

**REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF DEVICE
(AMENDS IN ITS ENTIRETY)**

NO.: NC-646-D-135-B

DATE: July 22, 2006

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DEVICE TYPE: Laboratory Asphalt Content System

MODEL No.: 3242

MANUFACTURER/DISTRIBUTOR: Troxler Electronic Laboratories
3008 Cornwallis Road
P.O. Box 12057
Research Triangle Park, NC 27709
(919) 549-8661

SEALED SOURCE MODEL DESIGNATION:

ISOTOPE:

MAXIMUM ACTIVITY:

Troxler Drawing No. A-105162 which covers:

OSA Global, Inc.

Model No. CVN.CY2

Capsule Type X.1

Special Form Certificate No. USA/0632/S

Cf-252

110 microcuries (4.07 MBq)

Troxler Drawing No. A-105862 which covers:

Isotope Product Laboratories

Model # HEG-252

Special Form Certificate No. USA/0632/S

Cf-252

110 microcuries (4.07 MBq)

LEAK TEST FREQUENCY: 12 months

PRINCIPAL USE: (G) Portable Moisture Density Gauge

CUSTOM DEVICE:

 YES

 X NO

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DESCRIPTION:

The Model 3242 Laboratory Asphalt Content Gauge is a semi-fixed, non-portable laboratory analysis device for measuring the asphalt content of paving material. The device design is based on the principle of neutron thermalization via collisions with atoms of similar mass and incorporates a doubly-encapsulated neutron-emitting californium-252 (^{252}Cf) radioactive source (neutron yield – 3.8×10^5 neutrons/second) and a series of four helium-3 detector tubes. The device operation can be described as follows: fast neutrons, emitted from the source, traverse the test sample and are subsequently slowed down (thermalized) by collisions with hydrogen atoms of the asphalt. The thermal neutrons are then detected by the helium-3 detectors and counted over a specified time period. Due to the inability of these detectors to detect fast neutrons, the number of thermalized neutrons counted is directly proportional to the number of hydrogen molecules (primarily in the form of asphalt) present in the sample. The accompanying electronics then process the count rates and calculate the asphalt content using operator-supplied information (e.g. mass of sample, calibration data, etc.).

Installation and setup of the device at the user's laboratory will be performed by the user following instructions provided in the accompanying "Manual of Operation and Instruction." This device is designed to be setup, calibrated and used by personnel who have not been specifically trained in radiation safety.

Use of the device consists of preparing the sample pan of asphalt, unlocking the sample chamber door, and inserting the pan into the sample chamber. The control unit containing the electronics and software for the gauge is positioned several feet from the sample chamber which contains the source and detectors. The sample chamber and control unit are connected by an interface cable which transmits data to the control unit. Once testing has been completed, the sample chamber should be locked.

DETAILS OF CONSTRUCTION:

The model 3242 is constructed from four basic materials: aluminum, cadmium, high-density polyethylene, and stainless steel. High density polyethylene is used in the construction of the source holder, the barrier surrounding the source holder in the top of the device, the sample chamber walls and floor, and the base stand. Cadmium is used to shield the outside of the polyethylene source holder and to line the inside walls of the device in such a fashion that no neutron emitted from the sealed source could leave the device without passing through at least one thickness of cadmium. Stainless steel is used in the bottom of the sample chamber to cover the aluminum housing over the detectors, giving increased shielding in the direction of the emitted beam. Finally, aluminum is used as the main construction material in the fabrication of the rest of the device. This includes the device walls, top and bottom; sample chamber interior faces; and other similar structures exterior to the device. A circular hole is cut into the top interior face plate of the chamber to act as the neutron exit beam port. The overall design and construction of the device renders the source housing immovable and access to the radioactive materials highly restricted. The entire device would have to be disassembled in order to gain access to the sealed source. Furthermore, the small sample chamber volume (10" x 7.5" x 4.5") precludes the operator from inadvertently being exposed.

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LABELING:

The Model 3242 is labeled in accordance with 15A NCAC 11 .1626 and .0309. The labels contain the radiation symbol, isotope, activity, model number, serial number, name of distributor, and the words "CAUTION-RADIOACTIVE MATERIAL."

DIAGRAM:

See Attachments 1 and 2 for approximate source and label locations.

CONDITIONS OF NORMAL USE:

The Model 3242 is designed to be used by personnel who have not been specifically trained radiation safety to measure asphalt content of paving materials in a laboratory setting. The user will normally be near the device only for the time period necessary to load and unload the chamber. The source capsule has a recommended working life of 15 or more years under normal use conditions. Due to the 2.65 year half-life of the Cf-252 source, the gauge should be returned to Troxler every 3 years for source replacement and a thorough manufacturer's inspection.

