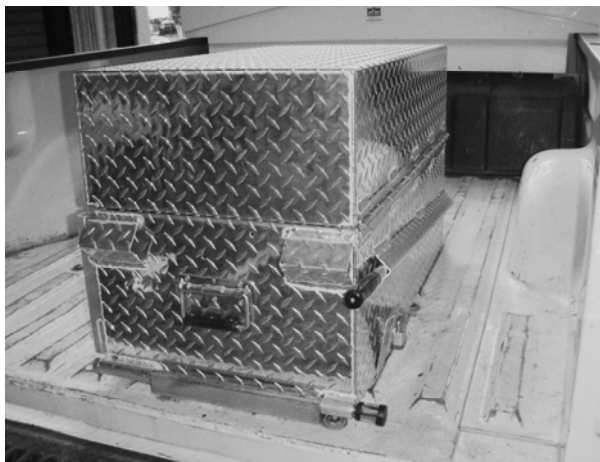
11.2 Each area in which nuclear gauges are used or stored shall be posted with a “Title 12, License No. 7.31, Notice Form” similar to Attachment #3, and a copy of the most current “Emergency Contact List” similar to the format of Attachment #4.

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 DSRO 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.

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 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.

15.3.2 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).

15.4 Storage areas for all nuclear gauges shall be inspected and approved by the Department and/or a Regional Radiation Safety Officer 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 and annual inspection reports received from the RRSO.

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

15.9.4 The DRSO shall inspect each Region's permanent storage facility annually for compliance with the Department's Radioactive Materials License.

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



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James P. Delton, P.E.  
Assistant State Engineer  
Materials Group

ARRA-6 (1993) ARIZONA RADIATION REGULATORY AGENCY

## **NOTICE TO EMPLOYEES**

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

In Article 4 of the Arizona Radiation Regulatory Agency (ARRA) rules for the Control of Ionizing 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 Ionizing 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 ionizing 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 protection 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 Article 4 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**

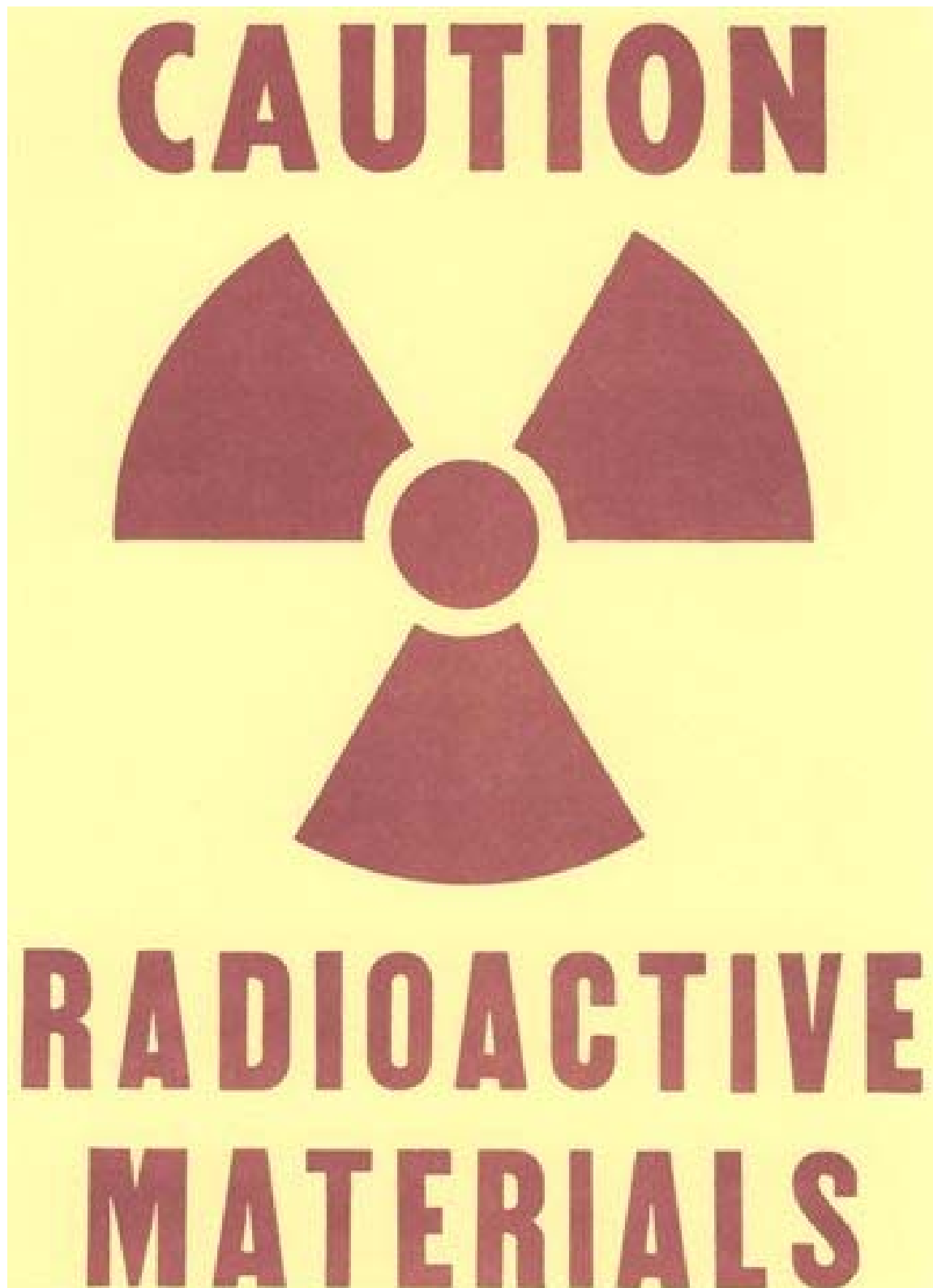
All licensed or registered activities are subject to inspection by representatives of the Arizona Radiation Regulatory Agency. In addition, any worker or representative of workers who believes that there is a violation of the regulations issued thereunder, or the terms of the employer's license or rules 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 on his own behalf or 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**

