

## APPLICATION FOR MATERIAL LICENSE

**INSTRUCTIONS:** SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

**FEDERAL AGENCIES FILE APPLICATIONS WITH:**

U.S. NUCLEAR REGULATORY COMMISSION  
DIVISION OF FUEL CYCLE AND MATERIAL SAFETY, NMSS  
WASHINGTON, DC 20555

**ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS, IF YOU ARE LOCATED IN:**

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION I  
NUCLEAR MATERIAL SECTION B  
631 PARK AVENUE  
KING OF PRUSSIA, PA 19406

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION II  
MATERIAL RADIATION PROTECTION SECTION  
101 MARIETTA STREET, SUITE 2900  
ATLANTA, GA 30323

**IF YOU ARE LOCATED IN:**

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION III  
MATERIALS LICENSING SECTION  
790 ROOSEVELT ROAD  
GLEN ELLYN, IL 60137

ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION IV  
MATERIAL RADIATION PROTECTION SECTION  
611 RYAN PLAZA DRIVE, SUITE 1000  
ARLINGTON, TX 76011

ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION V  
MATERIAL RADIATION PROTECTION SECTION  
1450 MARIA LANE, SUITE 210  
WALNUT CREEK, CA 94596

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTION.

**1. THIS IS AN APPLICATION FOR (Check appropriate item)**

- ☐ A. NEW LICENSE  
☐ B. AMENDMENT TO LICENSE NUMBER \_\_\_\_\_  
☒ C. RENEWAL OF LICENSE NUMBER 50-19127-01

**2. NAME AND MAILING ADDRESS OF APPLICANT (Include Zip Code)**

VECO, Inc.  
5151 Fairbanks Street  
Anchorage, Alaska 99503

**3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED.**

5151 Fairbanks Street, Anchorage, Alaska  
VECO Camp, Prudhoe Bay, Alaska  
Field Office, Kuparuk, Alaska

**4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION**

Frank Bailey

**TELEPHONE NUMBER**

(907)561-1701

SUBMIT ITEMS 5 THROUGH 11 ON 8 1/2 x 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

**5. RADIOACTIVE MATERIAL**

a. Element and mass number, b. chemical and/or physical form, and c. maximum amount which will be possessed at any one time.

**6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.**

**7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE.**

**8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.**

**9. FACILITIES AND EQUIPMENT.**

**10. RADIATION SAFETY PROGRAM.**

**11. WASTE MANAGEMENT.**

**12. LICENSEE FEES (See 10 CFR 170 and Section 170.31)**

FEE CATEGORY AMOUNT ENCLOSED \$ 120.00

**13. CERTIFICATION. (Must be completed by applicant) THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.**

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, AND 40 AND THAT ALL INFORMATION CONTAINED HEREIN, IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948, 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

**SIGNATURE—CERTIFYING OFFICER**

**TYPED/PRINTED NAME**

**TITLE**

**DATE**

*Frank X Bailey*

Frank Bailey

Personnel Director

5/22/85

**14. VOLUNTARY ECONOMIC DATA**

**a. ANNUAL RECEIPTS**

<\$250K	\$1M-3.5M
\$250K-500K	\$3.5M-7M
\$500K-750K	X \$7M-10M
\$750K-1M	>\$10M

**b. NUMBER OF EMPLOYEES (Total for entire facility excluding outside contractors)**

450

**c. NUMBER OF BEDS**

200

**d. WOULD YOU BE WILLING TO FURNISH COST INFORMATION (Dollar and/or staff hours) ON THE ECONOMIC IMPACT OF CURRENT NRC REGULATIONS OR ANY FUTURE PROPOSED NRC REGULATIONS THAT MAY AFFECT YOU? (NRC regulations permit it to protect confidential commercial or financial—proprietary—information furnished to the agency in confidence)**

YES

X NO

**FOR NRC USE ONLY**

TYPE OF FEE	FEE LOG	FEE CATEGORY	COMMENTS	APPROVED BY
AMOUNT RECEIVED	8512030034 851127 REG5 LIC30 50-19127-01	PDR		DATE

## PRIVACY ACT STATEMENT

Pursuant to 5 U.S.C. 552a(e)(3), enacted into law by section 3 of the Privacy Act of 1974 (Public Law 93-579), the following statement is furnished to individuals who supply information to the Nuclear Regulatory Commission on NRC Form 313. This information is maintained in a system of records designated as NRC-3 and described at 40 Federal Register 45334 (October 1, 1975).