The device is designed for the following environments:

Operating temperature -10°C to 70°C ambient

Pressure Atmospheric

Vibration Ranges from zero to mild (tested @ a displacement of 0.1" @ 12.5 Hz)

Corrosion Ranges from zero to corrosive

Fire +130°C (to melt the polyethylene shielding surrounding the source)

PROTOTYPE TESTING:

The Model 3242 underwent prototype testing for mechanical, structural, and radiological integrity using measurement methodologies and testing procedures found in ANSI Standard N538-1979. This prototype testing included stray radiation measurements of gamma dose rates at 5 cm, 30 cm, and 100 cm for the gauges in both the "on" and "off" configurations; testing of the gauges' safety features at room temperature and at an elevated use temperature of 105°C, and at a decreased use temperature of -40°C; a leak test of the radioactive source after the safety feature/temperature testing; and an engineering evaluation of the likelihood of source retention in the source housing following a severe accident involving fire. The results of the testing showed:

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PROTOTYPE TESTING (continued)

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(1) no safety feature failure or stray radiation increase over the range of temperatures tested and (2) no loss of radioactive material from the sealed source. There was no accident condition fire test conducted for this device. The assignment of Class "1" for the accident condition of the device is based on the 130°C melting point of the high density polyethylene shield around the neutron source. Although the 130°C temperature would not result in damage the source capsule that would allow for leakage, the "captive protective source housing" for the source would be lost. Therefore, the assignment of 1 is supported here. The results of the prototype testing support the assignment of an ANSI standard rating of ANSI-54-164-164-R1.

EXTERNAL RADIATION LEVELS:

See Attachment 3.

QUALITY ASSURANCE AND CONTROL:

Troxler Electronic Laboratories maintains a quality assurance and control program which has been deemed acceptable for licensing purposes by the North Carolina Radiation Protection Section. A copy of the program is on file with the Radiation Protection Section.

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE:

Distribution: This device will be distributed as a generally licensed device in accordance with the requirements of 15A NCAC 11 .0300 or equivalent regulations of the NRC or another Agreement State. The device may also be distributed as a specifically licensed device in accordance with applicable regulations of the State of North Carolina, the NRC, or another Agreement State. This shall not preclude the exportation of this device to a foreign entity, provided that the applicable NRC regulations are followed.

Leak Testing: The device shall be leak tested by the user following the instructions in the "Manual of Operation and Instruction" at intervals not to exceed **twelve** months using techniques capable of detecting the presence of 0.005 microcurie of removable contamination. If the level of contamination exceeds this limit, the device shall be returned to Troxler for repair/disposal. Please note, Troxler maintains a customer leak test service.

Servicing: The Model 3242 device contains no user serviceable components. The controller, containing the scaler and associated data analysis electronics, will generally be returned to Troxler for all servicing. The sample chamber, which holds the radioactive source, will be returned to Troxler for source replacement, servicing, repair and/or disposal.

Operating and Safety Instructions: The device shall be operated in accordance with the written operating and safety instructions given in the device manual.

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LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE (continued):

Reviewer Note: This registration sheet and the information contained within the references shall not be changed without the written consent of the North Carolina Radiation Protection Section, Radioactive Materials Branch.

DOCUMENTATION:

The documentation enclosed with the device upon shipment to the user shall include the following:

1. manual of operation and instruction,
2. special form certificate,
3. type "A" package testing results,
4. a copy of the final leak test results made prior to packaging,
5. an emergency response information sheet,
6. Model 3242 gauge certificate,
7. Troxler transportation guide.

SAFETY ANALYSIS SUMMARY:

The design of the 3242 gauge makes the devices safe to operate by persons not specifically trained in radiological safety. The inherent safety features of the device include: (1) a sealed source, doubly encapsulated, and secured into the device; (2) the use of shielding to attenuate the radiation to lower exposure levels; (3) the small sample chamber volume (10" x 7.5" x 4.5") precludes the operator from inadvertently being exposed, and (4) no user serviceable parts. The radiation profile for the device both shows relatively low radiation levels that are acceptable per federal regulations for exposure. Therefore, based on the information cited above and technical information provided in the application attachments, and with the condition that the licensee (*i.e.*, user) maintain the gauge(s) in accordance with the manufacturer's recommendations and the requirements of this registry sheet, we conclude that the Troxler Model 3242, meets and exceeds the requirements to be manufactured and distributed as either a generally or specifically licensed devices pursuant to applicable regulations listed in 15A NCAC 11.

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REFERENCES:

The following supporting documents are hereby incorporated by reference into this SS&D registry document:

1. All information and engineering drawings submitted by Troxler Electronic Laboratories in the application for a safety analysis of the Model 3242 contained in the gauge SS&D review file;
2. Letter with attachments dated February 14, 2006, signed by Stephen A. Browne, R.S.O.

