

# **PRACTICAL PROBLEMS AND SOLUTIONS FOR TRANSPORTATION AND DEPLOYMENT OF E-PERM® RADON MONITORS FOR INDOOR RADON MEASUREMENTS**

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## **INTRODUCTION**

Electret ion chambers are passive integrating ionization chambers used extensively for measuring indoor and outdoor radon concentrations. Electret ion chamber consists of a stable electret (electrically charged Teflon disc) mounted inside an electrically conducting chamber. The electret serves both as a source of the electric field and as a sensor. The ions produced inside the chamber are collected by the electret. The reduction in charge of the electret is related to total ionization during the period of exposure. This charge reduction is measured using a battery operated electret reader. Using appropriate calibration factors and the exposure time, the desired parameters such as airborne radon concentration in air is calculated. These low cost monitors require neither power nor battery and several hundreds of these can be used simultaneously and serviced by one reader.

Appropriate transportation and deployment of radon monitor is a first important step in radon measurement. The problems and solutions can be different for users wishing to use in different ways. The users themselves often arrive at the best solutions. The other user might not consider the procedure considered as best by one user as best. Based on the feed back from several users of E-PERM® radon monitors, the paper summarizes the commonly used, as well as some unique solutions devised by the users. The description of these solutions is expected to be of benefit to the current and future users of E-PERM® radon monitors. The problems addressed are: transportation in hot and cold climates, taking care of violent shocks, positioning the monitor, making the monitor tamper resistant and child proof, and the use of reader in high humidity environments.

## **STANDARD USE OF E-PERMs**

### **E-PERM® System Components and Standard Operating Procedures**

Basically E-PERM® System consists of three components: (1) electret, (2) chamber and (3) the reader. Each of these components has to be handled and used as described in the instructional manual provided by the manufacturer, to obtain correct radon concentrations.

The electret comes in a keeper cap and has to be removed from keeper cap, the initial reading taken using the reader and loaded into the chamber to form E-PERM<sup>®</sup> radon monitor. During this process, electret surface should not be touched. Electret surface should be clean and if found to have dust or fibers, it should be cleaned with a jet of nitrogen before taking the reading. The keeper cap should also be clean and free of dust or fibers to prevent transfer of dust/fibers to electret surface during its storage in keeper cap. The storage cap should be stored in a plastic zip lock bag, when not in use.

The chamber is made of electrically conducting plastic and has a threaded bottom to receive the electret. The S chamber has a mechanical arrangement by which electret can open and close from outside to turn the E-PERM<sup>®</sup> on and off, as needed. It also has an arrangement to introduce a lock tie in the neck to make it tamper resistant by preventing turning the monitor to off position. It has a hook to facilitate suspension using appropriate anchor.

The reader is a sensitive electronic unit and need to be used in an air-conditioned room with relative humidity of less than 75 % and should also be stored in such environment, when not in use. The reader has its own desiccant to keep it dry during storage and can be used in high humidity environs for a short time (half to one hour).

If E-PERM<sup>®</sup> radon monitor is hot or cold when returned to the laboratory for reading, these should be left in room temperature for three hours before taking the readings.

#### Environmental Parameters

Being a true integrator, varying radon concentrations are faithfully integrated.

Varying temperature and humidity have no effect on the performance of the E-PERM radon monitors. The radon monitors do not have response for thoron, as such the presence of thoron does not influence the radon results. Being made of electrically conducting plastic, the radon monitors are not affected by external electric fields including that from TV or high-tension wires.

Appropriate correction factors have to be applied for environmental gamma radiation and for locations at significantly above sea level. Filtered inlet stops the external ions as those produced by ion generators and the radon progeny present in the room.

### **SPECIAL SITUATIONS**

There are special situations when additional steps need to be taken when standard operating procedures are not sufficient.

#### Electrets Read On Site

There may be situations when readings have to be taken on site, when intermediate readings have to be taken before continuing the deployment, or when results have to be given on the spot. Transport the readers in a shock proof insulated container. Make sure that the temperature of the

site is similar to the temperature at which the initial reading was taken ( $\pm 5$  °F). The relative humidity of the site is less than 80 %.

#### High Humidity Environments

When the humidity in the reading area is above 75%, the electret voltage reader can give fluctuating readings. The reader can be taken out of the carrying case and used within half-hour. If the readings have to be taken during extended period, a special area with humidity control should be set up.

#### Very Dusty Testing Area

Enclose the E-PERM<sup>®</sup> radon monitors in a radon transparent Tyvek Bag or micro pore bag during the exposure. This will minimize the heavy coating of dust on the detector and transfer of such dust to electret surface during handling. This procedure is also recommended for extended outdoor sampling of radon.

#### High Temperature and Relative Humidity

If the sampling has to be done for extended period, more than 30 days, in temperatures above 90 deg F and 90% relative humidity, the detectors should be enclosed in radon transparent Tyvek bags and the electret surface visibly checked for any fungus before taking a final reading. The results are not valid if you see any fungus growth on the surface of the electret.

#### Locating the Detectors

If there is no table or any elevated area to locate the E-PERM<sup>®</sup> radon monitors, use low cost (\$50) reusable telescopic tripod stand with a holder for Rad Elec twin box. The standard Rad Elec twin box can hold two detectors and also makes the system more tamper resistant.

#### Rough Handling of Detectors

It may be necessary to use a mode of transportation of E-PERMs that is subject to violent shocks. The transportation may be needed either by mail, courier or in automobiles. It is important to minimize violent shocks. The bubble wrap containers or standard Rad Elec twin box can be used.

## **CONCLUSIONS**

The solutions suggested to meet unusual situations are given as guidelines. It is possible that the users may have different solutions to the same problems. As long as the user understands the limitations and use their own methods, the E-PERM radon monitors provide the answers in challenging situations, due to their versatility.