ARIZONA DEPARTMENT OF TRANSPORTATION * MATERIALS GROUP



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

CHANGE LETTER

James P. Delton Assistant State Engineer

POLICY AND PROCEDURE DIRECTIVES MANUAL	CHANGE LETTER NO. 12
SUBJECT:	EFFECTIVE DATE:
Title Page; Table of Contents; Policy and Procedure Directives No. 3a, No. 5a, No. 13a, No. 16a, No. 19, and No. 20.	April 14, 2010

SUMMARY:

- NOTE: Unless otherwise specified, changes issued under this Change Letter will be effective for projects with a bid opening date on or after April 14, 2010. 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 April 14, 2010.
- 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.
- 4. The following Policy and Procedure Directives are revised by this Change Letter.
 - P.P.D. No. 3a, "CURING COMPOUNDS"

Sections 1 and 2 of this PPD have been revised.

P.P.D. No. 5a, "EVALUATION OF CONCRETE AGGREGATE SOURCES"

Sections 1 and 2 of this PPD have been revised.

P.P.D. No. 13a, "CERTIFICATION AND ACCEPTANCE OF HYDRAULIC CEMENTS, FLY ASH, NATURAL POZZOLAN, SILICA FUME, AND LIME"

This entire PPD has been revised.

P.P.D. No. 16a, "ADOT RADIATION SAFETY PROGRAM"

Subsections 4.1 and 4.3 of this PPD have been revised.

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

P.P.D. No. 19, "ADOT SYSTEM FOR THE EVALUATION OF TESTING LABORATORIES"

This PPD replaces all previously issued versions of the "System for the Evaluation of Testing Laboratories".

P.P.D. No. 20, "GUIDANCE ON THE USE OF RECLAIMED ASPHALT PAVEMENT (RAP) IN ASPHALTIC CONCRETE"

James P. Delton, P.E. 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. 12 (April 14, 2010)

April 14, 2010 (2 Pages)



MATERIALS POLICY AND PROCEDURE DIRECTIVES MANUAL

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ARIZONA DEPARTMENT OF TRANSPORTATION * MATERIALS GROUP



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

POLICY AND PROCEDURE DIRECTIVE

James P. Delton Assistant State Engineer

TO: ALL MANUAL HOLDERS	PPD NO. 3a
SUBJECT:	EFFECTIVE DATE:
CURING COMPOUNDS	April 14, 2010

1. GENERAL

1.1 Section 1006-2.05 of the Specifications gives the requirements for liquid membrane forming concrete curing compounds.

1.2 All curing compounds, whether pre-approved with a green sticker (see Attachment #1) or not, are required to have a Certificate of Compliance submitted conforming to the requirements of Section 106.05 of the Specifications.

1.3 For pre-approved Type 2 (white pigmented) curing compounds, the pre-approval shall be effective for a maximum of six months from the production date.

1.4 For pre-approved Type 1-D (clear or translucent with fugitive dye) curing compounds, the pre-approval shall be effective for a maximum of twelve months from the production date.

1.5 Curing compounds shall be mixed thoroughly before samples are taken and prior to use on the project.

2. **PROJECT RESPONSIBILITIES**

2.1 When curing compound that has been pre-approved and tagged with a green sticker showing the project number, laboratory number, lot number, individual approving material, and date of approval arrives on the project, it is not required to do any further sampling. The project shall contact the appropriate laboratory (see Note below) for verification of the various information items and tests results.

Note: Generally Materials Group, Central Lab, Structural Materials Testing Section does the sampling, testing, and tagging of curing compounds for preapproval, and will be the lab which the project will contact for verification. However, in some cases the Regional Lab will sample the curing compound and send it to the Structural Materials Testing Section for testing. The Structural Materials Testing Section will then notify the Regional lab of the test results and other pertinent information, and the Regional Lab will tag the curing compound. In these cases the project shall contact the Regional Lab for verification.

2.2 When curing compound arrives on the project which has not been preapproved, immediately sample it (approximately 1/2 gallon) and send it to the Structural Materials Testing Section for testing. Make sure the project number, manufacturers name, type of curing compound, and lot number are on the sample ticket.

2.3 Do not use any curing compound until approval has been received either by verification for pre-tested material or notification of acceptable test results for project sampled material.

3. **REGION/DISTRICT RESPONSIBILITIES**

3.1 Confer with the Structural Materials Testing Section, in maintaining current sampling procedures and receiving other guidelines as necessary.

4. STRUCTURAL MATERIALS TESTING SECTION RESPONSIBILITIES

4.1 Promptly notify Project Personnel of acceptability of samples submitted for testing.

4.2 Send copies of test results on pre-approved curing compounds to the project and the Regional Lab.

4.3 Assist Regional and Project Lab personnel in the sampling and evaluation of curing compounds.

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

Attachment (1)

A.C. MATER App	D.O.T. IALS GROUP roved Only For
Proj. No	
Lab. No	<u> </u>
Lot No	
Ву	Date
44-9377 8/05	

(Sticker shown above is larger than actual size.)

(Sticker has black lettering on a green background.)

ARIZONA DEPARTMENT OF TRANSPORTATION * MATERIALS GROUP



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

POLICY AND PROCEDURE DIRECTIVE

James P. Delton Assistant State Engineer

TO: ALL MANUAL HOLDERS	PPD NO. 5a
SUBJECT:	EFFECTIVE DATE:
EVALUATION OF CONCRETE AGGREGATE SOURCES	April 14, 2010

1. GENERAL

1.1 This Policy and Procedure Directive outlines the procedure to be followed for the evaluation of concrete aggregate sources and their identification by the name of the source, the partial legal description, the latitude/longitude, and if appropriate, the source number assigned by the Materials Group Geotechnical Section or the Environmental and Enhancement Group.

1.2 Concrete aggregate sources that are subject to use by the Department are required to be tested initially, and thereafter at a minimum frequency of once every two years to determine suitability as sources of concrete aggregate.

2. SOURCE EVALUATION

2.1 The Regional Materials Engineer is responsible to assure that the appropriate sampling and testing of concrete aggregate sources in their Region is performed.

2.2 To reduce the impact due to the volume of testing, a uniform distribution of sample submittals from concrete aggregate sources within a Materials Group Region should be considered.

2.3 Sampling of fine and coarse aggregate shall be performed in accordance with Arizona Test Method 105.

2.3.1 For each sample, a Sample Tabulation Ticket shall be completed with all appropriate information. The remarks area must also be completed to contain the name of the source, the partial legal description, the latitude/longitude, and if appropriate, the source number assigned by the Materials Group Geotechnical Section or the Environmental and Enhancement Group. The latitude/longitude shall be based on the NAD83 geodetic datum, and shall be expressed in decimal degrees to at least five decimal places.

2.3.2 If sodium sulfate soundness (Section 2.6.2), or any of the tests listed in Section 2.7 are to be performed, it shall be so noted in the remarks area of the Sample Tabulation Ticket.

P.P.D. No. 5a April 14, 2010 Page 2

2.4 The sampling of concrete aggregate sources for testing as listed in Sections 2.6 and 2.7 shall be performed by ADOT personnel. For the mandatory testing specified in Section 2.6, a minimum of 55 lbs of fine aggregate and a minimum of 140 lbs of coarse aggregate shall be obtained. Typically, one 5-gallon bucket of fine aggregate and two 5-gallon buckets of coarse aggregate will be sufficient to meet these requirements. If the testing shown in Section 2.7.1 [Clay lumps and friable particles (AASHTO T 112)] or Section 2.7.2 [Lightweight particles, including coal and lignite (AASHTO T 113)] is required, the amount of coarse aggregate obtained shall be doubled.

2.5 Testing may be performed by either the Central Laboratory or a Regional Laboratory. If both laboratories are used to evaluate a single source, it must be clearly communicated as to what testing each laboratory is to perform. When any of the tests listed in Sections 2.6 and 2.7 are performed by a Regional Laboratory, the source location description (name of the source, partial legal description, latitude/longitude, and if appropriate, the source number assigned by the Materials Group Geotechnical Section or the Environmental and Enhancement Group) and the test results shall be submitted to the Materials Group Structural Materials Engineer.

- 2.6 The following mandatory tests will be performed:
- 2.6.1 Sieve analysis (Arizona Test Method 201) shall be determined on both the fine and coarse aggregate.
- 2.6.2 Sodium sulfate soundness (AASHTO T 104) shall be determined on both the fine and coarse samples when the aggregates are to be used in concrete placed above 4500 feet elevation.
- 2.6.3 Abrasion resistance (AASHTO T 96) shall be determined on the coarse aggregate.
- 2.6.4 Organic impurities (AASHTO T 21) shall be determined on the fine aggregate. (Based on the results of this test, it may be required to perform the Mortar Strength test, as described in Section 2.6.4.1.)
- 2.6.4.1 Mortar strength (AASHTO T 71, except Type II cement and graded sand conforming to the requirements of ASTM C 778 is to be used to determine the relative strength of the aggregate under test) shall be determined on the fine aggregate when results for AASHTO T 21 produce a color darker than the standard color.
- 2.7 The following tests will be performed, at the discretion of Materials Group:
- 2.7.1 Clay lumps and friable particles (AASHTO T 112) are determined on both the fine and coarse aggregate.

