alphaNUCLEAR

TECHNICAL DATA 282

SERIES 300 alphaCARD SYSTEM

alphaCARD SYSTEM

ACTUAL SIZE

alphaCARD

INTRODUCTION

The alphaCARD system is a passive radon detecting method which provides a sensitive measure of radon in soil-gas. Inexpensive and re-usable, the alphaCARDs can be situated in baseline or grid locations to collect radon (and thoron) daughters in as little as 12 hours, and interrogated for alpha particle concentration on the spot with the micro-processor based alphaCARD reader. Soil-gas thoron estimates can also be obtained by taking a second reading from the same alphaCARDs a fixed time later.

FEATURES

- **Short 12 hour integration time;**
- **Inexpensive, re-usable alphaCARDs;**
- **Results are displayed on the spot, and, stored in electronic memory for base camp print-out;**
- **Thoron corrected results are possible from the same measurement;**
- **Radium determinations in soil samples are possible.**

PRINCIPLE OF OPERATION

In the early part of this century, Ernest Rutherford found that plates of various materials exposed to "Radium Emanation" (^{222}Rn) collected an "active deposit" which consisted of radon daughters. Rutherford's "plates" have now been specially designed as alphaCARDs and the alpha particle emitting radon daughters are detected on both sides of the alphaCARD by two solid state silicon detectors. These silicon detectors respond only to alpha-particles and do not rely on the leaving of tracks in any medium. The radon collecting membrane is thin enough such that the alpha particles may penetrate through the membrane and be detected by the detector on the other side, thus ensuring a very efficient (double sided) counting geometry.

alphaCARD READER

The alphaCARD reader is a small, portable, battery powered instrument for field or base-camp interrogation of the alpha particle concentration from alphaCARDs. The instrument has a card entry slot, numerical keyboard, LCD display and a removable electronic memory module. Also, on the back of the instrument is an alphaCARD magazine which will sequentially store up to 50 alphaCARDs after reading. The instrument is micro-processor based and interacts with the operator through prompt commands which require a specific operator input. The prompt commands follow a logical order as follows:

Prompt P1 = set time of built-in real time clock;
P2 = enter location code;
P3 = enter alphaCARD serial number;
P4 = insert alphaCARD and begin 5 minute read cycle.

At the end of the 5 minute read cycle the normalized data in counts per minute will flash on the display. For subsequent locations the procedure P2 to P4 is repeated for as many alphaCARDs as is necessary.

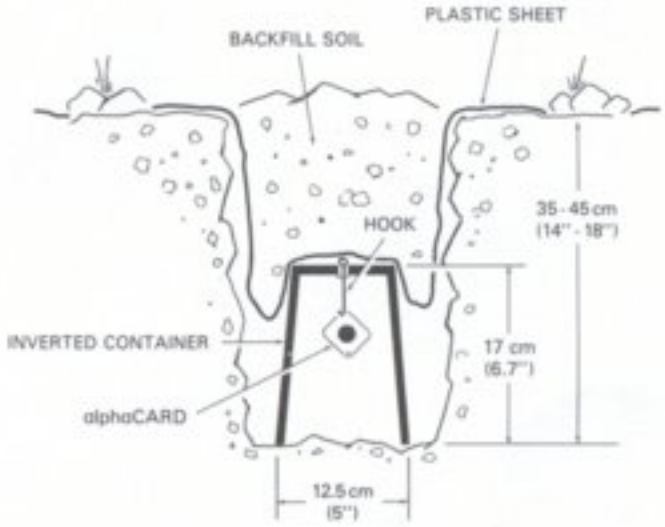
All of the data sets i.e. location, serial number, time and count are stored in a removable memory module for later interrogation or print-out. 126 data sets can be stored in this module and memory contents can be recalled and displayed at any time by using a sequence of commands known as OP codes. Data can also be erased when required.

The system with its inherent micro-processor intelligence will monitor for, and signal various fault conditions such as battery condition, memory failure and invalid data entries or commands through various error messages.

alphaPRINTER

alphaPRINTER

DISCONTINUED PRODUCT



RECOMMENDED alphaCARD SAMPLING METHOD

TIME AFTER END OF EXPOSURE	EXPOSURE DURATION (HOURS)			
HOURS	12	16	20	24
3.0	.965	.938	.924	.915
3.5	.941	.914	.899	.890
4.0	.916	.888	.873	.864
4.5	.889	.863	.848	.839
5.0	.864	.837	.822	.813
6.0	.812	.787	.773	.764
7.0	.762	.738	.725	.717
8.0	.715	.692	.680	.672
9.0	.670	.649	.637	.630
10.0	.628	.608	.597	.590
11.0	.589	.570	.559	.553
12.0	.552	.534	.524	.518
13.0	.517	.500	.491	.486
14.0	.484	.469	.460	.455
15.0	.454	.439	.431	.426
16.0	.425	.411	.404	.399
17.0	.398	.386	.379	.374
18.0	.373	.361	.355	.351
19.0	.350	.338	.332	.329
20.0	.328	.317	.311	.308

THORON CORRECTION FACTOR DATA

FIELD USE

The recommended method for using alphaCARDs is shown diagrammatically. The alphaCARD can be suspended inside an inverted flower pot or similar container and positioned in a hole approximately 14" (35 cm) deep. A plastic sheet is used to cover the container and then the hole is back-filled. A period of 12 hours should be sufficient for the radon daughters to achieve equilibrium. The plastic sheet makes recovery of the alphaCARD easier as well as sealing the radon measurement volume.