1. **AUTHORITY:** Sections 81 and 161(b) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2111 and 2201(b)).
2. **PRINCIPAL PURPOSE(S):** The information is evaluated by the NRC staff pursuant to the criteria set forth in 10 CFR Parts 30, 32, 33, 34, 35 and 40 to determine whether the application meets the requirements of the Atomic Energy Act of 1954, as amended, and the Commission's regulations, for the issuance of a radioactive material license or amendment thereof.
3. **ROUTINE USES:** The information may be (a) provided to State health departments for their information and use; and (b) provided to Federal, State, and local health officials and other persons in the event of incident or exposure, for their information, investigation, and protection of the public health and safety. The information may also be disclosed to appropriate Federal, State, and local agencies in the event that the information indicates a violation or potential violation of law and in the course of an administrative or judicial proceeding. In addition, this information may be transferred to an appropriate Federal, State, or local agency to the extent relevant and necessary for an NRC decision or to an appropriate Federal agency to the extent relevant and necessary for that agency's decision about you.
4. **WHETHER DISCLOSURE IS MANDATORY OR VOLUNTARY AND EFFECT ON INDIVIDUAL OF NOT PROVIDING INFORMATION:** Disclosure of the requested information is voluntary. If the requested information is not furnished, however, the application for radioactive material license, or amendment thereof, will not be processed. A request that information be held from public inspection must be in accordance with the provisions of 10 CFR 2.790. Withholding from public inspection shall not affect the right, if any, of persons properly and directly concerned need to inspect the document.
5. **SYSTEM MANAGER(S) AND ADDRESS:** U.S. Nuclear Regulatory Commission  
Director, Division of Fuel Cycle and Material Safety  
Office of Nuclear Material Safety and Safeguards  
Washington, D.C. 20555

RADIOACTIVE MATERIALS LICENSE  
APPLICATION FOR MATERIAL LICENSE

V. Radioactive Material

Element Name	Mass Number	Physical Form	Maximum Amount of Possession
Cesium	137	Sealed Source	10 mCi/Source
Americium	241	Sealed Source	50 mCi/Source

The above source material is listed for a "Troxler" 3400B Series Surface Moisture Density Gauge as manufactured by Troxler Electronic Laboratories, Inc.

VI. Purpose(s) For Which Licensed Material Will Be Used.

The "Troxler" unit(s) will be used for taking surface density and moisture measurements of construction materials including, but not limited to, sand, gravel, concrete, permafrost, and asphalt.

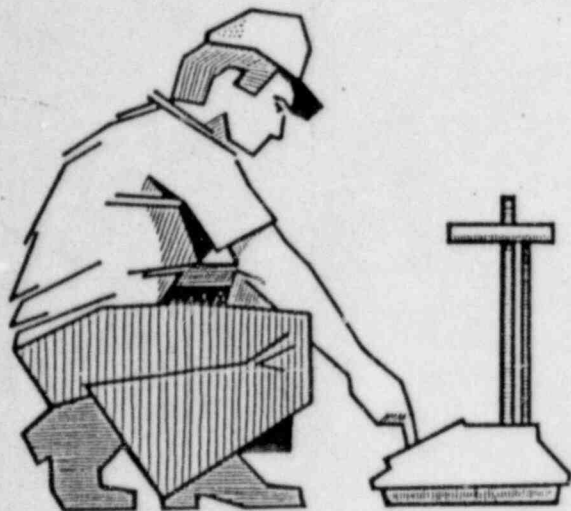
VII. Individual(s) Responsible for Radiation Safety Program and their Training and Experience.

1. Donavan Jackson

See attached information for further background and training of the above individual.

(Certification of completion of "Nuclear Gauge and Radiation Training" course by Troxler for Donavan Jackson will be forthcoming.)

# Nuclear Gauge and Radiation Safety Training by Troxler



TROXLER ELECTRONIC LABORATORIES, INC. historically has stressed the necessity for a comprehensive, in depth, course of instruction that leads to an understanding of nuclear theory as it relates to our total gauge line, field applications, gauge calibration and radiological safety. Proper field operation and maintenance procedures are stressed to ensure that tests are performed with maximum effectiveness and that the resulting data is accurately interpreted.