#### **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.



(Red or magenta legend on yellow background)





**Arizona Department of Transportation**

**Intermodal Transportation Division – Materials Group**

**1221 North 21st Avenue Phoenix, Arizona 85009-3740**

Phone (602) 712-7231 FAX (602) 712-8138

**Janice K. Brewer**  
*Governor*

**Floyd Roehrich Jr.**  
*State Engineer*

**John S. Halikowski**  
*Director*

# **- 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 #
FIRST AND LAST NAME	DEPARTMENT RSO	MATERIALS CENTRAL LAB	###-###-####	###-###-####
FIRST AND LAST NAME	ALTERNATE DEPARTMENT RSO	MATERIALS CENTRAL LAB	###-###-####	###-###-####
FIRST AND LAST NAME	ALTERNATE DEPARTMENT RSO	MATERIALS CENTRAL LAB	###-###-####	###-###-####
FIRST AND LAST NAME	REGIONAL RSO	PHOENIX	###-###-####	###-###-####
FIRST AND LAST NAME	ALTERNATE REGIONAL RSO	PHOENIX	###-###-####	###-###-####
FIRST AND LAST NAME	REGIONAL RSO	TUCSON	###-###-####	###-###-####
FIRST AND LAST NAME	ALTERNATE REGIONAL RSO	TUCSON	###-###-####	###-###-####
FIRST AND LAST NAME	REGIONAL RSO	PRESCOTT	###-###-####	###-###-####
FIRST AND LAST NAME	ALTERNATE REGIONAL RSO	PRESCOTT	###-###-####	###-###-####
FIRST AND LAST NAME	REGIONAL RSO	FLAGSTAFF	###-###-####	###-###-####
FIRST AND LAST NAME	ALTERNATE REGIONAL RSO	FLAGSTAFF	###-###-####	###-###-####

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 : \_\_\_\_\_



### 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
<b>DOSE TO MEMBER OF PUBLIC IN ONE YEAR</b>		
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 RADIATION SAFETY PROGRAM AUDIT CHECKLIST



Licensee name \_\_\_\_\_ License No. \_\_\_\_\_

Auditor's name (print) \_\_\_\_\_ Date of Audit \_\_\_\_\_

Auditor's signature \_\_\_\_\_

Audit Item	Yes	No	Comments
<b>1. Audit History</b>			
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?			
<b>2. Organization and Scope of Program</b>			
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?			
<b>3. Training and Instructions to Workers</b>			
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?			

