



# **MATHY CONSTRUCTION CO.**

(A CORPORATION)

**GENERAL CONTRACTORS**

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April 29, 1985

United States Nuclear Regulator  
Commission  
Region III  
799 Roosevelt Road  
Glen Ellyn, IL 60137

ATTN: Bruce S. Mallett, Ph.D.

RE: License No. 48-18722-01

Dear Sir:

In response to your letter of April 25, 1985,  
please find enclosed the Leak Test Kit Instructions  
for the Troxler Model 3880 Leak Test Kit.

This is the procedure we use and will continue  
to use.

If you have additional questions, please contact  
me.

MATHY CONSTRUCTION COMPANY

*Gail D. Jensen*  
Gail D. Jensen, PE  
Radiation Safety Officer

Enclosures

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REG3 LIC30  
48-18722-01 PDR

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AN EQUAL OPPORTUNITY EMPLOYER



MAY 2 1985

MODEL 3880 LEAK TEST KIT  
FOR  
SEALED RADIOACTIVE SOURCES

INSTRUCTION MANUAL

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## I. INTRODUCTION

This kit is designed and equipped with components to safely wipe sealed sources of radioactive materials or instruments containing these sources.

The maximum size of radioactive source which may be safely wiped will depend not on the amount of radioactive material in terms of curies but, on the dose profile in roentgen-equivalent-man (REM) or mREM (0.001 REM) per hour.

It is the responsibility of every user of this kit to be thoroughly familiar with the hazards involved and the regulations issued by the U.S. Nuclear Regulatory Commission or other governing agency such as Agreement State Public Health Service or regulatory agencies of countries other than the United States.

These instructions will cover, in general, the safety aspects of performing a wipe test and the present available regulations. However, Troxler Electronic Laboratories, Inc., assumes no liability for actual damages to the user nor warrants that the user will not be in violation of federal or state regulations by following these instructions.

## II. DESCRIPTION

The kit contains the following items which are replaceable as individual pieces as required:

102869	Manual
102870	Case, Plastic
102871	Tongs
102872	Dowel, Wood
102873	Solution, 1 ounce
102876	Leak Test Packet

The leak test packet consists of the following items which may not be purchased separately:

- Envelope, preaddressed, radiation safety department
- Form, triplicate leak test analysis
- Bag, plastic, self-sealing
- Label, self-adhesive
- Filter paper, 5.5 cm.

The purchase of a set of these items includes, as a prepayment, the cost of processing and reporting the analysis.

### III. REGULATIONS

Possession of a sealed source containing a radioactive material includes a legal responsibility to determine that the source is not leaking radioactive material which may contaminate equipment and personnel.

#### A. Period Between Tests

Title 10 of the Code of Federal Regulations specifies that leak tests must be made in six-month intervals. This period may be extended by request or may be different in some agreement state regulations, but in all cases is listed in your radioactive material license.

If the instrument or source is not in use and safely stored, leak tests may be discontinued but must be performed before transporting or otherwise put into use.

#### B. Transfer to Other Licensees

All sealed sources must have a current and valid leak test record before transfer to another licensee. This record should be included with other transfer documents.

#### C. Maintenance of Records

Records of tests for leakage of radioactive material must be retained for six months after the next required leak test is performed or until the sealed source is transferred or disposed. In most cases, this requires that records be kept for a period of one year after the date of the test.

#### D. Units of Measurement

All leak test records shall indicate removable activity in units of microcuries ( $\mu\text{Ci}$ ).

#### E. Limits of Contamination and Disposition

Any sealed source which has a removable activity of  $.005 \mu\text{Ci}$  or greater is considered to be leaking. The user shall immediately withdraw the instrument or source from service and cause it to be decontaminated and repaired or to be disposed of in accordance with regulations.

A report shall be filed within five days of the leaking test to the appropriate agency which issued the license.

#### F. Authorization to Perform a Wipe

A licensee's radioactive material license must contain a statement such as: "Tests for leakage and/or contamination shall be performed by the licensee or by other persons specifically authorized by the commission or an agreement state to perform such services." In some licenses a specific leak test kit and/or processor may be listed.

### IV. SAFETY

Persons performing the wipe for a leak test analysis will be exposed to a radiation dose rate somewhat higher than the normal exposure rate of persons operating the instrument or otherwise using a sealed source. For this reason, the radiation safety officer or other trained individual should perform the wipe and utilize the safety procedures as noted in the instrument manual or this instruction manual.

#### A. Dose Accumulation

Persons performing wipes should consider the maximum permissible dose for both "whole body" and "extremities." These values are 1,250 and 18,750 millirem respectively per calendar quarter. Further consideration must be given to the dose rate profile around the sealed source, distance between the sealed source and the hands and body, time required to perform the wipe, and the number of wipes to be made per calendar quarter. It must also be remembered that the dose received from performing wipes is in addition to that received during normal occupational exposure.

#### B. Typical Dose Rates

##### 1. Alpha and Beta Sealed Sources

In general, these sources have thin window areas to pass these types of radiation. The balance of the capsule is fairly massive and provides a large amount of shielding provided the user keeps his hands and body in a position in the shadow of the capsule and not in front of the thin window.

Most of the radiation from low to medium energy alpha and beta emitters is stopped by the skin, therefore only the skin and eye dose need be considered.

The attenuation of beta particles will result in low energy gamma radiation (bremsstrahlung) and since this will depend on the type of absorber and energy level it is necessary to measure the gamma dose rate using a survey instrument.