- 2.7.2 Lightweight particles, including coal and lignite, (AASHTO T 113, except the percent of lightweight particles shall be reported to the nearest 0.01%) are determined on both the fine and coarse aggregate.
- 2.7.3 Specific gravity and absorption (Arizona Test Method 210) are determined on the coarse aggregate.
- 2.7.4 Specific gravity and absorption (Arizona Test Method 211) are determined on the fine aggregate.
- 2.7.5 Sand equivalent (AASHTO T 176) shall be determined on the fine aggregate.
- 2.7.6 Fractured coarse aggregate particles (Arizona Test Method 212) shall be determined on the coarse aggregate.

3. SOURCE IDENTIFICATION BY PARTIAL LEGAL DESCRIPTION

3.1 A partial legal description of the source must be provided by identifying the location of the source as described in Sections 3.5 and 3.6 below. The General (County) Highway Maps or other suitable maps are helpful in identifying the location of the source. Suitable maps are typically available at the District Administration Offices, the Regional Laboratories, or the Materials Group Geotechnical Section.

3.2 There are two principal meridians in Arizona: the Gila and Salt River Meridian, and the Navajo Meridian. The Gila and Salt River Meridian governs most of the state, while the Navajo Meridian governs only a very small area in the northeast part of Arizona. In Utah, the Salt Lake Meridian is the principal meridian that identifies the area in Southern Utah.

3.3 Examples illustrating the relationship of Township, Range, Section, and Section Subdivisions are given in the ADOT Construction Manual. For convenience, these items are included as Attachment #1 and Attachment #2, respectively, in this Policy and Procedure Directive.

3.4 Locate the position of the source as close as possible on the appropriate General Highway Map or other suitable map of the area. Determine the meridian (baseline) which governs the area and identify it by one of the following: (G) for the Gila and Salt River Meridian, (N) for the Navajo Meridian, and (S) for the Salt Lake Meridian. Determine the Township number (north or south), Range number (east or west), Section number, and the appropriate subdivisions of the Section.

3.5 Shown in the table below are the possible correct entries for the corresponding partial legal description items for the source location:

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Partial Legal Description Item Meridian (Baseline) Township Range Section Quarter Half Possible Correct Entries G, N, or S T N or T S R E or R W 1 to 36 NE, NW, SE, or SW N, S, E, or W

3.6 An example of the entries that should be shown in the remarks area of the sample tabulation ticket is as follows: "N, SW, NE, 4, T24S, R13W, G". This entry would be read as "the north half of the southwest quarter of the northeast quarter of Section 4, Township 24 South, Range 13 West, of the Gila and Salt River Meridian".

3.7 The concrete source location description and all test results from the evaluation of the concrete aggregate source will be maintained by the Materials Group.

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

Attachments (2)

1301 TOWNSHIP SUBDIVISION



R. 103 W. R. 102 W.

R.102 W. R.101 W.

T. 43 N.	ы О RANGE	E N E	32	33	34	35	RANGE	UI 31 Township
T. 42 N.	1	6	5	4	3	2	1	LINE 6
	12	7	8	9	10	11	12	7
	13	18	17	16	15	14	13	18
	24	19	20	21	22	23	24	19
	25	30	29	28	27	26	25	30
T. 42 N.	36	31	32	33	34	35	36	31 Township
Т. 41 N.	1	6	5	4	3	2		LINE 6



ARIZONA DEPARTMENT OF TRANSPORTATION * MATERIALS GROUP



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

POLICY AND PROCEDURE DIRECTIVE

James P. Delton Assistant State Engineer

TO: ALL MANUAL HOLDERS	PPD NO. 13a
SUBJECT:	EFFECTIVE DATE:
CERTIFICATION AND ACCEPTANCE OF HYDRAULIC CEMENTS, FLY ASH, NATURAL POZZOLAN, SILICA FUME, AND LIME	April 14, 2010

1. GENERAL

1.1 This Policy and Procedure Directive outlines the procedures to be followed for certification and acceptance of hydraulic cements, fly ash, natural pozzolan, silica fume, and lime.

1.2 This Policy and Procedure Directive modifies the certification procedures for hydraulic cements, fly ash, natural pozzolan, and lime. It shall be used in conjunction with the requirements of Subsection 106.05 of the Specifications.

1.3 The certification and acceptance of hydraulic cements, fly ash, natural pozzolan, or lime for use in Portland cement concrete or asphaltic concrete is performed as specified in Section 2.

1.4 The certification and acceptance of silica fume for use in Portland cement concrete is performed as specified in Section 3.

1.5 The certification and acceptance of lime or hydraulic cement for use in soil stabilization (Lime Treated Subgrade, Cement Treated Subgrade, or Cement Treated Base) is performed as specified in Section 4.

1.6 The acceptance of Portland cement and hydrated lime for use in mortar or grout is performed as specified in Section 5.

2. CERTIFICATION AND ACCEPTANCE OF HYDRAULIC CEMENTS, FLY ASH, NATURAL POZZOLAN, OR LIME FOR USE IN PORTLAND CEMENT CONCRETE OR ASPHALTIC CONCRETE

2.1 Hydraulic cement, fly ash, and natural pozzolan used in Portland cement concrete shall conform to the requirements of Section 1006 of the Specifications.

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2.2 Portland cement, blended hydraulic cement, and hydrated lime used as a mineral admixture in asphaltic concrete shall conform to the following:

Material	Requirement
Portland Cement, Type I or II	ASTM C 150
Blended Hydraulic Cement, Type IP	ASTM C 595
Hydrated Lime	ASTM C 1097

2.3 The certification and acceptance of hydraulic cements, fly ash, natural pozzolan, or lime for use in Portland cement concrete or asphaltic concrete will be on the basis of the material originating from an <u>Approved Materials Source</u>.

2.4 Approved Materials Source Lists for "Hydraulic Cements", "Fly Ash and Natural Pozzolan", and "Lime (mineral admixture for asphaltic concrete)" are maintained by Materials Group, Structural Materials Testing Section. Current lists are available on the Materials Group, Structural Materials Testing Section homepage through the ADOT intranet (ADOTNet) and the ADOT internet website.

2.5 Project personnel shall verify that materials being used on their project are on the current Approved Materials Source List.

2.6 Certificates of Compliance and Certificates of Analysis are not required to be submitted with deliveries of material.

2.7 No samples of hydraulic cement, fly ash, natural pozzolan, or lime are required.

2.7.1 The Department reserves the right to sample and test material for acceptance from any source without notification.

2.8 Source approval of hydraulic cement, fly ash, natural pozzolan, or lime producers/suppliers will be based on the satisfactory submittal to the Materials Group, Structural Materials Testing Engineer, on a monthly and timely basis, of the following:

2.8.1 A Certificate of Compliance which lists the lots produced during that month.

2.8.2 A separate Certificate of Analysis for each lot shown on the corresponding Certificate of Compliance for that month.

2.8.3 Certificates of Compliance and Certificates of Analysis shall be submitted in electronic format (pdf) to the Structural Materials Testing Engineer at "cert@azdot.gov".

2.9 Examples of typical Certificates of Compliance and Certificates of Analysis are given in the attachments to this Policy and Procedure Directive.

2.9.1 Attachment #1 gives an example of a Certificate of Compliance for cement.

2.9.2 Attachment #2 gives an example of a Certificate of Analysis for cement.

2.9.3 Attachment #3 gives an example of a Certificate of Compliance for fly ash.

2.9.4 Attachment #4 gives an example of a Certificate of Analysis for fly ash.

2.9.5 Certificates of Compliance and Certificates of Analysis for natural pozzolan would be similar to Certificates of Compliance and Certificates of Analysis for fly ash.

2.9.6 Attachment #5 gives an example of a Certificate of Compliance for lime.

2.9.7 Attachment #6 gives an example of a Certificate of Analysis for lime.

2.10 To maintain an active status on the Approved Materials Source List, the producer/supplier shall, on a monthly and timely basis, provide either the required Certificates specified above, or other documentation described below.

2.10.1 If no materials are produced during any given monthly reporting period, the producer/supplier shall so notify the Structural Materials Testing Engineer by email at "cert@azdot.gov".

2.10.2 If no materials are produced during any given monthly reporting period, but materials are shipped from a previously certified lot of material, the producer/supplier shall so notify the Structural Materials Testing Engineer by email at "cert@azdot.gov".

2.10.3 If there is a temporary (more than one month) stop in production of materials from a specific source, the producer/supplier shall so notify the Structural Materials Testing Engineer by email at "cert@azdot.gov".

2.11 If there is a permanent stop in production of materials from a specific source, the producer/supplier shall so notify the Structural Materials Testing Engineer by email at "cert@azdot.gov".