<b>4. Radiation Detection Instruments</b>			
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?			
<b>5. Gauge Inventory</b>			
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?			
<b>6. Personnel Radiation Protection</b>			
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
<b>7. Public Dose</b>			
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?			
<b>8. Operating and Emergency Procedures</b>			
a. Are current copies of operating and emergency procedures available to each individual?			
b. Did any emergencies occur? Were they properly handled?			
<b>9. Leak Tests</b>			
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?			
<b>10. Maintenance of Gauges</b>			
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		
<b>11. Transportation</b>					
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?					
<b>12. Notifications and Reports</b>					
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?					
<b>13. Posting and Labeling</b>					
a. "Notice to Workers" posted?					
b. Notice posted stating where workers can read a copy of the regulations and license?					
<b>14. Summary of Deficiencies Identified During Audit (attach additional sheets as necessary)</b>					
<u>Deficiencies</u>		<u>Proposed Corrective Actions/Planned Completion Date</u>			
<b>15. Other Recommendations for Improvement (attach additional sheets as necessary)</b>					

**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.)



**ARIZONA DEPARTMENT OF TRANSPORTATION  
RADIOACTIVE MATERIALS INSPECTION REPORT**

DATE: \_\_\_\_\_



Central Laboratory ☐  
Regional Laboratory ☐

Construction Office ☐  
Field/Technician ☐

Org. Number: \_\_\_\_\_

Facility Name or Project #: \_\_\_\_\_

Facility/Location or Vehicle #: \_\_\_\_\_

**1. STORAGE**

**YES NO N/A**

- 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**

**YES NO N/A**

- 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**

**YES NO N/A**

- 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? ☐

ARIZONA DEPARTMENT OF TRANSPORTATION  
RADIOACTIVE MATERIALS INSPECTION REPORT

<b>4. TRANSPORTATION</b>	<b>YES</b>	<b>NO</b>	<b>N/A</b>
a. Is individual transporting a nuclear gauge on the approved operator's list?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Is individual transporting nuclear gauge wearing a TLD?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Is a Transportation/Transfer Receipt Form completed and visible to the driver in the cab of the vehicle?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Is nuclear gauge locked (padlock in handle) and in its approved transport case secured free from movement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Is nuclear gauge as far away from the passenger compartment as possible?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. If transporting nuclear gauge in a closed vehicle, is vehicle locked?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. If transporting nuclear gauge in an open bed vehicle, is the gauge secured to the vehicle?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
 <b>5. OPERATION</b>	 <b>YES</b>	 <b>NO</b>	 <b>N/A</b>
a. Is individual operating nuclear gauge on the approved operator's list?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Is individual operating nuclear gauge wearing a TLD?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Does operator of nuclear gauge maintain control of gauge at all times?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. When nuclear gauge is not in use, is gauge locked in safe position and returned to its transport case for storage?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Does operator practice the ALARA concept at all times?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
 <b>6. RECORDS</b>	 <b>YES</b>	 <b>NO</b>	 <b>N/A</b>
a. ARRA License 7-31, Amendments and letters legible and on file?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Training records/Licensed Operators list current and on file?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Leak Test/ Physical Inventory records current and on file?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Dosimetry reports current and on file?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Accumulative Dosage records current and on file?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Transportation/ Transfer Receipt records current and on file?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Calibration and Maintenance records current and on file?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. Audits and other reviews of program content and implementation current and on file?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
 <b>7. INSPECTION RESULTS</b>	 <b>YES</b>	 <b>NO</b>	 <b>N/A</b>
a. Were all applicable conditions reviewed? (if no, describe under remarks)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Were any deficiencies identified during inspection? (if yes, describe under remarks)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Corrective actions planned or taken? (if yes, describe under remarks)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**8. REMARKS**


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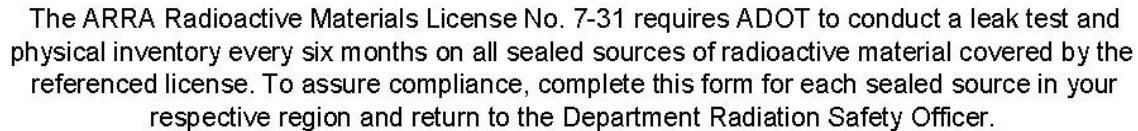
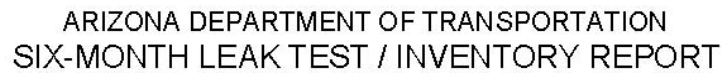
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INSPECTORS NAME: \_\_\_\_\_