Troxler engineers conduct these instructional programs with support from research, service and experienced field personnel. An effort is made to tailor the presentation of subject matter to the background and experience of the program participants. Group interaction and discussion of the material being presented is encouraged.

April 4, 1985

## TRAINING SCHEDULE SUBJECTS

### I. RADIOLOGICAL SAFETY

#### A. Atomic Structure

#### B. Radiation Characteristics

1. Types of Radiation
2. Types of Sources
3. Units of Radiation Dose

#### C. Hazards of Exposure to Radiation

#### D. Levels of Radiation from Troxler Gauges

#### E. Methods of Controlling Radiation Dose

1. Working Time
2. Working Distance
3. Shielding

#### F. NRC and State Regulations

1. Handling Procedures
2. Personnel Monitoring
3. Security
4. Records and Reports
5. Incidents
6. Transport and Shipping

#### G. Leak Test Procedures

### II. THEORY OF MEASUREMENT

#### A. Gamma Radiation and Matter

#### B. Test Modes

#### C. Neutron Radiation and Matter

### III. FIELD MEASUREMENT PROCEDURES AND GAUGE APPLICATION

### IV. DEMONSTRATION OF GAUGE OPERATION AND FIELD MEASUREMENT

### V. FACTORY CALIBRATION

### VI. PERIODIC MAINTENANCE

### VII. FIELD TROUBLESHOOTING AND SERVICE

### VIII. COURSE REVIEW

KENNETH J. PRATHER  
Northwestern Branch Manager

Troxler Electronic Laboratories, Inc.  
Northwestern Branch, 18222 - 1<sup>st</sup> Dr. S.E.  
Bothell, Washington 98012 Telephone 206/481-0550

## Texas Nuclear

A Division of Ramsey Engineering Company

Box 9267

Austin, Texas 78766 USA

Telephone (512) 836-0801

Telex 77-6413

### LETTER OF CERTIFICATION

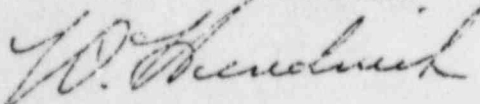
This is to certify that     Donovan Jackson  
                                     ARCO Oil and Gas Company

has attended and successfully completed a course of instruction, conducted under the auspices of Texas Nuclear Corporation and described in the attached Course Agenda. The course covers fundamentals of radiation, units of dose and quality of radiation fields, hazards of radiation exposure, detection devices, regulatory controls, industrial devices and specific training on installation and leak testing of Texas Nuclear density, level and weigh gauges.

The said course of instruction, together with prior experience, is structured to qualify persons who complete it to understand and safely perform various operations involving nuclear devices including the installation, relocation and leak testing of such equipment. The operations are to be done in accordance with the rules and regulations of the United States Nuclear Regulatory Commission and/or "Agreement States", and are in all respects subject to such rules and regulations.

This letter cannot be used in lieu of a specific license from or other sanction by an appropriate regulatory agency.

TEXAS NUCLEAR CORPORATION



W. G. Hendrick  
Health Physicist

# Certificate Of Training

This is to certify that

DONOVAN R. JACKSON

Has Successfully Completed a Radiation Safety Training Course  
sponsored by Texas Nuclear Division.



Texas Nuclear  
Division

Ramsey Engineering Company

Issued 24th Day Of October 1980

W. H. Hendrick

Health Physicist

Tom Rushmore

President



DONOVAN R. JACKSON  
Safety Engineer

#### EXPERIENCE SUMMARY

Four years experience as a Safety Engineer; 5 years experience in safety and engineering on the North Slope.

#### EXPERIENCE

1983 to Date Safety Engineer; VECO, Inc., Prudhoe Bay, Alaska. Responsible for safety on the Flow Station 3 Rebuild project for ARCO at Prudhoe Bay, West Sak Pilot Project and Seward Coal export project.

1983 Safety Engineer; VECO, Inc., Kuparuk Drill Site #12 VSM and Pipeline Project.

1982 Professional Engineering Consultant; Contere Engineering and Associates. Participated in negotiations for bids toward corporate contracts and implementing recommendation reports, cost analysis and justification or expenditure, optimization and economic analysis toward corporate projects.

1978 to 1981 Fire and Safety Engineering Specialist; ARCO Oil and Gas Company, Prudhoe Bay Fire and Safety Department. Responsible for the safety and fire engineering management of Flow Station #1 which provided the oil and gas processes in the production of fuel energy. Conducted facility/module safety inspections and hazard analysis to identify potential loss producing conditions and practices. Developed accident prevention and loss control methods procedures relevant to state and federal regulatory limits and guidelines.