2.12 The suspension of source approval shall be instituted for any of the following reasons. The Structural Materials Testing Engineer will notify the producer/supplier in writing (by letter or email) of such suspension.

(a) The producer/supplier provides materials from an approved source which fail to meet specification requirements to an ADOT project.

(b) The producer/supplier fails to provide the required documents to the Department as specified for the source approval on a monthly and timely basis.

2.12.1 Any suspension shall be in effect until such time that the hydraulic cement, fly ash, natural pozzolan, or lime producer/supplier can demonstrate that the deficiency in the material has been corrected and the product meets specification requirements, and/or the requirements for submittal of the required documents have been met. The Structural Materials Testing Engineer will notify the producer/supplier in writing (by letter or email) of the removal of such suspension.

3. CERTIFICATION AND ACCEPTANCE OF SILICA FUME FOR USE IN PORTLAND CEMENT CONCRETE

3.1 Silica fume used in Portland cement concrete shall conform to the requirements of ASTM C 1240.

3.2 A Certificate of Compliance conforming to the requirements of Subsection 106.05 shall be submitted for each delivery of silica fume.

3.3 No samples of silica fume are required.

3.3.1 The Department reserves the right to sample and test material which has been accepted on the basis of a Certificate of Compliance.

4. CERTIFICATION AND ACCEPTANCE OF LIME OR HYDRAULIC CEMENT FOR USE IN SOIL STABILIZATION (LIME TREATED SUBGRADE, CEMENT TREATED SUBGRADE, OR CEMENT TREATED BASE)

4.1 Lime used in soil stabilization shall conform to the requirements of ASTM C 977 and Section 301 of the Specifications.

4.2 Hydraulic cement used in soil stabilization shall conform to the requirements of Section 302 or Section 304 of the Specifications.

4.3 If desired by the producer/supplier, the acceptance and certification of hydraulic cement used in soil stabilization may be performed as specified in Section 2. Otherwise, a Certificate of Compliance conforming to the requirements of Subsection 106.05 shall be submitted for each delivery of hydraulic cement.

4.4 A Certificate of Compliance conforming to the requirements of Subsection 106.05 shall be submitted for each delivery of lime.

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4.5 No samples of lime or hydraulic cement are required.

4.5.1 The Department reserves the right to sample and test material as deemed necessary by the Engineer.

5. ACCEPTANCE OF PORTLAND CEMENT AND HYDRATED LIME FOR USE IN MORTAR OR GROUT

5.1 Portland cement used in mortar or grout shall conform to the requirements of Section 1006 of the ADOT Specifications.

5.2 Hydrated lime used in mortar or grout shall conform to the requirements of ASTM C 207, Type N.

5.3 Certificates of Compliance or Certificates of Analysis are not required.

5.4 Portland cement and hydrated lime used in mortar or grout shall be approved by the Engineer.

5.4.1 If desired by the producer/supplier, the acceptance and certification of Portland cement used in mortar and grout may be performed as specified in Section 2.

5.5 No samples of Portland cement or hydrated lime are required.

5.5.1 The Department reserves the right to sample and test material as deemed necessary by the Engineer.

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

Attachments (6)

ACME CEMENT COMPANY

9876 N. Notled Drive Bigtown, AZ 85555 Phone No. 602-555-4321

CERTIFICATE OF COMPLIANCE

Date:April 29, 2010Material:Type II/V Portland CementSource:Newton Plant

The following lots of Type II/V Portland Cement have been produced during the month of **March 2010** at the Newton Plant in Bigtown, Arizona.

I hereby certify that the Type II/V Portland Cement produced in the lots listed above meets or exceeds the requirements specified in ASTM C 150 and Subsection 1006-2.01 of the Arizona Department of Transportation Specifications.

Respectfully,

(Signature)

Billy B. Bop General Manager

ACME CEMENT COMPANY 9876 N. Notled Drive Bigtown, AZ 85555 Phone No. 602-555-4321

CERTIFICATE OF ANALYSIS

Date:April 29, 2010Material:Type II/V Portland CementSource:Newton Plant

The following are the test results for Lot Number 0011566 of Type II/V Portland Cement produced during the month of March 2010 at the Newton Plant in Bigtown, Arizona.

TESTS	RESULTS	SPECIFI	CATIONS
		TYPE II	TYPE V
Silicon Dioxide (SiO ₂), %	20.9		
Aluminum Oxide (Al ₂ O ₃), %	4.0	6.0 max.	
Iron Oxide (Fe ₂ O ₃), %	3.7	6.0 max.	
Calcium Oxide (CaO), %	63.5		
Magnesium Oxide (MgO), %	2.8	6.0 max.	6.0 max.
Sulfur Trioxide (SO ₃), %	2.9	3.0 max. 🖉	2.3 max.*
Loss on Ignition, %	2.6	3.0 max.	3.0 max.
Insoluble Residue, %	0.52	0.75 max.	0.75 max.
Equivalent Alkalies, %	0.56	0.60 max.	0.60 max.
Carbon Dioxide, (CO ₂), %	1.7		
Limestone, %	4.5	🥖 5.0 max.	5.0 max
Calcium Carbonate, (CaCO3 in Limestone), %	88	70 min.	70 min.
Potential Composition:			
C ₃ S, %	51		
C ₂ S, %	21		
C ₃ A, %	4	8 max.	5 max
C ₄ AF, %	11		
$C_3S + 4.75(C_3A), \%$	70	100 max.	
$C_4AF + 2(C_3A), \%$	19		25 max.
Physical Analysis:			
Blaine Fineness, m ² /kg	406	280 min.	280 min.
Air Content, %	7	12 max.	12 max.
Autoclave Expansion, %	0.03	0.80 max.	0.80 max.
3-Day Compressive Strength, psi	3980	1450 min.	1160 min.
7-Day Compressive Strength, psi	5060	2470 min.	2180 min.
28-Day Compressive Strength, psi	6350		3050 min.
Autoclave Expansion, %	0.03	0.80 max.	0.80 max
Initial Vicat, minutes	120	45 min.	45 min.
Mortar Bar Expansion, %	0.010	0.020 max.	0.020 max.

*Must conform to ASTM C 1038 mortar bar expansion limit of 0.020% if the maximum percent specified for SO₃ is exceeded.

I certify that Lot Number 0011566 of Type II/V Portland Cement, produced during the month of March 2010 at the Newton Plant, meets or exceeds the requirements specified in ASTM C 150 and Subsection 1006-2.01 of the Arizona Department of Transportation Specifications.

Respectfully,

(Signature)

Billy B. Bop General Manager

FLYASH R' US

1234 N. Gwegowy Way Littletown, AZ 85111 Phone No. 602-555-6789

CERTIFICATE OF COMPLIANCE

Date:May 13, 2010Material:Class F Fly AshSource:Ashley Plant

The following lots of Class F Fly Ash have been produced during the month of March 2010 at the Ashley Plant in Littletown, Arizona.

I hereby certify that the Class F Fly Ash produced in the lots listed above meets or exceeds the requirements specified in ASTM C 618 and Subsection 1006-2.04 of the Arizona Department of Transportation Specifications.

Respectfully,

<u>(Signature)</u>

Mat Erial President

FLYASH R' US

1234 N. Gwegowy Way Littletown, AZ 85111 Phone No. 602-555-6789

CERTIFICATE OF ANALYSIS

Date:May 13, 2010Material:Class F Fly AshSource:Ashley Plant

The following are the test results for Lot Number 041567 of Class F Fly Ash produced during the month of March 2010 at the Ashley Plant in Littletown, Arizona.

TESTS	RESULTS	SPECIFICATIONS
Silicon Dioxide (SiO ₂), %	61.12	
Aluminum Oxide (Al ₂ O ₃), %	22.09	
Iron Oxide (Fe ₂ O ₃), %	5.78	
Sum of SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , %	89.99	🖉 70 min.
Calcium Oxide (CaO), %	4.79	
Magnesium Oxide (MgO), %	0.98	
Sulfur Trioxide (SO ₃), %	0.42	5.0 max.
Sodium Oxide (Na ₂ O), %	0.87	
Potassium Oxide (K ₂ O), %	1.30	
Total Alkalies (as Na ₂ O), %	1.73	
Available Alkalies (as Na ₂ O), %	0.50	
Moisture Content, %	0.03	3.0 max.
Loss on Ignition, %	0.21	3.0 max.
Amount Retained on No. 325 Sieve, %	26.14	34 max.
Specific Gravity	2.25	
Autoclave Soundness, %	-0.01	0.8 max.
SAI, 7 Days, % of Control	76.5	75 min.*
SAI, 28 Days, % of Control	95.5	75 min.*
Water Required, % of Control	96.3	105 max.

*Meeting the 7 day or 28 day Strength Activity Index will indicate specification compliance.

I certify that Lot Number 041567 of Class F fly Ash, produced during the month of March 2010 at the Ashley Plant, meets or exceeds the requirements specified in ASTM C 618 and Subsection 1006-2.04 of the Arizona Department of Transportation Specifications.