INSPECTORS TITLE: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_

DATE: \_\_\_\_\_



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 from 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:**

Signature/ \_\_\_\_\_  
Date \_\_\_\_\_

Print Name/ \_\_\_\_\_  
Badge No.: \_\_\_\_\_

**RECEIVED BY:**

Signature/ \_\_\_\_\_  
Date \_\_\_\_\_

Print Name/ \_\_\_\_\_  
Badge No.: \_\_\_\_\_



44-0600 R9/02

WHITE : MATERIALS ANNEX

YELLOW: USER

PINK: REGIONAL RSO

**Region:**

[illegible]

02-11-09





James P. Delton  
Assistant State Engineer

**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. 21
SUBJECT:  SAMPLING, TESTING, AND ACCEPTANCE OF GLASS BEADS (SPHERES) FOR STRIPING MATERIALS	EFFECTIVE DATE:  January 6, 2011

### **1. GENERAL**

1.1 This Policy and Procedure Directive outlines the sampling and testing of glass beads used in conjunction with striping materials.

1.2 The term “glass beads” shall be synonymous with the term “glass spheres”.

### **2. ACCEPTANCE OF GLASS BEADS**

2.1 Acceptance of glass beads shall be determined by the test results of samples obtained for pre-approval at the striping contractor’s yard, or field samples taken from the project.

### **3. SAMPLING**

3.1 Sampling of glass beads must be for an active ADOT project.

3.2 For pre-approval of glass beads, the Structural Materials Testing Section will obtain a sample from each lot at the striping contractor’s yard as requested by the striping contractor.

3.2.1 One 50 pound bag of glass beads, or a minimum 1 gallon sample taken from a “super sack” as specified in paragraph 3.2.2, shall be sampled for each lot.

3.2.2 When sampling a lot consisting of super sacks, no less than four super sacks shall be sampled, and the samples combined to make one sample.

3.3 A field sample shall consist of one 50 pound bag or a minimum one gallon sample taken from the striping truck for each lot. Each field sample must be identified with the manufacturer's lot number. When sampling from the striping truck, the sample shall be obtained from the drop nozzle after 500 feet of striping has been placed.

3.3.1 Unless the inspector suspects contamination of the glass beads, no field samples will be required for pre-approved lots.

#### **4. TESTING OF GLASS BEADS**

4.1 Glass beads shall be tested in accordance with the applicable requirements of Section 704, 708, and 709 of the ADOT specifications, or other governing documents.

#### **5. STRUCTURAL MATERIALS TESTING SECTION RESPONSIBILITIES**

5.1 For each lot of glass beads that is to be pre-approved, Structural Materials Testing Section will perform the sampling and testing.

5.1.1 A test report with the lot number will be issued for each project the glass beads are to be used for.

5.1.2 Upon completion of testing for pre-approval, Structural Materials Testing Section will provide the striping contractor with a copy of the test results.

5.1.3 Structural Materials Testing Section will keep a log/file of all lots tested.

5.2 For glass beads that have not been pre-approved, Structural Materials Testing Section will test field samples submitted by the project.

5.2.1 The issuance of a test report and the maintaining of a log/file of all lots tested shall be performed as specified in paragraphs 5.1.1 and 5.1.3.

5.2.2 Structural Materials Testing Section will immediately notify the project of any failing test results.

## **6. PROJECT RESPONSIBILITIES**

6.1 The project must receive a Certificate of Compliance and/or a Certificate of Analysis, as required, for each lot of glass beads from the striping contractor before striping can begin. Certificates of Compliance and Certificates of Analysis must conform to the requirements of Subsection 106.05 of the Specifications.

6.1.1 For glass beads that have been pre-approved, the striping contractor shall also provide the project with a copy of the Structural Materials Testing Section test results.

6.2 The project personnel will contact Structural Materials Testing Section to determine if the glass beads have been pre-approved.

6.2.1 If the glass beads have not been pre-approved, the project will obtain a sample of the beads, as specified in paragraph 3.3, and submit the sample to Structural Materials Testing Section for testing.