1978 Environmental Research/Logistical Engineer; ARCO Oil and Gas Company. Performed logistical engineering for physical and biological research study upon the Beaufort Sea at Prudhoe Bay for a period of six months. This research was in relation to the proposed water injection plant on the ARCO side of West Dock region.

EXPERIENCE (Cont'd)

1977 Special Projects Engineering Technician; ARCO Oil and Gas Company. Responsible for petroleum revenue forecasting, special engineering studies and recommendation for department adoptions or revisions to production regulations. Responsible for optimization analysis and economic analysis for Kuparuk oil reservoir field, overseeing well testing and core analysis sampling.

1977 Operations Engineering Aide; ARCO Oil and Gas Company. Witnessed well testing, calibrations of oil and gas meters and quality of petrochemical product to ensure proper production accounting in ARCO's interest. Assisted in flaring and pressure testing of oil and gas wells; worked closely with drilling and maintenance department, liaison between ARCO and the Alaska Oil and Gas Conservation Commission.

EDUCATION

Texas A & M School of Engineering  
University of Alaska

Computer and Data Processing: FORTRAN IV, TSO (time share option); Mark III (systems); DMS II (data management systems); RE34 (economic criterion system); ARCO Prudhoe Bay Automation System; MS14 (economic analysis for reservoir engineering studies); CICS; SAS (statistical analysis system); Biomedical Statistical Analysis; Automation Program.

ACE (Assessment and Control of Hazardous Physical and Chemical Agents within an Industrial Environment)

#### VIII. Training for Individuals Working in or Frequenting Restricted Areas.

Only the individuals listed in Section VII will be authorized to handle the licensed material. These individuals will have successfully completed an approved Nuclear Gauge and Radiation Training course. Each of these persons will be individually responsible for seeing that the instrument(s) is handled properly and seeing that all of the safety precautions outlined in the training course are adhered to.

The safety engineers, Donovan Jackson, or others so designated and qualified will be responsible for insuring the proper working distances, exposure time limits, and shielding requirements are maintained by the trained operating personnel when the likelihood of others entering or working around the utilization of the source material could apparently take place.

VECO certifies that only those employees that successfully complete the device manufacturer's training program will be allowed to use the device. This training program will be the Nuclear Gauge and Radiation Safety Training program as presented by Troxler Electronics Laboratories, Inc.

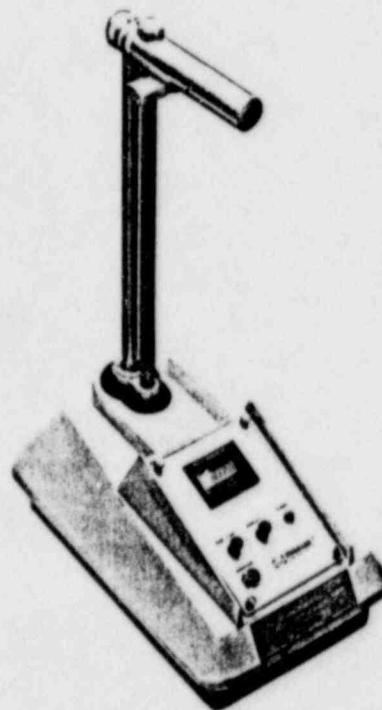
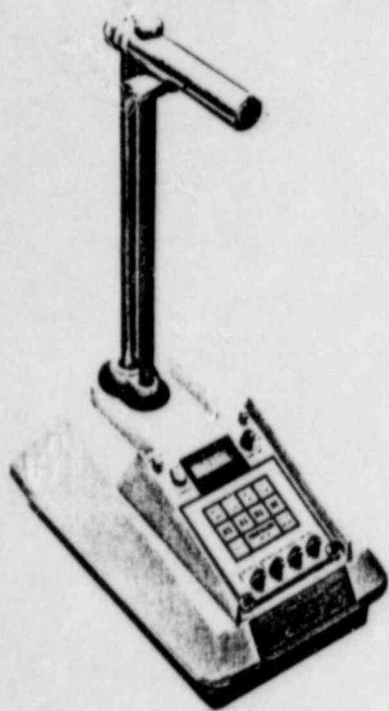
## IX. Facilities and Equipment

The equipment utilizing the source material is shown and its operations explained in the attached brochure copy.

