UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

EPA-SAB-RAC-89-017

April 25, 1989

OFFICE OF
THE ADMINISTRATOR

Honorable William K. Reilly
Administrator
U. S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

SUBJECT: Science Advisory Board Review of the Radon Measurement Proficiency Program

Dear Mr. Reilly:

On September 23, 1987 the Director of the Office of Radiation Programs requested that the Science Advisory Board review the Radon Measurement Proficiency Program. The request was referred to the Radiation Advisory Committee which formed the Radon Measurement Subcommittee to conduct the review. The Subcommittee held two open meetings. The first was held at the Eastern Environmental Radiation Facility in Montgomery, Alabama where the Radon Measurement Proficiency Program is housed on January 26-27, 1988 and the second was held February 16-17, 1988 at Region I Headquarters in Boston. The Subcommittee also held a writing session July 7, 1988 in Boston.

The Subcommittee addressed performance standards, statistical methods, standard measurement protocols, participant's procedures, blind tests of passive devices, consensus standards and voluntary accreditation, and user fees.

The Subcommittee's recommendations include:

- development of separate objectives for devices or methods used for screening, diagnostic measurements, and exposure evaluations,
- consideration of different testing protocols for passive devices and active measurements,
- design of the testing program to obtain independent measurements from each device of method to be tested,

- o testing should be done blind, wherever practicable as in the instance of passive measurement devices, and

- o strongly urges the assignment of a full-time statistician to the program at least until it is well established.

These and other recommendations are described in greater detail in the attached report which was approved by the Executive Committee January 31, 1989.

The Science Advisory Board was pleased to participate in this review and appreciates the opportunity to be briefed on the activities of the Radon Measurement Proficiency Program. We request that the Agency consider the advice contained here and respond in writing to our recommendations.

Sincerely,

Raymond C. Loehr, Chairman
Executive Committee

William J. Schull, Chairman
Radiation Advisory Committee

Keith J. Schiager, Chairman
Radon Measurement Subcommittee

cc: Deputy Administrator
Assistant Administrator for Air and Radiation
Director, Office of Radiation Programs

SCIENCE ADVISORY BOARD

RADIATION ADVISORY COMMITTEE

RADON MEASUREMENT SUBCOMMITTEE

REVIEW

OF THE

OFFICE OF RADIATION PROGRAM'S

RADON MEASUREMENT PROFICIENCY PROGRAM

JANUARY 1989

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ABSTRACT

The Radon Measurement Proficiency Program (RMPP) of the Environmental Protection Agency's Office of Radiation Programs was reviewed by the Science Advisory Board's Radiation Advisory Committee (SAB/RAC). The RMPP was established in 1986 to provide states and homeowners with some assurance that individuals and organizations making radon measurements were, in fact, competent to do so.

The SAB/RAC's recommendations include: definition of separate objectives for screening, diagnostic, and exposure measurements; the need for independent exposures when testing devices submitted by participants; improved statistical support for the program; blind testing for passive devices, and consideration of establishing consensus standards, voluntary accreditation, and user fees.

1.0 INTRODUCTION

Upon receiving a request from the Director of the Office of Radiation Programs (ORP) the Science Advisory Board's Radiation Advisory Committee formed a Radon Measurements Subcommittee to review the Radon Measurements Proficiency Program (RMPP). The Subcommittee held a public meeting at the Eastern Environmental Radiation Facility (EERF) of the EPA in Montgomery, Alabama on January 26-27, 1988. The EERF staff briefed the Subcommittee on the RMPP and provided a detailed tour of the facilities used for the RMPP and other programs conducted at the EERF. On February 16-17, 1988 the Subcommittee met at EPA's Region I Headquarters in Boston, Massachusetts. Staff from the National Bureau of Standards (NBS) described the structure and functions of the NBS-sponsored National Voluntary Laboratory Accreditation Program. The Subcommittee met again in Boston on July 7, 1988, to complete the writing of the report.

The Subcommittee considered the eight questions initially posed by the EPA, as well as oral and written comments from members of the public. The Subcommittee was pleased with the open nature of the discussions with the EPA staff, and encouraged by the fact that several of its recommendations have been adopted and put into effect during round 5 of the proficiency testing, even before this report was completed.

This report includes a brief summary of the Subcommittee's recommendations, a short history of the development of the RMPP, followed by a discussion of the major topics considered by the Subcommittee.

2.0 SUMMARY OF RECOMMENDATIONS

2.1 Performance Standards

The EPA may need to define separate objectives for devices or methods used only for screening measurement and those that are to be used for diagnostic purposes or exposure evaluations. Different testing protocols should also be considered for different categories of measurements, e.g. passive devices versus active measurements, since a single measurement by one measurement technique may carry greater significance than a single measurement by another technique.

For passive devices used only for screening measurements, a total uncertainty of a factor of 2 from the known test value at the 90% confidence level is recommended. (See Sec. 4.1)

For passive devices used for dosimetry purposes, i.e. for determining long-term average concentrations of radon or radon progeny, a total uncertainty of 25% at the 90% confidence level is recommended. (see Section 4.1)

For active devices used for screening, diagnostic or dosimetric purposes, a total uncertainty of 25% at the 90% confidence level is recommended. (see Section 4.1)

The EPA should design the testing program to obtain several independent measurements from each device or method to be tested. Even a smaller number of measurements, if truly independent, would serve the objectives of the RMPP better than the original test program.