Respectfully,

<u>(Signature)</u>

Mat Erial President

LIME INCORPORATED

4321 South Seger Drive Middletown, AZ 85999 Phone No. 602-555-9876

CERTIFICATE OF COMPLIANCE

Date:April 2, 2010Material:Hydrated Lime (ASTM C 1097)Source:Seger Plant

The following lots of Hydrated Lime (ASTM C 1097) have been produced during the month of March 2010 at the Seger Plant in Middletown, Arizona.

I hereby certify that the Hydrated Lime produced in the lots listed above meets or exceeds the requirements specified in ASTM C 1097.

Respectfully,

(Signature)

Barbie Que ^(*) Vice President, Quality Control

LIME INCORPORATED

4321 South Seger Drive Middletown, AZ 85999 Phone No. 602-555-9876

CERTIFICATE OF ANALYSIS

Date:April 2, 2010Material:Hydrated Lime (ASTM C 1097)Source:Seger Plant

The following are the test results for Lot Number 030810 of Hydrated Lime (ASTM C 1097) produced during the month of March 2010 at the Seger Plant in Middletown, Arizona.

TESTS	RESULTS	SPECIFICATIONS
Total Calcium Oxide (CaO) and Magnesium Oxide (MgO), %	97.37	90.0 min.
Carbon Dioxide, %	0.69	5.0 max.
Unhydrated CaO and MgO (Insolubles), %	0.90	5.0 max.
Free Moisture of Dry Hydrates, %	0.40	2.0 max
Retained on No. 30 Sieve, %	0.19	3.0 max.
Retained on No. 200 Sieve, %	5.65	30 max.

I certify that Lot Number 030810 of Hydrated Lime produced during the month of March 2010 at the Seger Plant, meets or exceeds the requirements specified in ASTM C 1097.

Respectfully,

(Signature) Barbie Que Vice President, Quality Control

ARIZONA DEPARTMENT OF TRANSPORTATION * MATERIALS GROUP



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

POLICY AND PROCEDURE DIRECTIVE

James P. Delton Assistant State Engineer

TO: ALL MANUAL HOLDERS	PPD NO. 16a
SUBJECT:	EFFECTIVE DATE:
ADOT RADIATION SAFETY PROGRAM	April 14, 2010

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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.

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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.

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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.

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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 **R**easonably 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 paragraph 3.5.2.1, individuals operating field nuclear gauges must have a current ATTI (Arizona Technical Testing Institute) "Field Technician" certification.

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 paragraph 3.5.3.1, individuals operating field nuclear gauges must have a current ATTI (Arizona Technical Testing Institute) "Field Technician" certification.

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.

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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 paragraph 3.5.4.1, individuals operating field nuclear gauges must have a current ATTI (Arizona Technical Testing Institute) "Field Technician" certification.

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 ATTI "Field Technician" certification and proper training and instruction on the use of the nuclear equipment may transport but shall not operate nuclear 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 ATTI "Field Technician" 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 "Field Technician" 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 "Field Technician" certification before authorization is granted to operate Department nuclear gauges. This employee will also be authorized to handle and transport and operate Department nuclear gauges.

4.5 In addition, all new employees (including contracted technicians) who may potentially use Department nuclear equipment shall be instructed in the requirements of the ADOT Radiation Safety Program as contained in this directive and the radiation safety procedures which must be observed in performing assigned duties.
4.6 All employees involved with packaging, preparing shipping papers, or transporting Department nuclear gauges shall receive refresher hazmat training at least every three (3) years (per US DOT regulations) if gauges are shipped only by highway. The training must be received every two (2) years (per IATA regulation) if gauges are shipped by air.

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

4.8 DRSO Responsibilities

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

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

4.9 **RRSO** Responsibilities

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

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

4.10 RSO Requirements

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

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

5. PERSONNEL MONITORING EQUIPMENT

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

•	Whole body deep dose	5 rem
•	Skin dose	50 rem
•	Extremity dose	50 rem
•	Lens of the eye dose	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 Section 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 Section 15.6.

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 in a locked and fixed (non-portable) storage unit, or in a locked storage room, within a secured office, laboratory, warehouse, or storage building.

15.3.1 A field nuclear gauge may be stored in the locked transport case which is attached inside the locked nuclear gauge containment system which is bolted to the bed of the truck [not to exceed sixty-six (66) hours of storage] 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 secured utilizing the method described in Section 15.3. The vehicle 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

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

Attachments (12)

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 Anizona 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 distion
- 2. Post or otherwise make available to you a copy of the operating procedures which apply to work you are Arizona Radiation Regulatory Agency rules, licenses, and
- engaged in, and explain their provisions to you. Post notice of violation involving radiclogical working conditions, proposed imposition of civil penalities, and andons. ė

YOUR RESPONSIBILITY AS A WORKER

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

WHAT IS COVERED BY THESE RULES

- 1. Limits on exposure to radiation and radioactive material in restricted and unrestricted areas.
 - Measures to be taken after accidental exposure;
 - N
- 3. Personnel monitoring, surveys, and equipment;
- Caution signs, labels, and safety interlock equipment;
 Exposure records and means
- 6. Options for workers regarding ARRA inspections; and Related matters.
- **REPORTS ON YOUR RADIATION EXPOSURE HISTORY** 1. The Arizona Radiation Regulatory Agency rules require

receive an exposure in excess of any applicable limit set that your employer give you a written report if you

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 n air and water.

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

INSPECTIONS

tion, any worker or representative of workers who believes that there is a violation of the regulations issued thereunder, or the terms of the conditions in which the worker is engaged, may request an inspection by sending a notice of the alleged violation to the Arizona Radiation Regulatory Agoncy. 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 employer's license or rules with regard to radiological working resentatives of the Arizona Radiation Regulatory Agency. In addiwhich he believes contributed to or caused any violation as described All licensed or registered activities are subject to inspection by rep **Wodia**

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 OFA 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)

April 14, 2010



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

John S. Halikowski Director Floyd Roehrich Jr. State Engineer

- 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	ON WORK # HOME/CEI				
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	###- <mark>#</mark> ##-####	###-###-####			
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): 02-11-09
V2-11-07



Andraids Greak

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		
-	DOSE TO MEMBER OF PUBLIC IN ONE YEAR		
1.	Identify the individual member of the public likely to receive the highest dose from gauges in storage. This will be the person who spends the most time in the vicinity of the stored gauges or who is closest to the		
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 <u>distance</u> between the gauges and personnel
- Add <u>shielding</u> 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	1⁄4 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.

02-11-09



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

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

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





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						
 Dose that may be received during remainder of pregnancy (500 mrem - line 1) If line 1 > 450 mrem, enter 50 mrem 	r: mrem n.						
3. Likely to receive > 50 mrem during pregnancy? Yes (If yes, monitoring required.)	No						

April 14, 2010

	ARIZOI RADIOA DATE:	NA DEPARTME	NT OF TRANSPORTATION ALS INSPECTION REPORT	Aricon	eument er rra D Blerials Grou	anoportation P
	Central Laboratory Regional Laboratory		Construction Office Field/Technician			
Or Facilty Name of	g. Number: or Project #:				_	
Facility/Location of	or Vehicle #:					
1. STORAGE				YES	NO	N/A
a. Is gauge stored in it	ts transportation case?					
b. Is gauge stored in lo	ocked storage unit?					
 c. Is storage unit within d. Transport case is in 	n a locked building or fac	condition?				
e. Hinges, hasps, and	latches are in good cond	dition?				
f. Plan or drawing of f	acility and location of ga	uge storage area	within facility?			
2. SURVEYS AND MO	ONITORING			YES	NO	N/A
a. Has a radiation surv	vey been performed outs	ide the storage a	irea?			
b. Have there been an	iy changes to the storage	e, security, or use	e of surrounding areas			
c. Survey equipment of	calibrated and operationa	al?				
d. Personnel monitorir	ng devices used by only t	those individuals	to whom the device			
has been issued?	end in a way wadiation ava	- 2				
e. Control badges stor	red in a non-radiation are	ea ?				
3. POSTING AND LA	BELING			YES	NO	N/A
a. ARRA-6 NOTICE T	O EMPLOYEES					
b. CAUTION-RADIOA	CTIVE MATERIALS					
c. TITLE 12, 7-31, NO						
e. Transport case has	required labels (1) DOT	label and (2) Yel	llow II labels?			
f. Utilization Log (star	idard count logbook)?	Droooduroo?				
g. Radiation Salety Ma	anuar / Gauge Operating	Procedures?				

