1990_16

ABSTRACT FOR AARST CONFERENCE OCTOBER 1990

INSTRUMENTATION FOR RADON MEASUREMENT AND DIAGNOSIS

Knowledge of existing protocols and guidelines, coupled with equipment acumen can make for a successful endeavor in the radon field. But where do you collect a users perspective on radon equipment? Obtaining a first hand understanding of how radon detection equipment may be applied can be a lengthy and expensive process.

First principals of progeny collection, and counting, will be briefly covered.

Use of Thomson and Nielsen equipment to screen, and diagnose radon will be presented. Equipment performance in a wide variety of field applications and in calibration chambers will be brought to light. The distinctive nature and versatility of the equipment will be outlined with applications information, system performance, and unique configurations.

Neil Whyte, Ken Ellacott, Line Brabant

Thomson and Nielsen Electronics Limited

1050 Baxter Road

Ottawa, Ontario, Canada, K2C 3P1

INSTRUMENTATION FOR RADON MEASUREMENT AND DIAGNOSIS

Introduction:

As the sphere of the radon industry increases, so does the need for time dependent instrumentation such as the array of flexible equipment described in this paper. Additionally, users of such equipment require an increasing understanding of the tools they attempt to use.

Thomson and Nielsen, located in Ottawa, Canada, was established in 1984 and over the years has forged an international reputation in the radiation detection field.

The purpose of this paper is to focus on the method of progeny collection employed, operation and application of Thomson and Nielsen radon-222 progeny measurement instrumentation.

First Principles:

The basic premise of operation of T&N equipment is to trap airborne radionuclides on a filter that is held in close proximity to an alpha sensitive real time counting system.

Radionuclides aloft are captured by pumping air through a small pore size filter. Once trapped, the particles when ready, will decay further down the radon-222 chain of elements and in doing so release energy in the alpha, beta or gamma range. Thomson and Nielsen radon equipment is sensitive only to energy in.the alpha range.

By correlating the volume of air sampled, the resulting total alpha count for a known duration, and sensor efficiency, to the known alpha activity in the air, the alpha concentration may be determined and indicated in an appropriate unit (working level, Becquerels per cubic meter EER, etc).

The Product Line:

The current supportive structure of the T&N product line is composed of two instruments intended for the measurement and diagnosis of radon-222 progeny, and a number of support products.

The Instant Radon Progeny Meter:

The Instant Radon Progeny Meter (IRPM) is a portable instrument designed and intended to provide a fast and accurate indication of instantaneous working level. It is, in essence, a self contained working level grab meter.

The IRPM is the newest tool offered to T&N customers, and it is quickly establishing a place within the radon field. Intended primarily as a diagnostic/quick screening instrument, it can be applied in many other settings.

The IRPM is used to provide an accurate, on site indication of the local working level in residential and commercial settings, and industrial environments such as mines, manholes, or manufacturing areas. Additionally, the IRPM may be used to quickly assess the effect of a radon mitigation system.

The five minute sample time and direct indication of working level facilitates multi-area screening to provide a prompt cross section of radon progeny distribution throughout a building such as a school or office building.

In addition, the IRPM may be used to find areas of increased alpha particle activity as would be present at, or very near, radon entry points in buildings such as sump holes, foundation cracks, and floor drains. In such situations the device may be used with an inlet tube to allow easy sampling from flux buckets, enclosed sumps, and crawl spaces.

The IRPM directly indicates the presence of radon progeny by accumulated alpha count, working level, and audible tone.

The IRPM is equipped with a quick-change filter holder to enable rapid, successive tests.