Since the source window is generally very thin, extreme care should be exercised if it is necessary to directly wipe the window. In most situations, it is only required to wipe the area immediately adjacent to the window.

Due to the thin window, the radionuclide will probably migrate through the window material and there will always be some removable contamination. Internal absorption of alpha emitters is extremely hazardous, therefore the filter paper must never be touched after the wipe has been made.

## 2. Gamma Sealed Sources

The dose rate in millirem-per-hour at a distance of one foot (30 cm) from the source may be estimated by multiplying six times the energy in MeV times the number of millicuries of material times the number of gammas per disintegration.

The table below gives typical dose rates at one foot (30 cm) for one millicurie of some commonly used radionuclides.

Nuclide	Millirem-Per-Hour At One Foot-Per-Millicurie
Americium-241	.4
Barium-133	2.67
Cesium-134	9.67
Cesium-137	3.67
Cobalt-60	14.67
Radium-226	9.17
Sodium-22	13.33

The "distance squared" relationship can be used to estimate the dose rate at other distances from the source. For instance, if the hands are receiving the above dose rates at one foot (30 cm) the body will be approximately three feet (1 M) away and the dose rate will be one ninth of the above. If the hands are placed at six inches (15 cm) the dose rate will be four times that listed in the table.

Where possible, shielding which may be contained in the instrument should be positioned so that it provides as much protection to the user as possible, particularly to the areas of reproductive organs of the body.

If large activity sources are involved, it must also be remembered that gammas may scatter off dense materials on the opposite side of the source and thus increase radiation levels on the user side.

## 3. Neutron Sealed Sources

Most neutron sealed sources contain an alpha emitter such as Americium or Radium encapsulated with beryllium as a target material. These sources emit neutrons at an average energy of 4.5 MeV. (Note: They also emit gamma radiation which must be considered.)

The dose rate in millirem per hour at a distance of one foot (30 cm) may be estimated by dividing the neutron yield (neutrons-per-second) by  $8.2 \times 10^4$ .

The neutron yield from a well-designed source will be  $2.2 \times 10^6$  per curie of Americium, or  $1.3 \times 10^7$  per curie of Radium.

Typical fast neutron dose rates for several neutron sources are listed below:

Nuclide/Beryllium	Millirem-Per-Hour At One Foot
2 mCi RA-226	.32
50 mCi AM-241	1.07
100 mCi AM-241	2.14

As with gamma sources, the "distance squared" rule can be used to obtain dose rates at other distances.

## C. General Precautions

Keep exposure time to a minimum.  
Maintain distance between source and body.  
Use shielding where available.  
Never touch the source with bare hands.  
Never touch the filter paper after wiping.

#### D. Monitoring Dose

Some type of whole body dosimeter should be used when performing the wipe and if numerous wipes are to be made, a wrist or finger dosimeter should be worn. The latter applies when anticipated doses are expected to approach the maximum allowable levels.

#### PROCEDURE

##### A. Preparation

Before opening the instrument or exposing the sealed source in any way, obtain the materials (tongs, dowel, etc.) from the kit and wet the filter paper with a few drops of the solution. It is not necessary to saturate the complete disk but visible wetness should exist over at least half of the paper.

##### B. Exposing the Source and Wiping

Regulations require that either the actual source capsule be wiped (weld area) or the most accessible point of a containment system. Most licensees of radioactive material are not permitted to disassemble or service a source containment system.

If a source holder is involved, then it may be exposed to allow wiping the most accessible point. At the other extreme, it may only be possible to wipe some seal or closure on the outside of an instrument case. Refer to the instrument manual to determine the proper place to be wiped.

Remember to keep the source as far as possible from the body.

Grasp the wetted filter paper with the tongs and, using the wood dowel, gently rub the filter paper over the area selected to be wiped.

Lay the filter paper on a clean paper towel with the unused side of the filter paper in contact with the towel.

Close the instrument or re-shield the source as applicable.

##### C. Completing the Form

Where possible, leave the filter paper exposed to air for several hours in order to dry the solution. If a warm surface is available the drying can be accomplished in five to ten minutes. Holding the paper over a hot light bulb is recommended.

While drying is taking place, complete all requested information on both the plastic bag label and the leak test analysis form. Please print legibly or type in order to insure that all information is readable. A complete mailing address is necessary to insure that the returned form will arrive safely and promptly.

When dry, place the filter paper in the plastic envelope using the tongs and press the seal to close. Retain the middle copy of the form as your record of having made the wipe. Place the plastic envelope and the other two copies of the form in the pre-addressed envelope, put your return address on the outside, seal, stamp, and mail.

Postal authorities will no longer deliver an unstamped letter with "Postage Due."

#### VI. REPORT

Troxler Electronic Laboratories, Inc. will, in most cases, process the wipe within 24 hours after receipt and mail the certified analysis to the user. The third copy will be retained for their files.

Troxler uses a flow-thru proportional counter capable of detecting .00003 uCi. Removable activity measured at less than .00005 uCi is reported as zero.

Due to the potential hazard, if the removable activity is greater than .0005 uCi but less than .005 uCi, it is recommended that an additional wipe be made.

If the removable activity is greater than .001 uCi but less than .005 uCi, a collect telephone request will be made for an additional wipe.

If the removable activity is equal to or greater than .005 uCi a collect telephone notice will be made to initiate removal of the sealed source from service. This will be followed by a written report.