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James P. Delton, P.E.  
Assistant State Engineer  
Materials Group





James P. Delton  
Assistant State Engineer

**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. 22
SUBJECT:  QUALIFICATION AND SPECIFICATION REQUIREMENTS FOR THE MANUFACTURING OF PRECAST/PRESTRESS CONCRETE BRIDGE MEMBERS	EFFECTIVE DATE:  May 3, 2011

### **1. GENERAL**

1.1 This Policy and Procedure Directive outlines the requirements for the manufacturing of Precast/Prestress concrete structural bridge members for the use on ADOT projects. These requirements are used in conjunction with, and in addition to, ADOT Specifications.

1.2 The manufacturer must designate in writing, a competent English-speaking superintendent or foreman(s) responsible for the manufacturing of bridge members during all phases of construction. The designee(s) must be experienced with the work being performed and capable of reading and understanding all pertinent contract documents. The manufacturer must ensure that the designee(s) is available at all times.

1.3 The manufacturer shall give the constant attention necessary to facilitate the production of concrete bridge members, and shall cooperate with the Structural Materials Testing Section inspectors at all times. All bridge members that do not conform to the requirements of the contract and approved drawings will be considered unacceptable.

1.4 ADOT Materials Group, Structural Materials Testing Section, will maintain an "Approved Precast/Prestress Manufacturers List" on its website. The approved manufacturer's name, address, and phone number will be included on that list. Only the manufacturers who are on the "Approved Precast/Prestress Manufacturers List" will be allowed to manufacture bridge members for ADOT construction projects.

### **2. SAFETY**

2.1 Working in a Precast/Prestress manufacturing plant is inherently very hazardous because of the large tensioning forces, debris, heavy equipment, etc., necessary to the operations. The inspector(s) shall comply with all safety requirements at each plant, and shall take any steps they deem necessary for safety. All manufacturers shall comply with current OSHA requirements.

QUALIFICATION AND SPECIFICATION  
REQUIREMENTS FOR THE MANUFACTURING  
OF PRECAST/PRESTRESS CONCRETE  
BRIDGE MEMBERS

### **3. MATERIALS**

3.1 All materials used in the manufacturing of Precast/Prestress bridge members shall meet the requirements shown on the approved shop drawings and shall conform to ADOT Specifications and other governing documents.

3.2 At no time will materials with chlorides be allowed to be incorporated into any Precast/Prestress bridge member.

3.3 A Certificate of Compliance or a Certificate of Analysis conforming to the requirements of Subsection 106.05 of the ADOT Specifications shall be submitted for all specified and applicable materials subject to the approved shop drawings prior to their incorporation into a Precast/Prestress bridge member. Such materials include, but are not limited to: reinforcing steel, prestress cable strand, bearing plates, embed materials, inserts, anchor plates, epoxy coated or galvanized materials, and mechanical lifting devices. Materials that fail to have the required certification will not be allowed.

3.4 All welding shall be performed by a welder certified for the type of welding required. The manufacturer shall submit the welding certifications to the Structural Materials Testing Section upon request.

### **4. PLANT AND PERSONNEL CERTIFICATIONS**

4.1 All Precast/Prestress concrete structural bridge members shall be manufactured in a plant certified by the Precast/Prestress Concrete Institute (PCI). The manufacturer shall be, at a minimum, certified for Product Group "B"- Bridge Products, Category B4.

4.2 Erection of Precast/Prestress bridge members shall be performed by a contractor, manufacturing plant, or erector which has an individual on staff who has attended and received a "Certification of Completion" from the PCI "Industry Erection Standards School" or is certified by PCI as a "Certified Field Auditor".

4.3 All plant and personnel certifications must be maintained throughout the production of all Precast/Prestress bridge members. Production will immediately stop if at any time the manufacturer's certification is revoked, regardless of the status of completion of contracted work. Production will not be allowed until certification has been re-established.

4.4 The manufacturer shall supply the Department with documentation of Plant Certifications and Personnel Certifications, and a copy of the plant's Quality Systems Manual (QSM). The manufacturer must provide the Department all documentation of any changes to the QSM or certified personnel within ten days.

4.5 The manufacturer must have a QC Manager or Engineer, who is certified by PCI as QC Level II or higher.

QUALIFICATION AND SPECIFICATION  
REQUIREMENTS FOR THE MANUFACTURING  
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## **5. PLANT QUALITY CONTROL**

### **5.1 Fabrication Details**

5.1.1 The manufacturer shall submit fabrication details along with the concrete mix design(s) to the Structural Materials Testing Section for approval.