The gauge(s) will be stored and locked up while unattended inside either the survey field office, survey equipment van, or other locked enclosure that will prevent access by unauthorized persons.

# TROXLER

## 3400B Series



# THE ROAD/READERS

The Troxler Series 3400B Surface Moisture-Density Gauge, models 3401B and 3411B, are the most precise, easy to use test instruments for determination of moisture content and density of soils, soil-stone aggregates, cement, asphalt treated bases and asphalt paving. The Troxler Model 3400 Series incorporates state of the art microprocessor based electronics providing a high degree of accuracy and reliability. The design of the 3400 culminates some 20 years of Troxler research and experience in nuclear electronic gauge design. The years of research plus the user experience of over 5000 instruments in field in over 100 countries has allowed Troxler to develop the most precise, easy to use testing equipment in the world.

### WHY DOES TROXLER'S 3400 PROVIDE A BETTER METHOD FOR MOISTURE AND DENSITY TESTING?

**RAPID RESULTS:** A site can be prepared and testing completed in approximately 5 minutes. With use of the 3411, results read directly in  $\text{Kg/m}^3$ ,  $\text{lb/ft}^3$ , percent Moisture, percent Proctor or percent Marshall.

**ACCURACY:** *Direct Transmission* is the most accurate means of determining density. This test is used on soil, soil-stone aggregates and cement for densities to depths of 5 to 30 cm (2 to 12 inches). Compare Troxler accuracy with any other material testing technique.

**NONDESTRUCTIVE TEST:** On asphalt, no removal of the test sample is required. Tests are conducted from the surface. On soils and aggregate, a 2 cm diameter rod is driven into the soil to a depth of 30 cm minimizing destructiveness.

**ASTM APPROVAL:** The American Society of Testing Materials

has approved nuclear testing for density and moisture of soils and density of asphalt. Currently approved standards include ASTM D-2922-81, ASTM D-2950-82 and D-3017-78.

**PRODUCT FEATURES:** The Model 3400 Series gauges take simultaneous measurement of moisture and density. With use of the 3411, measurements are displayed directly in metric or English standard engineering units. Also, a Marshall or Proctor value may be inserted for direct reading in percent compaction.

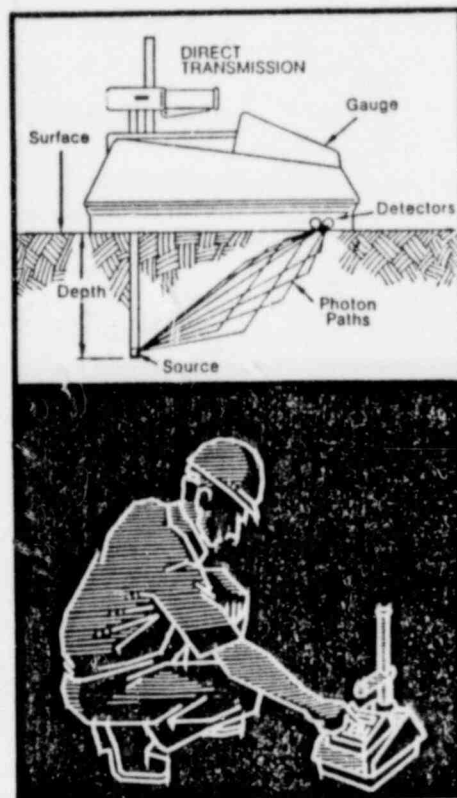
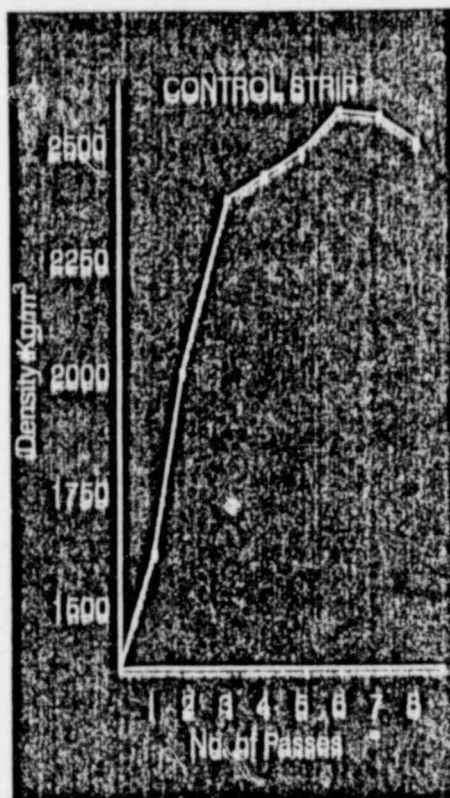
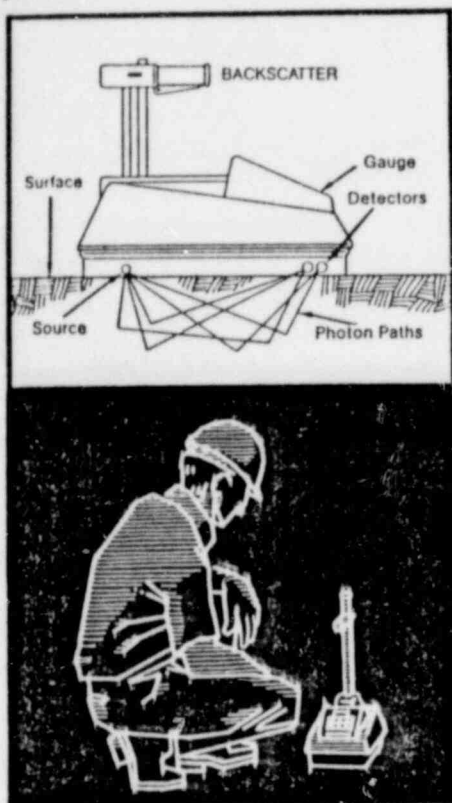
For precise measurements, all Troxler gauges feature calibration on standards traceable to the U.S. Bureau of Standards.