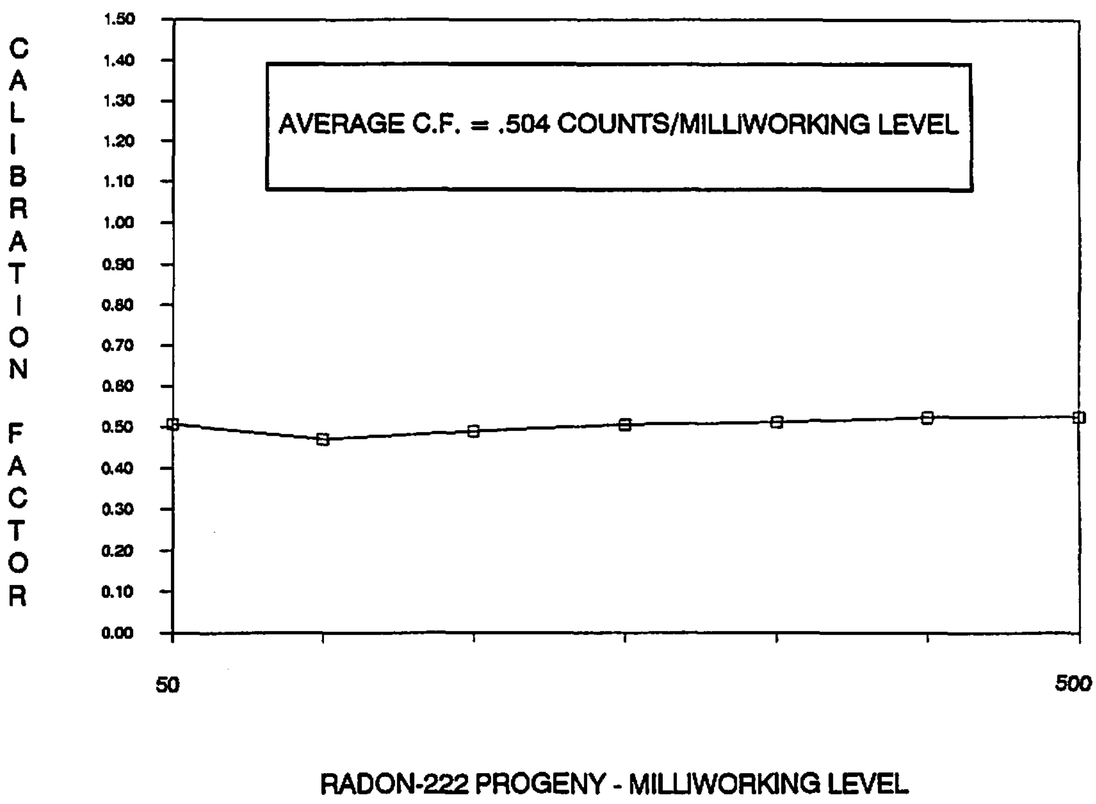
The IRPM is free from sensor saturation and the need to purge due to the proprietary detection system employed.

Figure 1 is a plot of the performance of the Instant Radon Progeny Meter. It relates the calibration factor to activity in milliworking level.

The Radon Working Level Meter:

The Radon Working Level Meter (RWLM) is a portable instrument intended to operate on a continuous basis. The basic instrument may be used on its own or coupled with a range of optional units to tailor its application to many environments. Further, the RWLM has been successfully evaluated and accepted by the U.S. Environmental Protection Agency.

FIGURE 1: INSTANT RADON PROGENY METER LINEARITY TEST



CALIBRATION FACTOR = COUNTS/MILLIWORKING LEVEL

Intended primarily as a screening and measurement instrument for indoor applications, the device is also seeing proficient application in mining and cave environments. The RWLM also has potential to see employment as a method of monitoring and logging worker exposure to radon progeny.

When used on its own, the RWLM will provide an averaged indication of radon progeny. The unit is equipped with an LCD display used to indicate total alpha count and a selectable timer which may be used to stop the internal pump and freeze the count at the end of the selected duration.

An extremely useful option available for the RWLM is the Recorder/Printer interface. This device interconnects the RWLM to a portable printer. When in use, this system will provide an hourly printout of the alpha activity averaged over the previous sixty minutes. The printout indicates progeny in working level, and based on an assumed equilibrium ratio of .5, gas in picoCuries per liter or Becquerels per cubic meter. Refer to figure 2 for a sample print out.

The Data Recorder is an option that offers further insight into radon progeny analysis. When used in conjunction with the RWLM, this device provides a rich profile of radon progeny fluctuation. Minute by minute

FIGURE 2: SAMPLE PRINTOUT FROM RECORDER/PRINTER INTERFACE

```
   THOMSON AND NIELSEN ELECTRONICS LTD.
             OTTAWA, CANADA

    CONTINUOUS WORKING LEVEL MONITOR
    RECORDER PRINTER MODEL TN-RP-01

TEST COMPANY:



LOCATION:


START TIME/DATE:


TN-WL-02 SERIAL #:


CURRENT CALIBRATION FACTOR SETTING IS
6.3 CNTS/HR/mWL. PLEASE ENSURE THIS
SETTING CORRESPONDS TO THE SPECIFIED
CF OF THE TN-WL-02 WL METER BEING USED.


Current Print Mode: Continuous

Current Print Units: WL

First Data Available in 1.0 Hr

PRINTING CURRENT READING

Cal. Factor: 6.3 Counts/Hour/mWL
Total Counts:                42
Counts in Last Hour:         42
Elapsed Time:                 1 Hrs
Present Level:            0.013 WL
Average Level:            0.013 WL
```

variations may be seen that could indicate effecting environmental and atmospheric factors, or possible tampering. The Data Recorder is intended to be used with an IBM PC or compatible for data manipulation. Refer to figure 3 for a sample output from the Data Recorder.