THORON CORRECTION

Thoron correction is possible with the one in-ground measurement by making use of the fact that thoron daughter half life is quite long compared to radon daughter half life (refer to graph below). By taking an alpha particle concentration reading immediately upon removing the alphaCARD from the ground, the total daughter activity is noted. A certain time later, say 5 hours, when the radon daughter activity has decayed to essentially zero, a second reading can be taken to indicate thoron daughter activity. To obtain the correct thoron abundance this second reading should be normalized by applying a factor taking into account the 5 hour delay.

As an example, assume the following:

(a) an alphaCARD has been in the ground for 12 hours and registers an alpha particle activity of 250 counts per minute.

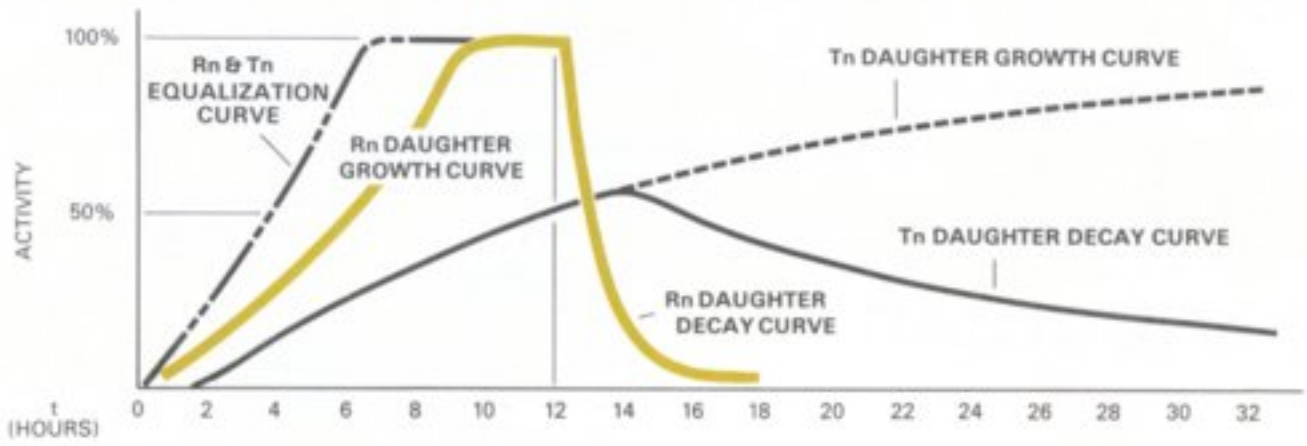
(b) a second reading 5 hours later shows 64 counts per minute.

A decay table for thoron indicates that after 5 hours 86.4% of the initial activity remains;

therefore 64 = 0.864 of initial thoron activity,

therefore original thoron activity $= \frac{64}{0.864} = 74$ counts per minute.