5.1.2 The fabrication details shall contain at the minimum:

- a) Concrete strength requirements.
- b) Method of concrete placement.
- c) Method of concrete vibration.
- d) Method of curing.
- e) Tensioning method and calculations, including stressing jacks and pumps, gauge pressure values and theoretical elongations.
- f) De-tensioning method.
- g) Concrete finish requirements and method of finishing.
- h) Storage method.

5.1.3 When Requests for Information (RFI) are submitted to the ADOT Engineer, a copy of the RFI shall also be submitted to the Structural Materials Testing Section for informational purposes only.

### **5.2 Tensioning Operations**

5.2.1 Stressing operations shall comply with Section 602 of the ADOT Specifications. Stressing will be accomplished by stressing single strands or by multiple cable tensioning. Stressing gauges, jacks, and other related equipment shall be calibrated annually, or more frequently if necessary. The manufacturer shall supply calibration reports when requested by the Department.

5.2.2 No more than one splice chuck may be used on a cable strand. Splice chucks will not be allowed within the member. When multiple cable tensioning is employed, the use of splice chucks shall be limited to ten percent of the cable strand to be tensioned or all cable strands to be tensioned.

QUALIFICATION AND SPECIFICATION  
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BRIDGE MEMBERS

5.2.3 Each plant shall be required to supply load cells to measure force on each production bed as directed by the Department. This may include load cells placed on cable strand between chucks and the dead men (anchorage bulkheads) on both straight and harped strands, at both the live and dead ends. Load cells shall be used as necessary to monitor the gauge pressure during stressing operations, abutment rotation, and bed shortening. Load cells must be calibrated annually, or more frequently if necessary.

NOTE: The intent is not to place load cells between the stressing chucks and the anchorage on an every day basis unless loss of force is suspected, but rather to verify stressing forces for each production bed. When all losses have been verified for each production bed and stressing values are within tolerances, load cells will be used daily as needed to monitor stressing forces of each stressing jack. Periodically, load cells will be placed between strand chucks and anchorage as verification.

5.2.4 All cable strands must be placed within 1/4 inch of the strand locations indicated on the approved shop drawings. All hold downs and cable locations shall be clearly marked on the approved drawings.

5.2.5 At no time shall a cable strand which has been previously stressed and used outside a Precast/Prestress product or member be used at a later time within another Precast/Prestress member.

5.2.6 No more than one broken wire will be allowed in a single strand.

5.2.7 Elongations will be measured to the nearest 1/8 inch.

5.2.8 Cable strand shall be free of deleterious materials such as release agents, oils, grease, dirt, mud, or other foreign matters. Any cable found in such condition will be cleaned or removed, based on the inspector's observations.

5.2.9 Harped strand shall be tensioned from both the live and dead ends, except for the following:

- a) If one member is to be produced.
- b) If multiple strand tensioning is used and cables are vertically displaced into the correct height. Load cells must be used to verify the force.
- c) If load cell verifies force after stressing from the live end.

5.2.10 At no time will stressing operations exceed 80% of minimum ultimate tensile strength for the cable strand as listed in approved drawings or Section 602 of the ADOT Specifications.



QUALIFICATION AND SPECIFICATION  
REQUIREMENTS FOR THE MANUFACTURING  
OF PRECAST/PRESTRESS CONCRETE  
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5.2.11 Initial stressing force will not exceed 25% of the final force.

5.2.12 De-tensioning of cables will not be performed until concrete test cylinders indicate release strength has been attained. De-tensioning will be performed in a manner that keeps the prestressing forces nearly symmetrical about the vertical axis of the product and:

- a) Minimizes shock to the member.
- b) Minimizes movement against restrained items such as forms, inserts and hold downs.
- c) Prevents overstressing or damaging members.
- d) Prevents shock and thermo-cracking that may be caused by using accelerated curing such as steam or radiant heat.
- e) De-tensioning must be performed immediately after curing and the removal of forms, curing blankets, tarps, or plastic coverings while the concrete is warm and moist.