For easy service, all electronics are packaged in modules which allow 100% field replacement. The electronics are powered by rechargeable nickel-cadmium batteries allowing operation for up to eight weeks on a single charge.

**TROXLER ELECTRONIC LABORATORIES, INC.**

AND SUBSIDIARY  
**TROXLER INTERNATIONAL, LTD.**

P.O. Box 12057 / Research Triangle Park, North Carolina 27709 USA / Telephone (919) 549-8661 / Cable TROXELEC / Telex No. 6844902TROXL UW



## PRINCIPLE OF OPERATION

**DENSITY TEST MODES** The 3400B Series offers two test modes for measuring the density of construction materials. The operator may choose either Backscatter or Direct Transmission, depending upon the material and the thickness of the lift to be tested.

**BACKSCATTER** The Backscatter method is nondestructive and may be performed rapidly. Both the gamma source and detectors remain on the surface. Gamma rays enter the material and those scattered back into the detectors are counted. Backscatter is generally insensitive to changes in density below 9 cm, which limits its use to thin lifts of material. Backscatter is recommended primarily for use on asphaltic concrete.

A widely used Backscatter technique for stone-base and asphaltic concrete lifts is the "control strip" method. The procedure involves the construction of a 400 square meter test section of representative material. Compaction is accomplished with selected rollers, and nuclear Backscatter tests are performed after each roller pass until no further increase in density is observed. Maximum density is determined by taking the average of 10 randomly selected tests. Nuclear tests are normally run on 2800 square

meter sections and must average 98% of the target density, with no single test falling below 95%. A new test section must be established when a change of material occurs or after 10 sections have been approved. *The obvious advantage of the nuclear gauge on hot asphalt is a quick, on-the-spot test which pinpoints areas needing compactive effort while the asphalt can still be worked.*

*The Model 3411B allows the entry of Marshall values (maximum obtainable density of asphalt) and will compute and display percent compaction of wet density.*

**DIRECT TRANSMISSION** Direct Transmission is a pseudo non-destructive test which places the gamma source into the material by means of a punched access hole. Standard gauges have thirty cm depth capabilities in five cm increments. Two and one-half cm increments are available by special order. A special twenty cm depth capability may also be ordered. Gamma rays are transmitted from the source through the material to be measured to the detectors located on the surface. The average density of the lift of material is determined. *Direct Transmission allows the operator to*

*choose the depth of measurement and greatly reduces error resulting from surface roughness and chemical composition of the test material.* Gauge precision is also improved. Direct Transmission is used primarily for testing medium to thick lifts of soil, stonebase, and asphalt.