ARIZONA DEPARTMENT OF TRANSPORTATION RADIOACTIVE MATERIALS INSPECTION REPORT

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

INSPECTORS NAME:

INSPECTORS TITLE:

SIGNATURE:



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



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

Fill in the blanks or cir	cle the appropriate info	ormation.			
Gauge Manufacturer:	Troxler		CPN		Humboldt
Gauge Model No.	501 3241 4	640 5001			
Gauge Serial No.					
lsotope: Acti∨ity:	<u>Cs-137</u> 8mCi 10mCi		40mCi	<u>Am-241:Be</u> 50mCi	100mCi
Gauge Location:					
	Org. No.			Address	
Leak Test / Inve	ntory Date:			-	
Taken By: (print name)				
	(signature)				
Log Book Entry	Dated and Signed or I	nitialed: Y	es No		
Date of Previous	s Leak Test:			-	
	DO NOT W	RITE BELOW T	THIS LIN	IE	
This is to certify the al indication of source le	pove described smear akage.	has been assa	yed at o	ur facilities f	or
Our findings sho	w the leakage to be	ALPHA	BET	a-gamma	
Certified By:	Arizona State Ur	niversity	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 form the operator, wipe the area around the metal wiper ring in the removable plate on the bottom surface of the gauge. This will complete the leak test for the 5001 series gauges.
- 2(c) Return the Q-tip to the plastic envelope and return the completed form and leak test kit to the Department Radiation Safety Officer.
- 3. For Model 4640 (Thin Layer Density), Model 3241 (Asphalt Content), and Model 501 (Down Hole Probe) gauges, leak testing shall be performed in accordance with the manufacturer's instructions. After wiping the source(s), complete step 2(c).
- 4. Enter date of leak test and sign or initial the entry into the log book for the gauge. Also, note the same on the front of this form; and note the date that the gauge was previously leak tested on the front of this form.

ARIZONA DEPARTMENT OF TRANSPORTATION **RADIOACTIVE MATERIALS UNIT** TRANSPORTATION/TRANSFER RECEIPT FORM

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

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

THREE PART FORM - PLEASE PRESS FIRMLY

TO: ADOT ORG: ____

FROM: ADOT ORG: ____

CITY / TOWN

CITY / TOWN

HAZARDOUS MATERIAL

IDENTIFICATION NUMBER: UN3332 TRANSPORT LABEL: YELLOW II TRANSPORT INDEX: 0.4 mR/Hr.

PROPER SHIPPING NAME: RQ, RADIOACTIVE MATERIAL, SPECIAL FORM, N.O.S. HAZARD CLASS: RADIOACTIVE MATERIAL

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

OPERATOR/SAFETY MANUAL LOCK & GAUGE	REMOTE CONTROLLER PRINTER
LOCK & GAUGE	PRINTER
CHAIN W/LOCK	SAMPLE PANS
CABLE,	CLEANING BRUSH
CABLE CLAMP	CABLE RS232C
CABLE COUPLING	PLUG FIXTURE
DUMMY PROBE W/CORD	CHARGER
SCALER	
	CABLE, CABLE CLAMP CABLE COUPLING DUMMY PROBE W/CORD SCALER

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

TRANSFERRED BY:	RECEIVED BY:
Signature/ Date	Signature/ Date
Print Name/ Badge No.:	Print Name/ Badge No.:
44-0600 R9/02	

WHITE: MATERIALS ANNEX YELLOW: USER PINK: REGIONAL RSO

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SEMI-ANNUAL (MARCH, SEPTEMBER) NUCLEAR GAUGE INVENTORY

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

INSTRUCTIONS: The Regional Radiation Safety Officer and/or their Alternate must first identify all radioactive materials (gauges) and their locations within the Region by review of Transfer/Receipt forms. Once radioactive materials (gauges) not atternate the RRSO or Alternate will contact the user of the radioactive materials (gauges) and have those personnel perform a physical inventory of the radioactive materials. All columns above must be completed. Once all radioactive materials inventory is identified and documented send the completed copy to the Department Radiation Safety Officer as soon as possible.

ARIZONA DEPARTMENT OF TRANSPORTATION * MATERIALS GROUP



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

POLICY AND PROCEDURE DIRECTIVE

James P. Delton Assistant State Engineer

TO: ALL MANUAL HOLDERS	PPD NO. 19
SUBJECT:	EFFECTIVE DATE:
ADOT SYSTEM FOR THE EVALUATION OF TESTING LABORATORIES	April 14, 2010

1. GENERAL

1.1 This Policy and Procedure Directive specifies the requirements which materials testing laboratories must meet in order to be approved by ADOT to perform sampling and testing activities for the Department.

1.2 This ADOT System for the Evaluation of Testing Laboratories incorporates the procedures and requirements of the AASHTO Accreditation Program (AAP) in conjunction with AASHTO R 18, "Establishing and Implementing a Quality Management System for Construction Materials Laboratories", as part of the requirements for a laboratory to demonstrate competency in the performance of specific tests on construction materials. Laboratories which are approved by ADOT must obtain and maintain AASHTO accreditation for any AASHTO or ASTM test method specified or referenced by a contract document. In addition, AASHTO accreditation is required for any AASHTO or ASTM test method which an Arizona Test Method modifies.

1.3 On all projects advertised/awarded by ADOT, the materials testing laboratory must satisfy the qualification criteria as specified herein and be approved by ADOT Materials Group prior to performing materials sampling and testing activities for the Department. For Certification Acceptance projects that are advertised/awarded by a local government agency, AASHTO accreditation in applicable test methods is sufficient. Those laboratories submitting asphaltic concrete mix designs must also meet the requirements of *Materials Group Policy and Procedure Directive No. 4, "Asphaltic Concrete Mix Design Proposals and Submittals"*, and be approved by the Materials Group Bituminous Engineer. Approved laboratories will be periodically evaluated to verify compliance with this system. This system is administered by the State Engineer. This system will apply to any laboratory performing sampling and testing activities for the Department, directly or as a subconsultant.

1.4 The ADOT System for the Evaluation of Testing Laboratories is revised periodically. The latest version of this Policy and Procedure Directive can be accessed at the following website: "www.azdot.gov/Highways/Materials/QA/QA_Manuals/index.asp".

2. ADOT SYSTEM CRITERIA

2.1 The following requirements are <u>in addition</u> to Section 3, "AASHTO Accreditation Program Criteria", of the *AASHTO Accreditation Program Procedures Manual*:

2.1.1 "<u>3.1 Quality System Criteria</u>" is modified to add the following:

2.1.1.1 The laboratory shall have and maintain the current ADOT Materials Testing Manual. The manual shall be readily accessible to all laboratory personnel.

2.1.2 "<u>3.2 On-Site Inspection and Quality System Evaluation Criteria</u>" is modified to add the following:

2.1.2.1 Any laboratory performing materials sampling and testing in Arizona, or within 50 miles of its borders, for ADOT projects shall be open for inspection by Arizona Department of Transportation personnel at any time. ADOT Materials Group Quality Assurance Section shall regularly schedule and conduct periodic on-site equipment and procedural inspections at all approved permanently based laboratories. The laboratory shall demonstrate the capability to perform tests according to the current ADOT Materials Testing Manual for those testing services offered under the scope of this system.

2.1.2.2 Approval will be given for those AASHTO/ASTM test methods which the laboratory has obtained AASHTO accreditation and which are successfully demonstrated during the ADOT inspection. Approval will be given for those Arizona Test Methods which modify AASHTO/ASTM methods, <u>if</u> the laboratory has AASHTO accreditation for the AASHTO/ASTM methods, <u>and</u> the Arizona Test Methods are successfully demonstrated during the ADOT inspection. Approval will also be given for unique Arizona Test Methods that are successfully demonstrated during the inspection.

2.1.2.3 A written response to any deficiencies noted during ADOT inspections shall be submitted to the ADOT Materials Group Quality Assurance Engineer within 30 days of notification. Failure to respond to noted deficiencies within the 30 day limit will be grounds for revocation of ADOT approval.

2.1.2.4 Laboratory inspections performed by ADOT Materials Group Quality Assurance Section will be conducted according to **Table 1**.

2.1.2.5 To perform acceptance or quality control sampling and testing on a project, a lab facility must be located within 50 miles of the project site. In addition, the lab must be completely equipped for all phases of project-related sampling and testing, as required by the contract specifications.
	LAR	DRATORV IN	TABLE 1	REQUIREM	FNTS	
TYPE OF LAB	Evaluate personnel, Quality Management System Manual, etc.	Inspect procedures and equipment <u>on</u> <u>a regular</u> <u>schedule or</u> <u>as needed</u>	Approve via Acceptance Letter	Include in ADOT Directory of Approved Testing Labs	Performing Acceptance sampling and testing for ADOT: <u>INSPECT</u> <u>PER</u> <u>PROJECT</u>	Performing quality control sampling and testing for Contractor: <u>INSPECT</u> <u>PER</u> <u>PROJECT</u>
All ADOT Labs Statewide	Х	Х	Х			
AASHTO Accredited Independent Labs within Arizona* which are ADOT Approved	Х	Х	Х	Х		
Satellite Labs** within Arizona* of an ADOT Approved Lab		Х			Х	AS REQUESTED BY THE RESIDENT ENGINEER
Satellite Labs** within Arizona* of an out-of-state AASHTO accredited independent Lab which is not ADOT Approved	Х	Х	X		Х	Х
Portable Labs*** within Arizona* of an ADOT Approved Lab					Х	AS REQUESTED BY THE RESIDENT ENGINEER
* Operating w** Any perman	ithin Arizona, or ently based lab f	within 50 miles	s of Arizona bo g under the auth	rders.	НТО	
accreditation *** Portable lab accreditation	facility operating of, a main labor	ratory facility (" g under the auth ratory facility ("	parent" lab). ority, and AAS parent" lab).	ЭНТО		

2.1.2.6 At least 10 days prior to any phase of construction requiring materials acceptance sampling and testing by the laboratory, the Resident Engineer shall notify the ADOT Materials Group Quality Assurance Engineer in writing to request an inspection of a portable or satellite laboratory. Portable or satellite laboratories contracted to do materials acceptance sampling and testing on ADOT projects shall be set up and available for inspection by ADOT at least 5 days prior to any phase of construction requiring materials acceptance sampling and testing by the laboratory.