### 5.3 Concrete Operations

5.3.1 Concrete mix designs shall be submitted and comply with the requirements of ADOT Materials Policy and Procedure Directive No. 15 "Submittal and Approval of Portland Cement Concrete Mix Designs", Section 1006 of the ADOT Specifications, and the requirements listed herein. Calibration reports for batch plants scales and measuring devices shall be supplied to ADOT when requested.

5.3.2 All concrete used in the production of Precast/Prestress bridge members at the manufacturer's plant or purchased from a Ready Mix supplier shall be batched with load cell indicating devices providing a digital readout and printed weights. Printed copies must be available when requested by ADOT.

5.3.3 The rate of concrete placement and consolidation shall be such that the formation of cold joints within monolithic sections of any bridge member will not occur, but at no time shall concrete placement be less than 25 cubic yards per hour.

5.3.4 Accelerated curing shall not commence until one hour after initial set or three hours after placement of concrete, whichever is longer. Initial set will be determined in accordance with AASHTO T197 and the results submitted with each mix design.

5.3.5 Concrete test cylinders shall be cured with, and in the same manner, as the bridge member being manufactured.

5.3.6 The concrete temperature during accelerated curing shall not exceed 170 degrees F. The manufacturer shall have a temperature measuring device(s) that allows the

QUALIFICATION AND SPECIFICATION  
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BRIDGE MEMBERS

Department to monitor the concrete curing temperature at all times. A temperature measuring device shall be placed in each member. The location of each temperature measuring device will be chosen by the Department. The enclosure around each bridge member shall be adequate to ensure a consistent concrete curing temperature. The difference in the concrete curing temperature at the ends of each bridge member shall be no more than 20 degrees F. When box girders or voided slab lengths are less than 60 feet, the concrete curing temperature will be measured on every other bridge member. The manufacturer shall supply a report of the concrete curing temperatures for each concrete casting.

NOTE: It is intended that the curing enclosure procedure(s) be established such that the difference in the concrete curing temperature at the ends of each bridge member is no more than 20 degrees F. Once the curing enclosure procedure is established, the concrete curing temperature will be monitored at one location for each bridge member per casting, with the concrete curing temperature at the end of each bridge member being verified periodically.

5.3.7 When the ambient temperature falls below 50 degrees F, steam or radiant heat may be used to keep the enclosure at a temperature of not more than 90 degrees F until the accelerated curing period begins.

5.3.8 When ready mix trucks are used to mix concrete, the truck must be certified per ADOT Materials Policy and Procedure Directive No. 7, "Inspection of Concrete Batch Plants and Concrete Mixers Trucks".

5.3.9 When a concrete mix contains "Silica Fume", a curing plan must be submitted for approval.

5.3.10 When concrete placement is interrupted by rain, the forms shall be covered with tarps or plastic. If it is determined that concrete placement can proceed during rain, tarps or plastic shall be used to cover the forms ahead of and behind the concrete placement.

5.3.11 Self Consolidating Concrete (SCC)

5.3.11.1 Concrete must be able to flow under its own weight and completely fill the formwork, even in the presence of dense reinforcement, without the need of any vibration, while maintaining homogeneity. Placement is to be accomplished in one lift, with the placement equipment within 15 feet of the rolling edge that the SCC creates.

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5.3.11.2 Trial mixes will be observed by an ADOT representative. Trial mixes may include an inverted slump spread test, L-box, J-box, J-ring, Column Segregation test, or other tests as deemed necessary by the Department for the concrete mix approval. In addition the following is required:

- a) All admixtures must be on the ADOT Approved Products List (APL).
- b) Each mix will include a spread range of  $\pm 3''$ .
- c) The use of a Viscosity Modifying Agent (VMA) will be identified for each mix.
- d) The Visual Stability Index (VSI) shall be determined for each member being produced.

5.3.11.3 Concrete strength test cylinders shall be fabricated in the following manner:

- a) The concrete strength test cylinders will be fabricated in accordance with AASHTO T23 except the molds shall be filled with concrete in one lift to the rim. The concrete shall not be dropped into the mold from more than six inches above the rim. The rim shall be struck off and the lid placed on the test mold.

5.3.11.4 Concrete unit weight and air content tests shall be performed in the following manner:

- a) The unit weight and air content tests shall be performed in accordance with AASHTO T121 and AASHTO T152, respectively, except the unit weight/air content bowl shall be filled in one lift to the rim. The concrete shall not be dropped into the test bowl from more than six inches above the rim. The rim shall be struck off and the testing completed.