The 3411B also allows the entry of Proctor values for soil and soil aggregate. The micro computer will process the data and display percent moisture and percent compaction of dry density.

**MOISTURE** The moisture measurement is nondestructive with the neutron source and detector both located on the surface of the test material. A field of fast neutrons enters the material and thermalization occurs after a series of collisions between the neutrons and hydrogen atoms present in the test material. The helium-3 detector, located in the gauge, detects the thermalized neutrons.

It is suggested that factory moisture calibration data be compared to oven dry methods and adjustments be made, if necessary. *The Model 3411B has a "built-in" provision to allow the insertion of a correction factor for hydrogen which is not contained in the dry density of the soil which contains the moderator or neutron absorber.*

# GAUGE DESIGN

**MECHANICAL STRUCTURE** The 3400B Series instruments are housed in an aluminum casting to provide a rugged structure which is immune to physical damage except for major accidents. There are no openings from the bottom surface to the interior which would allow ground water or soil to enter the instrument. All topside openings are gasketed to maintain a clean environment. The exterior of the housing is either anodized or coated with epoxy paint.

The source rod is manufactured from hardened stainless steel to reduce wear and insure proper indexing of the measurement geometry. The source rod is positioned in stainless steel linear bearings.

All interior parts are either anodized aluminum or stainless steel to prevent corrosion.

**RADIOLOGICAL** The instrument contains two sealed sources—an eight millicurie cesium 137 source to provide gamma radiation for the density measurement and a forty millicurie americium-241: beryllium source yielding seventy thousand neutrons per second for the moisture determination. Both sources are doubly encapsulated in stainless steel, and fusion welded.

All shielding is constructed of tungsten having a specific gravity of eighteen and a melting point of over 3,000°C. While more expensive than lead, tungsten insures permanent protection since it does not cold flow or melt under conditions likely to be imposed on the instrument by fire.

Radiation levels on any surface of the instrument are less than fifteen millirem-per-hour, including both gamma and neutron. The dose rate at ten cm (4 in) from any surface of the gauge are less than five millirem-per-hour.

## SIMPLE USE PROCEDURES

**1 Take your daily standard count.**—The standard count is used in moisture and density calculations to compensate for long-term drift and background radiation effects as well as checking the stability of the gauge. The 3400 Series takes moisture and density counts simultaneously.

**2 Prepare your site.**—Smooth the surface with a scraper plate and fill voids as required. Drive your hole if you are using direct transmission.

**3 Take your test count.**—The gauge is placed and the measurement is taken.

**4 Your answer.**—Read moisture, density, and percent compaction directly.

For economy, the 3401B is available. Utilizing a computer derived calibration table, calculations can be done by the operator.

The 3400B gauge weighs 16 Kg. Accessories supplied with the gauge include scraper plate/drill rod guide, drill rod, 110/220V 50-60 Hz charger, reference standard, calibration table, manual, and heavy-duty transport case.

**DETECTORS** Two high temperature platinum lined Geiger-Mueller detectors are used for density determinations. Platinum greatly increases the efficiency and life of these detectors which are manufactured to rigid Troxler specifications. Years of research and nuclear gauging experience have contributed to the design of these highly efficient detectors.

One helium-3 detector is used for the moisture measurement. This detector is specifically designed for use in the Troxler 3400B Series.

**ELECTRONICS** The 3411B micro computer is programmed to compute wet density, dry density, moisture, percent moisture, and percent compaction for direct reading. The 3401B is furnished with calibration tables for calculations.

All 3400B electronic circuits utilize CMOS integrated circuits for increased reliability, reduced complexity and longer battery life. Electronics are packaged in modules which allow 100% field replacement. User activated test routines are designed into the gauge to allow verification of proper functioning of the electronics. Bright sunlight enhances the readability of the liquid crystal display and shading is never required.

**BATTERIES** The 3400B Series operates on two nickel-cadmium battery packs with a capacity of 40 watt hours. A 3400B Series gauge can operate for approximately eight weeks on a full charge. Under normal conditions and using recommended charging procedures, the battery packs should never need replacing. Recharge may be made overnight by use of a 110/220 volt 50-60 Hz charger or by means of a DC charger plugged into a cigarette lighter using 12 volt vehicle power.

**CALIBRATION** No test instrument is better than its calibration. Troxler's patented calibration process utilizes density and moisture blocks traceable to the U.S. Bureau of Standards.