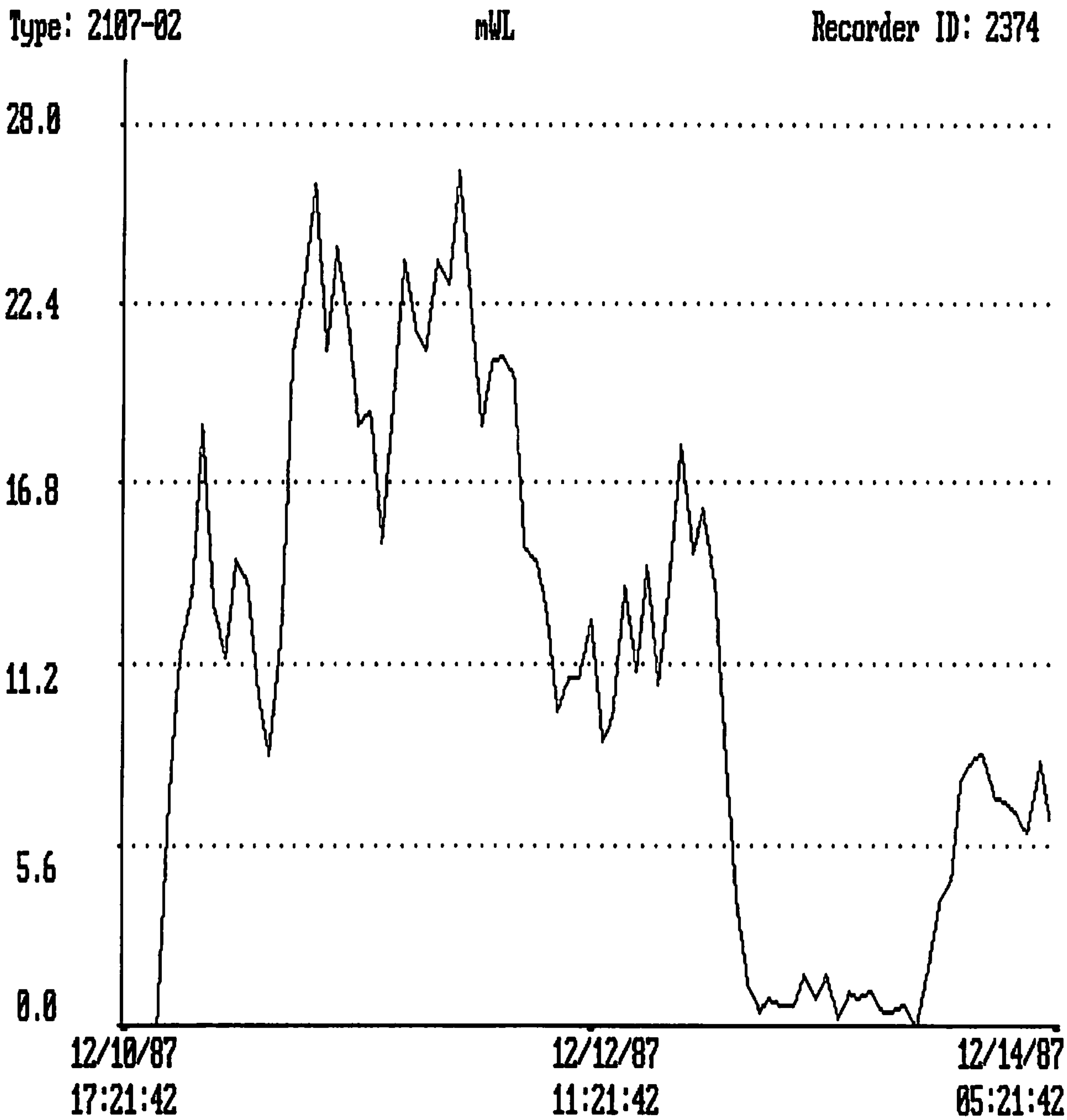
An option available which is intended to verify instrument integrity, is the Field Calibration Check Source. This device is a low level source of alpha energy that when employed will verify instrument functionality.

Two remaining options available to support the operation of the Radon Working Level Meter are the battery back-up unit and a security clamp system. These products are intended to stave off tampering and assist in ensuring a reliable result.

For the more advanced user, the above system may be configured with a conventional stand-alone modem to enable interrogation remotely with a computer. In this form, a site could be monitored, from across the city, or around the world.

Conclusions:

FIGURE 3: SAMPLE PRINTOUT FROM DATA RECORDER



The array of instrumentation presented in this paper is intended to equip any user from beginner, to seasoned professional with an accurate, cost effective set of tools for radon progeny diagnosis and measurement.

As more attention is focused upon the presence of radon in our lives, so will more attention need to be given to the quality and accuracy of the devices used to measure and monitor it. With this, radon practitioners must also increase their understanding. Indeed, in a field so steeped in opinion, it is best for us all to rely on the facts.