2.1.2.7 As an addendum to their AAP Quality Management System Manual, each approved lab shall submit, for review and acceptance by ADOT, written policy and procedures that address the following issues:

- 1. How portable or satellite laboratories maintain test method and specification compliance while sampling and testing materials for ADOT projects.
- 2. How inspection and calibration of sampling and testing equipment at portable or satellite laboratories are performed and documented.
- 3. How the correlation testing program is performed between the accredited "parent" laboratory and its portable or satellite facilities.

2.1.2.8 Copies of AMRL and CCRL inspection reports and responses to any deficiencies shall be transmitted to the ADOT Materials Group Quality Assurance Engineer within 30 days of receipt of the inspection report.

2.1.2.9 Additional information regarding laboratory inspections can be found in Series 900 "Materials Quality Assurance Program" of the ADOT Materials Testing Manual, obtained by accessing the Materials Quality Assurance Section website at "www.azdot.gov/Highways/Materials/quality_assurance.asp".

2.1.3 "<u>3.3 Proficiency Testing Criteria</u>" is modified to add the following:

2.1.3.1 The laboratory shall participate in the ADOT Proficiency Sample Program, performing at least those test methods for which ADOT approval has been granted. A written response to any deficiencies shall be submitted to the ADOT Materials Group Quality Assurance Engineer within 30 days of notification. Failure to respond to deficiencies within the 30 day limit will be grounds for revocation of ADOT approval. If a laboratory does not perform testing on two consecutive sets of proficiency samples of the same material type, that laboratory will be removed from the ADOT Proficiency Sample Program entirely. If that laboratory is also an ADOT approved laboratory, it will lose ADOT approval to perform sampling and testing on <u>ADOT projects.</u>

2.1.3.2 Copies of AMRL and CCRL proficiency sample test result reports and responses to deficiencies shall be transmitted to the ADOT Materials Group Quality Assurance Engineer within 30 days of receipt of the final report.

2.1.3.3 Additional information regarding the ADOT Proficiency Sample Program can be found in Series 900 "Materials Quality Assurance Program" of the ADOT Materials Testing Manual, obtained by accessing the Materials Quality Assurance Section website at "www.azdot.gov/Highways/Materials/quality_assurance.asp".

2.1.4 "**3.4 Personnel Qualification Criteria**" is modified to add the following:

2.1.4.1 An individual who is responsible for supervising sampling and testing shall meet the requirements given in Table 2 for the appropriate field in which sampling and testing is being performed.

2.1.4.2 **Individuals who perform actual sampling and testing** shall meet the requirements given in **Table 3** for the appropriate field in which sampling and testing is being performed, and shall be supervised by an individual who meets the requirements of **Table 2** for the appropriate field in which sampling and testing is being performed.

2.1.4.3 Additional information regarding certification requirements can be obtained from ADOT Materials Group Quality Assurance Section, or by accessing the Materials Quality Assurance Section website at "www.azdot.gov/Highways/Materials/quality_assurance.asp".

2.1.5 "<u>3.5 Additional General Criteria</u>" is modified to add the following:

2.1.5.1 Copies of a laboratory's notification to or from AASHTO of any major change in its quality system, capability to perform tests for which it is accredited, laboratory ownership, location (for permanent facilities), managerial personnel, facilities, and any other change which may affect the scope of its accreditation shall be transmitted to the ADOT Materials Group Quality Assurance Engineer within 30 days of when the change occurs.

2.1.5.2 The ADOT Materials Group Quality Assurance Engineer must be notified within 30 days of changes in supervisory and key technical personnel.

2.1.5.3 To be eligible to perform referee testing on ADOT projects as an independent testing laboratory, the laboratory must provide proof to the Department of their independent status by submitting a letter to the ADOT Materials Group Quality Assurance Engineer indicating all individuals and corporations that have ownership of the laboratory. In addition, the letter must indicate that each of the owners of the laboratory is devoid of any ownership in contracting firms or materials suppliers who perform work for the Department.

	TABI	LE 2		
	REQUIREMENTS FOR SAMPLIN	IG AND TESTING SUPERVISOR		
	Soils and A	Aggregate		
	Field	Laboratory		
Ariz "Fie belo	zona Technical Testing Institute (ATTI) eld" certification plus one of (a) through (g) ow.	Arizona Technical Testing Institute (ATTI) "Laboratory Soils/Aggregate" certification plus one of (a) through (g) below.		
	Asphaltic	Concrete		
	Field	Laboratory		
Ariz "Fie belo	zona Technical Testing Institute (ATTI) eld" certification plus one of (a) through (g) ow.	Arizona Technical Testing Institute (ATTI) "Asphalt" certification plus one of (a) through (g) below.		
	Conc	rete		
	Field	Laboratory		
Ame Field plus	American Concrete Institute (ACI) "Concrete Field Testing Technician Grade I" certification plus one of (a) through (g) below.American Concrete Institute (ACI) "Concrete Strength Testing Technician" certification plus one of (a) through (g) below.			
(a)	Professional Engineer, registered in the State sampling and testing experience acceptable to	e of Arizona, with one year of highway materials o the Department.		
(b)	Engineer-In-Training, certified by the State sampling and testing experience acceptable to	of Arizona, with two years of highway materials o the Department.		
(c)	Obtained a Bachelor of Science Degree in C Construction, or related field acceptable to t materials sampling and testing experience ac	Civil Engineering, Civil Engineering Technology, he Department; and with three years of highway ceptable to the Department.		
(d)	(d) Certified by the National Institute for Certification in Engineering Technologies (NICET) in the Construction Materials Testing field as an Engineering Technician (Level III) or higher in the appropriate subfield in which sampling and testing is being performed.			
(e)	Certified by NICET in the Transportation I Technician (Level III) or higher in the Highv	Engineering Technology field as an Engineering vay Materials subfield.		
(f)	Certified by NICET as an Engineering Technology with five years of highway mate to the Department.	Technician, or higher, in Civil Engineering erials sampling and testing experience acceptable		
(g)	An individual with eight years of highway respectively.	naterials sampling and testing, and construction,		

TABI REQUIREMENTS FOR SAMPLIN	LE 3 IG AND TESTING TECHNICIAN
Soils and A	Aggregate
Field	Laboratory
Arizona Technical Testing Institute (ATTI) "Field" certification.	Arizona Technical Testing Institute (ATTI) "Laboratory Soils/Aggregate" certification.
Asphaltic	Concrete
Field	Laboratory
Arizona Technical Testing Institute (ATTI) "Field" certification.	Arizona Technical Testing Institute (ATTI) "Asphalt" certification.
Conc	crete
Field	Laboratory
American Concrete Institute (ACI) "Concrete Field Testing Technician Grade I" certification.	American Concrete Institute (ACI) "Concrete Strength Testing Technician" certification.

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

ARIZONA DEPARTMENT OF TRANSPORTATION * MATERIALS GROUP



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

POLICY AND PROCEDURE DIRECTIVE

James P. Delton Assistant State Engineer

TO: ALL MANUAL HOLDERS	PPD NO. 20
SUBJECT:	EFFECTIVE DATE:
GUIDANCE ON THE USE OF RECLAIMED ASPHALT PAVEMENT (RAP) IN ASPHALTIC CONCRETE	April 14, 2010

1. GENERAL

1.1 Reclaimed asphalt pavement (RAP) may be used in asphaltic concrete provided it is allowed per Specification.

1.2 This Policy and Procedure Directive was developed to provide guidance to those involved in the production of asphaltic concrete containing RAP. It assumes the reader has a general understanding of the requirements for mixtures not containing RAP.

2. TERMS

2.1 Asphaltic concrete with RAP consists of a mixture of virgin aggregate, virgin binder, RAP, and mineral admixture.

2.1.1 Virgin aggregate consists of mineral aggregate not previously used.

2.1.2 Virgin binder consists of asphalt cement not previously used.

2.1.3 RAP consists of salvaged, milled, pulverized, broken, or crushed asphalt pavement. For purposes of the Specification, RAP is made up of two main components: RAP aggregate and RAP binder.