ISSUING AGENCY:

This Sealed Source & Device registry certificate is hereby amended July 22, 2006.



Principal Reviewer:

J. Marion Eaddy III, Health Physicist

Date: July 22, 2006

Concurrence Reviewer:



Gerald A. Speight, Health Physicist

Date: July 22, 2006

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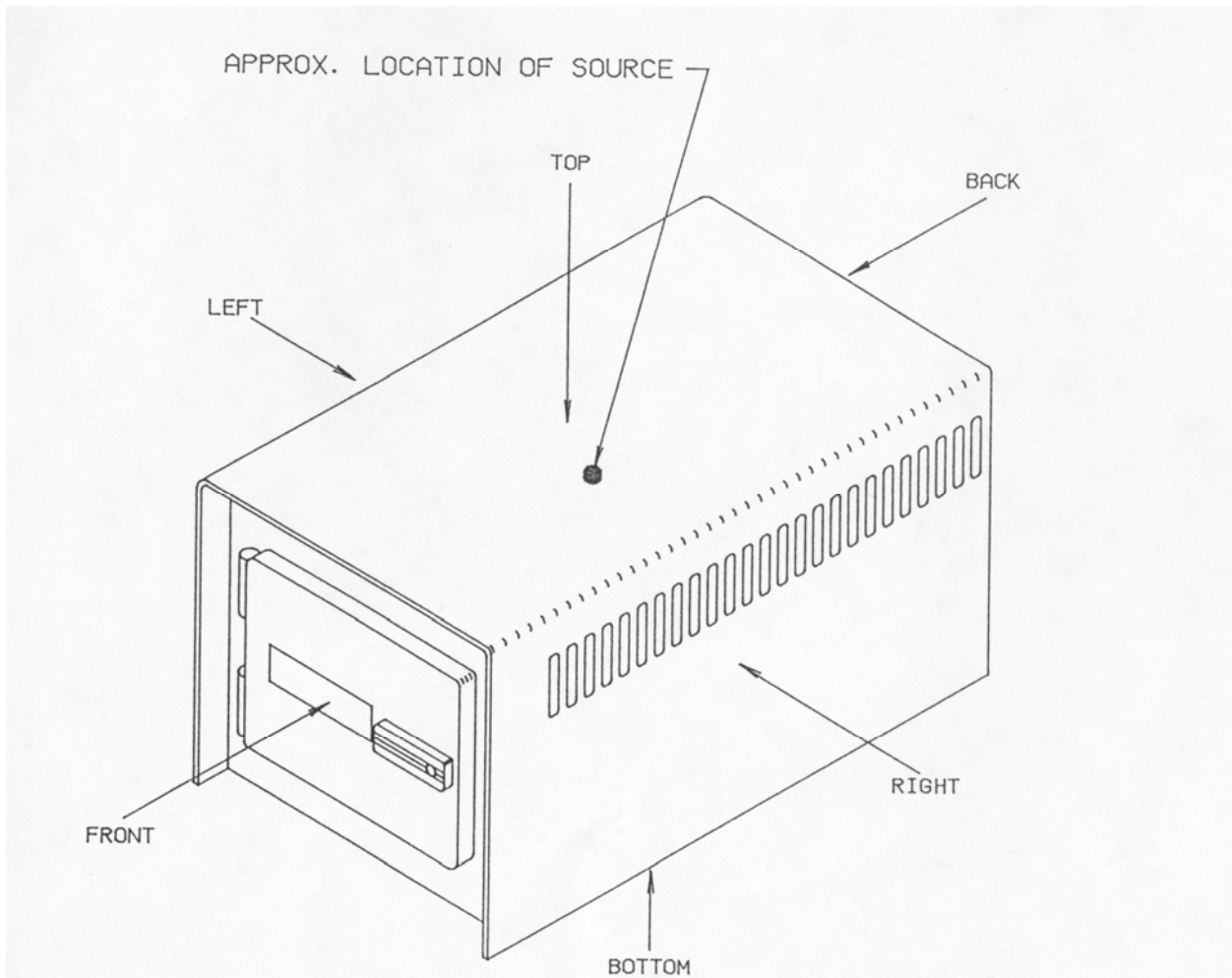
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ATTACHMENT: 1 of 3