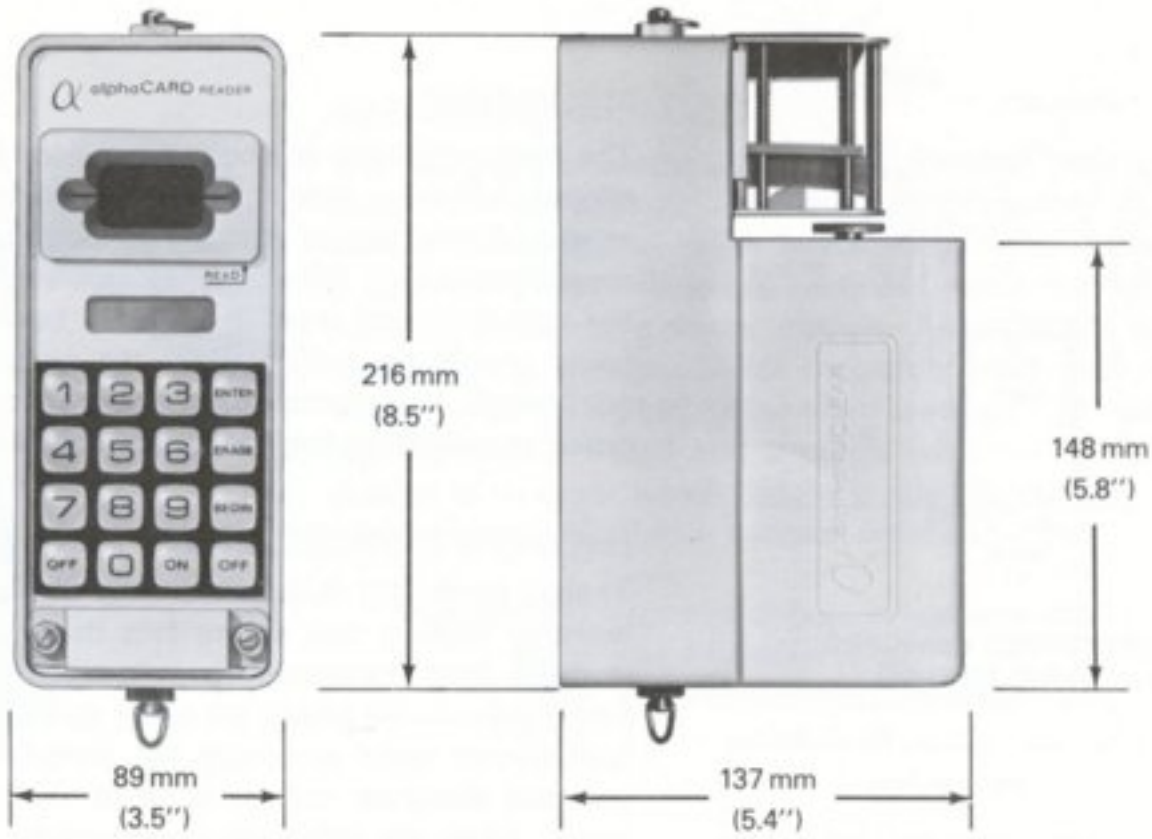
Thus true radon value is 250 − 74 = 176 counts per minute.



RADON AND THORON DAUGHTER GROWTH AND DECAY CURVE

SERIES 300 alphaCARD SYSTEM

PHYSICAL

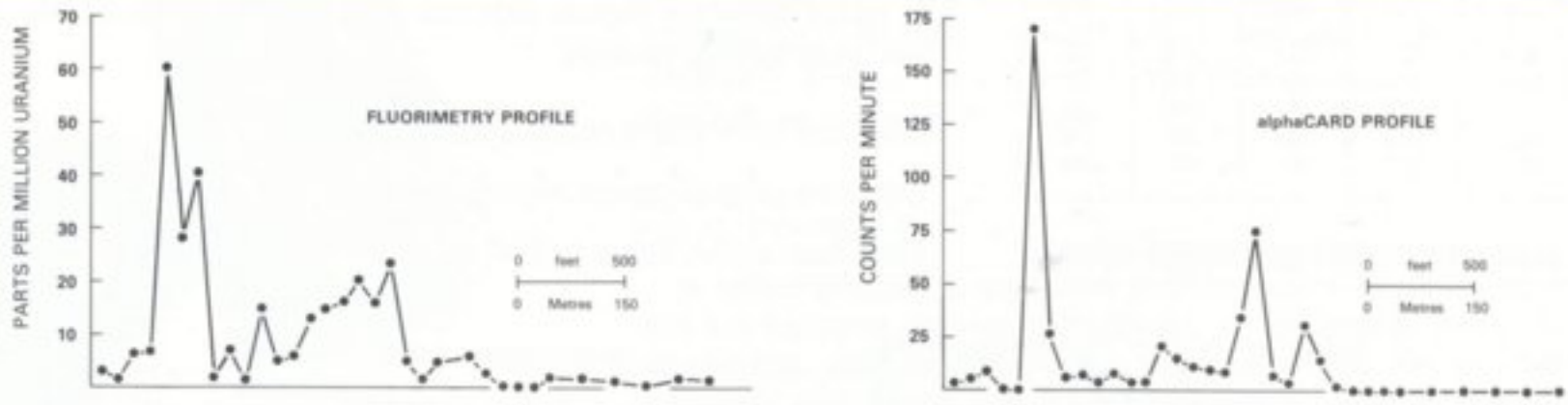


WEIGHT: 2.5 kg (5.5 lbs.) including batteries.

CONSTRUCTION: Rugged cast aluminum case.

OPERATING TEMPERATURE RANGE: -5° C to +50° C (23° F to 122° F)
A low temperature option is available for winter field use.

POWER REQUIREMENTS: 8 "D" Cells
Alkaline cells should provide 100 hours of operation. Carbon-zinc cells should provide 30 hours of operation. Low battery voltage is indicated by an "E4" message on the display.



COMPARISON OF alphaCARD AND FLUORIMETRY PROFILE ALONG SAME BASELINE

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