5.21.02 INDEPENDENT ASSURANCE REPLICATE (ASR) CHECK FOR NUCLEAR DENSITY GAUGES

The following establishes a method for verifying whether a nuclear density gauge is properly operating as established in Appendix C. It can also be a check to determine if the operator understands proper procedures for running the nuclear gauge.

a. GENERAL OVERVIEW

Nuclear gauge operators are to demonstrate proficiency in operating the gauge *at the project*. This will represent the Independent Assurance Witness (ASW) portion of the program. The focus of this section is to determine if the nuclear gauge can function properly. If more than one type of nuclear gauge (different series or manufacture) might be used during the course of the project, then each gauge is to be checked by this procedure. Properly warm up the gauge and establish the standard count as outlined under **b. NUCLEAR GAUGE**. Turn off all offsets and correction factors (see **OPERATOR)**. Place the nuclear gauge on the verification block and establish the density of the block by taking 3 one-minute counts or 1 four-minute count.

If the gauge value is within the quantity established in Appendix C, when on the district's verification block, then the gauge can be used on the project. If not, then run a stability and drift test. If the gauge passes the stability and drift test, as outlined in **b. NUCLEAR GAUGE**, then the gauge can be used on the project. If not, the gauge cannot be used on a KDOT project until the above requirements are met. Proof must be provided to the district, that attempts to correct the problem have been made (i.e. new factory calibration with appropriate papers).

b. NUCLEAR GAUGE

FACTORY CALIBRATION: The nuclear gauge is to receive a factory calibration annually[a]. A copy of the calibration papers is to be presented to the district representative at the time of the Independent Assurance (IA) check. Calibration papers are also to be located in the QC/QA project's Quality Manual when applicable.

NOTE a: The use of a portable single calibration block, such as the Validator™ (or Validator II™ when checking the 4640 gauge) or a similar product that is acceptable to KDOT, can be used to calibrate the nuclear gauge every other year (biennial) if available. It can also be used for verification purposes. However, as a minimum, the gauge must be sent in to qualified service center, approved by KDOT, for a full multi-block calibration on a biennial basis with the Validator™ being used between factory calibrations. The validator block shall receive a new calibration at least once every five years. Provide a copy of the current validator calibration documents and the a copy of the gauge calibration documents to the district representative at the time of the IA check. Both documents are also to be located in the QC/QA project's Quality Manual when applicable.

PROPER WARM-UP: The gauge should be properly warmed up before starting any check. For the Troxler units, this means a minimum of 15 – 20 minutes. This permits the electronics to warm up to operating temperatures. If this step is not permitted the counts given can be significantly altered.

STABILITY AND DRIFT TEST: Perform a stability and drift test on the gauge when the gauge fails the IA check. Any time the nuclear gauge readings are "suspect", perform the STAT TEST (or stability test) to validate the normal operation of the gauge. The stability test requires the gauge to take 20 one-minute counts.

Perform the drift test 2 to 3 hours after the stability test to determine if the gauge reading "drifts" between tests. The drift test consists of 5 four-minute counts. It is highly recommended that the gauge not be moved from the block after taking the stability test and prior to taking the drift test.

Check the manufacturer's manual for specifics on the results to be obtained. Contact the Materials Quality Control Engineer at the Materials and Research Center for assistance. For Troxler gauges, use the following table for acceptable limit results:

TROXLER GAUGE SERIES	Stability (STAT) Test*	Drift Test
3411-B and 3440	0.17 to 0.33 – acceptable <0.12 or >0.40 - unacceptable	Density: <0.5% Moisture: < 1.0%
4640-B	0.25 to 0.45	System 1 (Drift A): 0.50% System 2 (Drift B): 0.80%

* For the 3411-B and 3440, the numbers falling between acceptable and unacceptable should be considered carefully prior to acceptance/unacceptance. The 4640-B is considered to be unstable if the ratios are outside these limits for two out of three stat tests.

STANDARD COUNTS: Take a standard count on a surface with 100 lb/ft^3 (1600 kg/m^3) or better. **DO NOT perform the standard count on the Validator**. Perform the stability and drift test prior to taking the standard count.

PASS/FAIL OF STABILITY AND DRIFT: If the gauge fails the stability and drift test as defined in the manufacturer's manual, then see **a. GENERAL OVERVIEW** and consult the manufacturer (if KDOT gauge, call Materials Quality Control Engineer). If the gauge passes the stability but fails the drift, one alternative is to have the operator take new standard counts twice each day. Once when the operator begins in the morning and another in the early afternoon. All standard counts are to be recorded and monitored. As always, pay attention to your immediate surroundings when operating a nuclear gauge.

c. OPERATOR

The operator is to demonstrate understanding of the gauge's fundamental operations, which include the following:

1	Gauge turned on and permitted proper warm up time?	____
2	Set up, establish, and record a standard count?	____
3	Maintained a minimum of 3 ft (1 m) distance from gauge when in operation?	____
4	Verified all offsets and correction factors were turned off?	____
5	Properly seated gauge on concrete block?	____
6	Probe securely placed in the backscatter mode? (verified the latch is properly seated in the notch)	____
7	Gauge permitted to determine density and results recorded?	____
8	Were there any vehicles within 10 ft (3 m)?	YES / NO
9	Were there any nuclear gauges within 30 ft (10 m)	YES / NO
10	What was the density determined?	_____ lb/ft^3 or kg/m^3

DISTRICT 1 2 3 4 5 6

COMMENTS: _____

_____

_____

OPERATOR'S NAME: _____

WORKS FOR: _____

DATE: _____

The checklist represents the minimum an operator should know. A knowledgeable operator should provide new operators guidance. New operators are encouraged to take the gauge out and record a multitude of numbers in a single location with slight variations to the positioning of the base. This will give the operator a better understanding of the gauges' precision and how to optimize seating the gauge to the surface when such conditions apply.