DEVICE TYPE: Laboratory Asphalt Content System

Attachment 1: Three Dimensional View of the 3242 Source Locations



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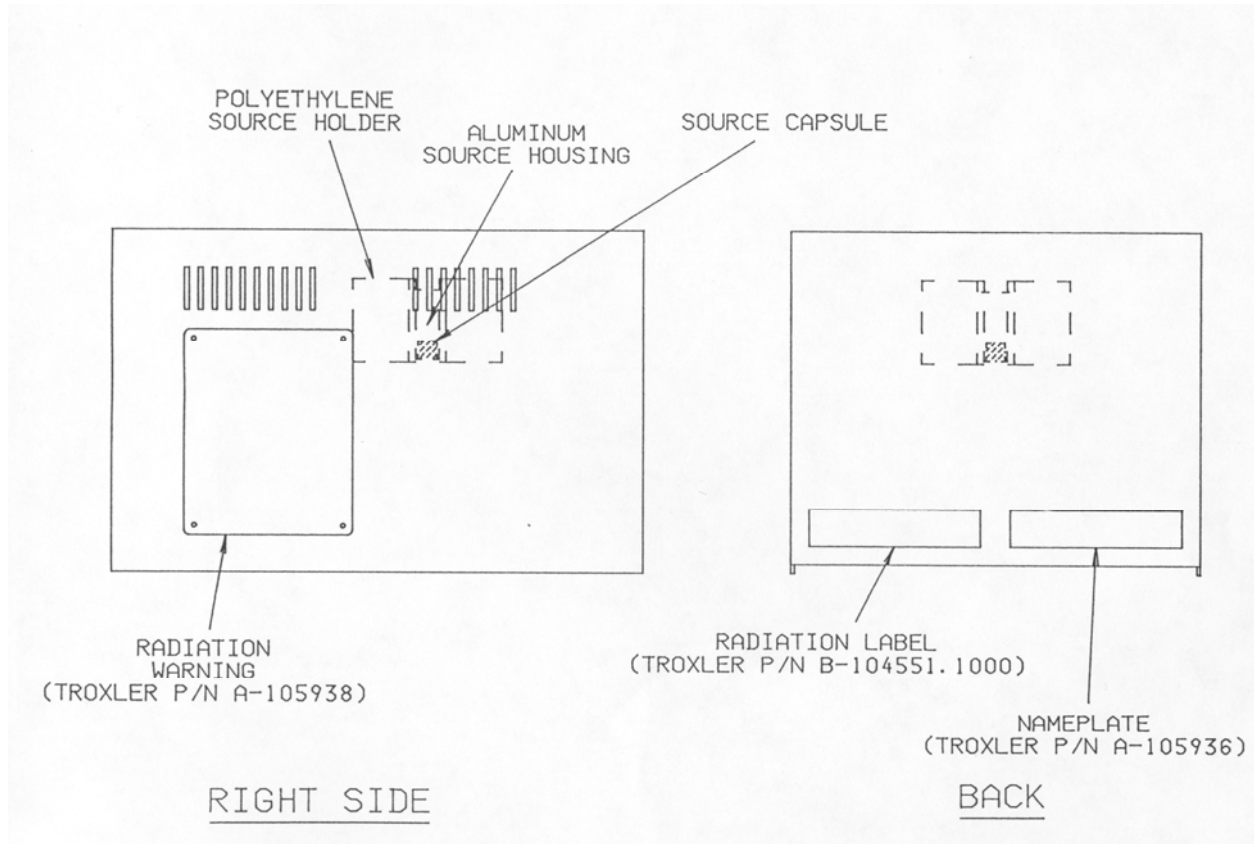
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Attachment 2: 3242 Gauge Source and Label Locations



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Attachment 3: Radiation Profiles for 3242 Gauge

Location	5 cm			30 cm			1 meter		
	γ	η	$\gamma+\eta$	γ	η	$\gamma+\eta$	γ	η	$\gamma+\eta$
Top	.09	*	0.9	0.25	0.80	1.05	0.1	0.1	0.2
Bottom	0.45	*	0.45	0.2	0.45	0.65	0.1	0.1	0.2
Right	0.5	*	0.5	0.25	0.75	1.0	0.1	0.15	0.25
Left	0.6	*	0.6	0.2	0.85	1.05	0.15	0.10	0.25
Front	0.6	*	0.6	0.25	0.90	1.15	0.1	0.2	0.3
Back	0.4	*	0.4	0.2	0.55	0.75	0.1	0.1	0.2

Notes:

1. Radiation measurements were for a gauge containing a nominal and a nominal 0.100 millicurie Californium-252 neutron source.
2. All radiation measurements are in millirems per hour.
3. Gamma (γ) measurements were obtained with a Bicron RSO-5 survey meter, calibrated September 18, 1995.
4. Neutron (η) measurements were obtained with a Nuclear Research Corp. Model NP-2 survey meter, calibrated May 08, 1995.
5. "*" denotes measurement not made because center of detector volume was greater than 5 cm from source
6. See Attachment 1 for profile orientation.