2.1.3.1 RAP aggregate consists of the aggregate portion of the reclaimed asphalt pavement.

2.1.3.2 RAP binder consists of the binder, or asphalt cement, portion of the reclaimed asphalt pavement.

2.2 When the term "aggregate" is used without being further described as "RAP" or "Virgin", the intended meaning is the total aggregate used in the mixture. Also note that the term "aggregate" is used interchangeably with "mineral aggregate".

2.3 When the term "binder" is used without being further described as "RAP" or "Virgin", the intended meaning is the total binder used in the mixture. Also note that the term "binder" is use interchangeably with "bituminous material", "asphalt cement", and "asphalt".

2.4 The specifications are very deliberate in their use of the terms "RAP" and "Virgin" when describing aggregate or binder. Therefore, it is important that the user be familiar with these definitions and read the specifications carefully.

3. LIMITS ON RAP USAGE

3.1 The amount of RAP material allowed in asphaltic concrete is limited by both a maximum RAP aggregate contribution and a maximum RAP binder contribution to the mixture. In addition, production and testing requirements vary depending on the amount of RAP aggregate and RAP binder in the mixture.

3.1.1 A maximum of 25% RAP aggregate, by weight of total aggregate in the mix, may be used in mixes placed in a lower lift (minimum 2" below finished surface). A maximum of 20% RAP aggregate, by weight of total aggregate in the mix, may be used at all other locations.

3.1.2 A maximum of 25% RAP binder, by weight of total binder in the mix, may be used in mixes placed in a lower lift (minimum 2" below finished surface). A maximum of 20% RAP binder, by weight of total binder in the mix, may be used at all other locations.

3.2 When less than or equal to 15% RAP aggregate is used, by weight of the total aggregate in the mix, all RAP material must pass the 1-1/4 inch sieve.

3.3 When more than 15% RAP aggregate is used, by weight of the total aggregate in the mix, the RAP must be processed into uniform coarse and fine stockpiles meeting the gradation requirements of the specifications, and such that there will be a minimum amount of fines.

3.4 When less than or equal to 15% RAP binder is used, by weight of the total binder in the mix, no testing is required on the RAP binder properties during the mix design process.

3.5 When more than 15% RAP binder is used, by weight of the total binder in the mix, the RAP binder must be extracted, recovered, and tested during the mix design process. Depending on the results of these tests, the grade of virgin binder supplied to the project may need to be different than the grade specified in the bid documents. A different virgin binder grade may be required to ensure the blend of virgin and RAP binder meets the grade specified in the bid documents. The virgin binder grade delivered to the project shall be as specified in the approved mix design.

3.6 There are no specific restrictions on the source of RAP material for a project. However, the contractor is responsible to determine the suitability of the RAP proposed for use regardless of its source.

4. SAMPLING AND TESTING

4.1 The sampling and testing of asphaltic concrete containing RAP is similar to non-RAP mixtures, with some important differences. These differences deal primarily with aggregate properties and asphalt cement content. For mixtures containing RAP, the RAP binder must be tracked separately from the virgin binder. This requires additional sampling, testing, data collection, and calculations.

4.2 During production of asphaltic concrete, sampling and testing is required on the following materials:

- 4.2.1 Mineral Aggregates (See Section 5 for details.)
- 4.2.2 Virgin Binder (See Section 6 for details.)
- 4.2.3 RAP Material (See Section 7 for details.)
- 4.2.4 Asphaltic Concrete (See Section 8 for details.)

4.3 Additional contractor quality control is required for an asphaltic concrete mixture containing RAP. See the project specifications for specific requirements.

5. SAMPLING AND TESTING OF MINERAL AGGREGATES

5.1 Virgin mineral aggregate will be sampled in accordance with Arizona Test Method 105.

5.2 Requirements for the sand equivalent and uncompacted void content are on the composite of the virgin aggregates only. Samples will be obtained from the cold feed belt prior to the addition of admixture, or from the stockpiles when sampling from the cold feed belt is not possible.

5.3 The requirement for fractured coarse aggregate particles is on the composite of the virgin aggregate and RAP aggregate material. The aggregate material for determining fractured coarse aggregate particles will normally come from an asphaltic concrete sample taken and tested for binder content and gradation in accordance with ARIZ 427. However, if the engineer determines that excessive breakdown of the aggregate has occurred due to the use of the ignition furnace, the fractured coarse aggregate particles testing will be performed on a composite of RAP aggregate obtained in accordance with ARIZ 427, and virgin mineral

aggregate. The virgin mineral aggregate will be obtained from the cold feed belt prior to the addition of admixture, or from the stockpiles when sampling from the cold feed belt is not possible. The virgin aggregate and RAP aggregate shall be batched per Composite #1 in the mix design.

6. SAMPLING AND TESTING OF VIRGIN BINDER

6.1 Virgin binder will be sampled and tested in the same way as it is done for non-RAP mixtures. However, as mentioned in Section 3.5, the virgin binder grade required may be different than what is specified in the bid documents to ensure the blend of virgin and RAP binder meet the grade specified. This will be determined during the mix design process. Sample labels shall indicate the actual grade of virgin binder provided to the project.

7. SAMPLING AND TESTING OF RAP MATERIAL

7.1 RAP material must be sampled and tested to ensure it meets the gradation requirements in the specifications. The intent of the RAP material gradation requirements is to prohibit the use of oversized (+1-1/4 inch) material, improve consistency, and minimize segregation. RAP material must also be sampled and tested for moisture content and RAP binder content. Virgin binder and RAP binder contents must be tracked separately in order to determine correction factors, validate and/or determine payments for asphalt cement, and to properly apply asphalt price adjustments.

7.2 RAP material will be sampled in accordance with Arizona Test Method 105. When multiple RAP stockpiles are used, RAP material shall be sampled separately from each stockpile.

7.3 Each RAP stockpile will be sampled and tested for gradation, moisture content, and binder content at a minimum frequency of one sample per lot of asphaltic concrete production. When more than one RAP sample is tested for moisture content and binder content, for a given lot and stockpile, the average of the results will be used.

7.4 Prior to testing the RAP material for gradation and binder content, the weight of the RAP material is recorded and the material is then dried at 140 °F to a constant weight. A higher temperature is not appropriate because it will soften the binder causing the RAP material to break into smaller particles and adhere to the pan. Drying to a constant weight at 140 °F will typically take overnight. The moisture content by drying at 140 °F shall be determined and recorded. After drying and determining the moisture content at 140 °F, the material shall be allowed to cool and then be tested for gradation and binder content.

7.5 The gradation of the RAP material will be determined by first dry sieving the material in accordance with ARIZ 240, but utilizing the No. 8 sieve as the smallest sieve. ARIZ 240 limits the time for shaking the sample to 5 minutes \pm 15 seconds to control breakdown

of the particles of salvaged material into smaller size fractions. The gradation of the RAP material is then determined in accordance with ARIZ 248 (Alternate #2).

7.6 RAP binder content will be determined in accordance with ARIZ 427. A correction factor will be applied to each RAP binder content result determined in accordance with ARIZ 427. A correction factor is required for each stockpile and is determined as follows:

7.6.1 The first two samples of RAP from each stockpile will be split and tested for binder content in accordance with ARIZ 427 (Ignition Furnace) and AASHTO T 164 (Solvent Extraction). A RAP binder content correction factor will be determined by subtracting the average ignition furnace result from the average solvent extraction result. This correction factor will be added to each RAP binder content test result determined in accordance with ARIZ 427 to determine the corrected RAP binder content. At the discretion of the Engineer, the correction factor may be determined prior to the start of asphaltic concrete production provided representative RAP samples are available. A new correction factor may be determined at any time the Engineer believes it is necessary due to a change in material or other circumstances. See Attachment #1 for an example calculation for determining the RAP binder content correction factor.

7.6.2 When splitting RAP material to determine the RAP binder content correction factor, it is extremely important that a representative split be obtained because the correction factor will be applied to all RAP binder content test results. To help ensure a good split is obtained the sample should first be reduced to the approximate size required to perform both procedures (ARIZ 427 and AASHTO T 164). This will generally be 9,000 grams. Then the sample should be split and each half visually observed to verify that both halves appear similar in composition. One half of the split is then tested by the acceptance laboratory in accordance with ARIZ 427. The other half is sent to the Central Laboratory to have tested accordance with AASHTO T 164. Split samples must be sent to the Central Laboratory as quickly as possible to ensure a tank stab correction factor can be calculated in a timely manner.

- **Note 1:** ADOT does not currently perform AASHTO T 164. Therefore, the Central Laboratory will send their split of the RAP material to an on-call laboratory for the required testing.
- **Note 2:** The October 1, 1999 version of ARIZ 427 is written for asphaltic concrete which typically has a very low moisture content (i.e., less than 0.5%). In order to test RAP material using this version of ARIZ 427, it is first necessary to reduce the moisture content of the RAP material in accordance with Section 7.4. After drying and determining the moisture content at 140 °F, the material shall be allowed to cool and then be tested per ARIZ 427, including the requirement to split out a moisture sample to be dried at 290 °F. Additional moisture will be lost when drying the sample at 290 °F.

total moisture content of the RAP material shall be determined by adding the moisture content by drying at 140 °F to the moisture content by drying at 290 °F.