# SPECIFICATIONS

## MEASUREMENT

	15 sec	1 min	4 min	
Test Count Time				
Direct Transmission Density 150mm (6 in.)				
Precision at 2000 kg/m <sup>3</sup> (120PCF)	7.68(0.48)	3.84(0.24)	1.92(0.12)	kg/m <sup>3</sup> (PCF)
Depth of Measure	50 — 300 mm (2-12 inches)			
Backscatter Density				
Precision at 2000 kg/m <sup>3</sup> (120PCF)	16.6(1.04)	8.30(0.52)	4.15(0.26)	kg/m <sup>3</sup> (PCF)
Depth of Measure (98%)	100 mm (4 inches)			
Moisture Content				
Precision at 250 kg/m <sup>3</sup> (15PCF)	10.2(0.64)	5.10(0.32)	2.55(0.16)	kg/m <sup>3</sup> (PCF)
Depth of Measure at 250 kg/m <sup>3</sup>	150 mm (6 inches)			

The precisions stated are the standard deviation of twenty (20) tests. Chemical composition and surface voids of the test material can also affect accuracy of all nuclear gauges. The following examples represent extreme conditions. Chemical composition and surface void effects normally encountered in the field will be less.

Chemical Composition	Direct Transmission Density	Backscatter Density	Moisture	
Pure Limestone	22 (1.4)	40 (2.5)	—	kg/m <sup>3</sup> (PCF)
Pure Granite	-22 (-1.4)	-40 (-2.5)	—	kg/m <sup>3</sup> (PCF)
Surface Voids				
1.25 mm (0.05 in.)	-7.2 (-0.45)	-32 (-2.0)	-8.8 (-0.55)	kg/m <sup>3</sup> (PCF)
50% void				

## RADIOLOGICAL

Gamma source	8 ±1 mCi cesium-137
Neutron source	40 ±10% mCi americium-241: beryllium with 70,000 N/sec. yield.
Surface dose rates	15 mrem/hour max., neutron and gamma
Shipping case	DOT 7A, Type A, Yellow II Label 0.1 Transport Index
Source seal approval for domestic and international shipment	Cs-137, SPECIAL FORM Certificate GB:SFC 140 Am-241, SPECIAL FORM Certificate GB:SFC 7

*Standard!  
1 gm of Radium = 1 mCi*

## MECHANICAL

Case	Epoxy finish aluminum casting
Operating temperature: Ambient	-10 to 70°C (14 to 158°F)
Surface	175°C (350°F)
Storage temperature	-55 to 85°C (-70 to 185°F)
Size (excluding handles)	368x229x183 mm
Height (including handles)	495 mm
Weight	16 Kg
Shipping Weight	32 Kg w/o Case 39 Kg with Case

## ELECTRICAL

Stored power	40 watt-hours
Battery recharge time	14 hours
Charge source	110/220V, 50-60 Hz or 12-14 VDC

## ACCESSORIES

Scraper plate/drill rod guide	Reference Standard
Drill rod, Drill rod removal tool	Manual
110/220V, 50-60 Hz charger	Calibration table
12-14 VDC charger	Heavy-duty shipping case

#### X. Radiation Safety Program

The safety engineers, Donavan Jackson, or other designated qualified individual will be responsible for seeing to it that:

1. All byproduct materials, sealed sources, and devices in use and/or in VECO's possession are limited to those specified in this license
2. Only those individuals authorized by the license use or supervise the use of the device(s).
3. Periodic leak tests on sealed sources are conducted as required by this license.
4. Operating procedures are being adhered to by the operating personnel that insure safe working distances, exposure time limits, and shielding requirements are maintained.
5. Regular safety meetings are held that include precautions concerning activity around the use of the source material, as well as the general safety precautions needed for general job safety.
6. Operating personnel will wear film badges or thermoluminescent dosimeters when using the devise(s).
7. Cleaning of the device will be done only in the safe shielded position. Any repair or maintenance will be done by Troxler Electronic Laboratories, Inc.
8. The unit will be properly transported to and from the work place.
9. Personnel are informed of the emergency procedures which includes steps to be taken and individuals to be notified if an accident occurs.

## XI. Waste Management

The manufacturer "Troxler Electronic Laboratories, Inc." will be contacted when use of the device(s) is discontinued. They will handle any and all repairs, replacement, or disposal involving the source material.