#### 5.4 Plant Operations

5.4.1 The manufacturer shall give the Structural Materials Testing Section a minimum of one week written notification before production may begin. The manufacturer shall supply a written schedule of the date and time for the start of production along with scheduled times for inspection and a pour schedule with the product ID or marked number for casting. It may be advisable to have a meeting between the manufacturer's QC Manager, Production Manager, and Structural Materials Testing Section personnel to discuss scheduling and potential issues regarding the bridge members to be manufactured.

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5.4.2 The manufacturer shall give a minimum of one week written notice to the Structural Materials Testing Section prior to delivery of bridge members for final inspection and approval.

5.4.3 When lifting Precast/Prestress bridge members from the production bed, setting in storage, loading for delivery, or erecting bridge members at the project, each bridge member will be lifted from the lifting points in a manner that will not cause structural damage to the bridge member due to stresses, torsion, or other forces.

5.4.4 Precast/Prestress members shall be stored on suitable supports placed on level, well compacted material with adequate drainage. Bridge members shall be stored in a manner that will prevent sweeps or damage. When requested by the Department, the manufacturer shall re-set any bridge member that is not level.

5.4.4.1 Unless bridge members have been preapproved, they must be stored in a manner that allows the inspector full access around each member to perform inspections.

5.4.5 When Precast/Prestress bridge members are to be stored for extended periods, the manufacturer shall coordinate with the general contractor to address any potential camber issues. The Structural Materials Testing Section shall be given written notification of precautions taken.

5.4.6 All minor repairs, such as bottom corner spalls and hold-down holes, shall be made with a "High Strength, Non-Shrink" grout which is listed on the Department's APL. Prior to patching, hold-down holes must be cleaned of deleterious materials, grease, oil, and laitance. All repairs must match the color of the concrete being repaired. Patching materials used shall be free of chlorides and meet or exceed the 28-day concrete strength requirement(s) shown on the approved shop drawings. Cracks at the end of girders shall be pressure injected with an epoxy which is listed on the APL.

5.4.7 All major repairs will require the submittal of a repair procedure for review and approval. Examples of a major repair are: exposed cable strand, concrete voids, missing inserts or pipes, and required projected strand that has been cut off. The manufacturer shall notify the Department immediately of these or other defects before submitting a repair procedure. All repairs must match the color of the concrete being repaired. Patching materials used shall be free of chlorides and meet or exceed the 28-day concrete strength requirement(s) shown on the approved shop drawings.

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5.4.8 Within one week after the production of a bridge member, the manufacturer shall submit a post-pour checklist report to the Structural Materials Testing Section. All dimensions shall meet the requirements given in Subsection 601-4.02 of the ADOT Specifications.

5.4.8.1 The following items shall be listed in the checklist report:

- a) Lengths.
- b) Widths.
- c) Heights.
- d) Camber (camber must be measured within twenty-four hours after de-tensioning).
- e) Sweeps.
- f) Insert and imbed locations.
- g) Projected strand locations.
- h) Lifting device locations.
- i) Damage requiring a repair procedure submittal.
- j) Patched hold-down holes.

## **6. STRUCTURAL MATERIALS TESTING SECTION RESPONSIBILITIES**

6.1 The Structural Materials Testing Section will review all Precast/Prestress concrete mix designs and fabrication details. Upon review and approval, Structural Materials Testing Section will forward a copy of the approved mix design and fabrication details to the manufacturer and the construction project office.

6.2 The Structural Materials Testing Section will sample and test reinforcing steel, prestress cable strand, aggregates, concrete (for release strength and 28-day strength), and other materials as necessary.

6.3 The Structural Materials Testing Section will perform the inspection of tensioning and de-tensioning operations, reinforcing steel placement, void placement, insert and imbed placement, and concrete placement.

6.4 The Structural Materials Testing Section will approve, for delivery, all bridge members which meet the Specifications. All bridge members approved will be stenciled "ADOT".

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**7. PROJECT RESPONSIBILITIES**

7.1 The project will supply the Structural Materials Testing Section with a set of the approved shop drawings. The size of the drawings shall be 22" x 34".

7.2 The project will verify with the Structural Materials Testing Section, the quantity of bridge members that have been produced for partial payment.

7.3 The project will notify Structural Materials Testing Section of any RFI's or changes to the approved drawings.



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