7.7 The total moisture content and RAP binder content results will be used to determine the total quantity of RAP binder used in each lot, as well as in the calculation of a tank stab correction factor (See Section 8.2.2).

8. SAMPLING AND TESTING OF ASPHALTIC CONCRETE

8.1 Asphaltic concrete containing RAP is sampled in the same manner as asphaltic concrete without RAP.

8.2 Testing for gradation, total asphalt content by ignition furnace, effective voids, stability, and compaction for asphaltic concrete containing RAP is done in the same manner as asphaltic concrete without RAP with the following exceptions:

8.2.1 The ignition furnace calibration in ARIZ 427 must be performed in accordance with appropriate modifications for RAP.

Note 3: The October 1, 1999 version of ARIZ 427 does not contain modifications for RAP. Until such time that ARIZ 427 is revised, please contact Materials Group for the necessary modifications.

8.2.2 A tank stab correction factor must be calculated for all mixtures containing RAP. If the correction factor is greater than 0.1%, it shall be applied to the ignition furnace results. Applying the correction factor is not optional as is the case for mixtures that do not contain RAP. The tank stab correction factor is defined as the average difference between the asphalt cement content as measured by the ignition furnace testing and the actual asphalt cement content for the first five lots of production. The "actual" asphalt cement content is determined by adding the virgin asphalt cement content to the RAP binder content, both expressed as a percent of the total mix. See Attachment #2 for an example calculation for determining the tank stab correction factor.

8.2.3 Asphalt content results for mixtures containing RAP are not subject to referee testing because a tank stab correction factor cannot be established for referee results.

9. MEASUREMENT AND PAYMENT FOR ASPHALT CEMENT

9.1 Asphaltic cement will be measured by the ton, for each lot of asphaltic concrete accepted, in one of the following ways:

9.1.1 Asphalt cement may be measured by multiplying the average asphalt cement content (from the Mix/Compaction Report) by the total tons of asphaltic concrete in that lot.

9.1.2 Asphalt cement may be measured by adding invoice quantities for virgin binder to the RAP binder used, adjusted as necessary for waste. The invoice quantities should be shown on the hot plant reports and substantiated by certified weights. RAP binder used shall be determined by multiplying the RAP binder content determined in Section 7.6 by the number of tons of dry RAP materials used in that lot. The tons of RAP material shall be a measured value (i.e., from a belt scale) rather than a calculated value. The measured tons of RAP material shall be shown on the hot plant report. When multiple RAP stockpiles are used, the RAP quantities and RAP binder contents must be determined separately for each stockpile.

9.2 In no case shall the measured amount of asphalt cement for payment be greater than the quantity determined in Section 9.1.2 above, adjusted for waste.

10. OTHER CONSIDERATIONS

10.1 Asphalt cement penalties and price adjustments only apply to the virgin binder in the mixture.

10.2 During production, the percent RAP aggregate shall be maintained to within plus 2 percent and minus 5 percent of the mix design values, not to exceed the maximum allowed by specification. When more than one RAP stockpile is used, this tolerance shall apply to the total percent RAP aggregate in the mixture, as well as the percent RAP aggregate from each stockpile.

10.3 For mixes containing RAP, an asphalt cement tank shall be dedicated to the project for each shift of asphalt concrete production. This is necessary in order to accurately track virgin binder usage for the project and to establish an accurate tank stab correction factor.

10.4 At least five days prior to the start of asphaltic concrete production, a copy of the mix design and representative samples of the virgin mineral aggregate, RAP aggregate, mineral admixture, and asphalt cement used in the mix design must be submitted by the contractor for calibration of the ignition furnace, and determination of aggregate properties. A minimum of 40 pounds of representative RAP material and a minimum of 10 pounds of solvent extracted RAP aggregate shall be submitted. If the RAP is fractionated, the RAP material and RAP aggregate from each stockpile shall be kept separate. All materials must be submitted in sufficient quantity to perform an ignition furnace calibration by both the acceptance lab and a referee lab if

necessary. If referee testing is performed, the referee testing laboratory will only be required to perform the ignition furnace calibration to determine a minus No. 200 correction factor.

10.5 The contractor shall provide daily documentation of the weight, determined by a belt scale, and proportion of material from each individual RAP stockpile incorporated into the mix. The percent moisture content of the RAP material from each stockpile shall also be determined and provided daily by the contractor.

10.6 A pre-activity meeting shall be held approximately two weeks prior to the start of paving. The agenda should include discussion items dealing with the production of asphaltic concrete containing RAP.

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

Attachments (2)

RAP BINDER CONTENT CORRECTION FACTOR (IGNITION FURNACE VS SOLVENT EXTRACTION)

		RAP Binder	r Content (%)	
Sample #	Date	Ignition Furnace (ARIZ 427)	Solvent Extraction (AASHTO T164)	RAP Binder Content Correction Factor (Average Solvent Extraction Value) Minus
1	7/16/2009	7.73	6.51	(Average Ignition Furnace Value)
2	7/17/2009	8.31	7.28	
	Average	8.020	6.895	- 1.13

Notes:

1) Shaded columns contain data input by the user. All others columns are calculated values.

2) The RAP binder contents and RAP binder content correction factor in this example are high due to the recycling of ARAC.

EXAMPLE RAP BINDER CONTENT CORRECTION FACTOR DETERMINATION

<u> </u>				"Actual	" Binder (Content				Binder	
		=	Actual" R/	AP Binder			"Actual Bin	l" Virgin Ider	Total "Actual" Binder	Content by Ignition Furnace	
0		٥	ш	ш	თ	н	_	٦	×		Μ
Pero Binc RA Mate	der der RP srial	Tons of RAP Material used in the Lot	Tctal Percent Moisture Content RAP Material	Tons of Dry RAP Material used in the Lot	Tans of RAP Binder in the Lot	Percent RAP Binder in the Mix	Tons of Virgin Binder in the Lot	Percent Virgin Binder in the Mix	Calculated Total Percent RAP Binder and Virgin Binder in the Mix	Total Percent Binder Content from Ignition Furnace	Difference
0	60	205.47	3.14	199.02	13.14	0.96	59.76	4.36	5.32	5.20	- 0.12
	18	371.27	2.98	360.21	25.86	1.04	114.10	4.59	5.63	5.43	- 0.20
	.27	252.96	3.57	243.93	17.73	1.06	78.11	4.65	5.71	5.05	- 0.66
G	.89	202.40	3.42	195.48	13.47	1.00	54.94	4.07	5.07	4.91	- 0.16
	3.87	489.01	3.86	470.13	32.30	0.98	135.20	4.12	5.10	4.95	- 0.15
								Tan	k Stab Corre	ction Factor	= - 0.26
Imns -	contair	n data input	by the user	. All others	columns ar	e calculate	ed values.				
the to	otal tor	ıs of asphalt	tic concrete	 produced for 	or the given	lot.					
the p	ercent tion fa	: binder cont ctor (see At	ent of the F tachment #	RAP materia	l, as detern	nined by A	RIZ 427 and	d corrected	by the RAP bii	nder	
the to	ons of	RAP materi	al used in th	he lot.							
the 1	otal pe	rcent moistu	ure content	of the RAP r	material (the	e sum of p	ercent mois	sture conten	ts from drying	at 140 °F anc	290 °F).
the .	tons of	dry RAP use	ed in the giv	/en lot. F =	D x [(100 -	E) / 100]					
the	tons of	RAP binder	in the lot.	G = (C × F) /	/ 100						
the	percent	RAP binde	r by weight	of total mix.	H = (G/B)) x 100					
thet	otal ton:	s of virgin bi	nder in the	lot (per the I	hot plant rej	port, verifie	ed by certifie	ed weights).			
the	percent	virgin binde	r by weight	of total mix.	J = (I / B)	x 100					
the	Total "A	∖ctual" binde	er content ("	'Actual" RAF	^o binder plu:	s "Actual"	virgin binde	rt) used in th	ie mixture. K :	С+Н=	
the 1	total bin	der content	in the mixtu	ure as meas	ured by the	ignition fu	Irnace (ARI	Z 427).			
; the	differen	ice between	the binder	content me:	asured by th	he ignition	furnace and	d the "actual	l" binder conte	nt. M = L - K	
8 9	rrection	factor is the	e average o	of the five va	lues in Colu	ımn M.					
alue	ss includ	le waste at t	he plant an	d grade. W	aste must b	be deducte	d prior to pa	ayment for b	vinder and mix		
conte	ents are	e high in this	s example d	lue to the rec	cycling of A	RAC.					
e is fo	ır a mi:	xture with or	ne RAP sto	ckpile. Addi	tional colun	nns are re	quired for m	nultiple RAP	stockpiles.		

EXAMPLE TANK STAB CORRECTION FACTOR DETERMINATION

April 14, 2010