Based on the capabilities demonstrated in round five, at least 4 independent measurements can and should be used to evaluate performance for proficiency listing. (See Sections 4.1 and 4.2)

Retesting of each participant should be conducted at least within one year after its first proficiency listing and at regular intervals thereafter. The retesting interval should be determined by the overall proficiency demonstrated during the past two or three proficiency tests. (see Section 4.1)

None of the objectives should be stated in terms of the EPA's present exposure guideline of 4 pCi/L; they should be stated in terms of acceptable error at low radon concentrations, e.g. less than 10 pCi/liter or 0.05 WL.

2.2 Statistical Methods

The Subcommittee strongly recommends that a statistician be assigned on a full-time, on-site basis until the RMP Program is well established. (See Section 4.2)

2.3. Standard Measurement Protocols

The EPA should require that the information provided to the client by the measurement company before and after the measurement include clear statements of the purpose and proper interpretation of the measurement. (See Section 5.1)

2.4 Participants' Procedures

Detailed procedures for exposing, evaluating (counting) and calibrating each passive measurement device, as well as the methods used for calculating the radon concentration, should be submitted with the application for admission to the proficiency testing program. (See Section 5.2)

For active measuring devices, the application should include performance characteristics, calibration data, qualifications of existing operators and details of the training program for future or unidentified operators. (See Section 5.2)

2.5 Blind Tests of Passive Devices

The technical advantages of blind testing are sufficient that the EPA is encouraged to adopt this system as soon as feasible. (See Section 5.3)

2.6 Testing of Active Devices and Operators

The accepted use of grab sampling should be made conditional on the use of good procedures by a qualified operator. (See Section 5.4)

Active devices admitted to the RMP Program should be certified as to their original calibration and continued maintenance of that calibration. (See Section 5.4)

The qualification and/or training of the operators of active devices must be retested or reviewed periodically. (See Section 5.4)

2.7 Consensus Standards and Voluntary Accreditation

The Subcommittee recommends that serious consideration be given to establishing consensus standards and voluntary accreditation procedures.

EPA should solicit the advice of various organizations that establish consensus standards and voluntary accreditation programs and should work toward converting the RMPP to such a voluntary program as expeditiously as possible.

2.8 Adequate Program Support

The Subcommittee notes that a successful program will require adequate and continuous support, and recommends the EPA explore all such avenues including user fees.

The present funding is not sufficient to support the level of independent testing the Subcommittee believes to be needed. In addition to providing the financial support necessary for more thorough and independent testing, the use of fees would help to screen out participants who have not invested sufficient time or effort to learn the basics of radon measurements.

3.0 DEVELOPMENT OF THE RADON MEASUREMENTS PROFICIENCY PROGRAM (RMPP)

EPA established the RMPP in response to specific needs and urgent requests for help from private laboratories and state agencies. Concern, and even fear, among residents in areas where high indoor radon concentrations had been found, and widespread media coverage, led to numerous requests for radon measurements. One of the immediate effects of the rapidly increasing demand for radon measurements was the sudden appearance of numerous individuals or companies offering radon measurements for a fee. Since many of these individuals and companies had no previous experience and no apparent qualifications related to indoor radon measurements or evaluations, state agencies became rightly concerned. The RMPP was established by the EPA as a prompt and effective response to the growing problem.

The EPA contacted companies already involved in radon measurements and encouraged them to participate in voluntary proficiency testing. During these initial phases of the program, it was necessary and normal to assist inexperienced companies with measurement equipment and methods in order to assure the development and availability of radon measurement capabilities to meet the needs of the public. Companies who were able to demonstrate adequate proficiency were listed in a "proficiency report" distributed by the EPA to state agencies. For companies providing radon measurement services, listing in the EPA's proficiency report has become a de facto license to do business.

When the RMPP was first initiated in early 1986, the EPA facilities were not adequate to conduct the program. The EPA received assistance from the Environmental Measurements Laboratory (EML) of the Department of Energy (DOE) in New York City, where the first three rounds of proficiency testing were conducted. The program was originally designed as a single test process that would be repeated every three months with results reported after each round of testing. Round one, conducted at EML in April 1986, result in 35 participants listed; 85 were listed after round three in November 1986. Recognizing the need for larger and more versatile facilities for radon measurements calibration and testing, the EPA built a new radon chamber at its Eastern Environmental Radiation Facility (EERF) in Montgomery, Alabama. Round 4 of the RMPP was conducted in the new chamber. Round 5 was conducted during the summer of 1988.

Until the Subcommittee's review, EPA conducted all of the proficiency testing in a batch mode. For logistical reasons, all participants were required to submit devices or equipment for testing within the same limited time interval, and all devices were exposed to the same test atmosphere. The scheduling of groups of similar devices for simultaneous testing has been necessary to accommodate all participants with the existing facilities and personnel.

Calibration and testing of radon and radon progeny measurement devices and instruments requires a large-volume test chamber containing very well-known radon and progeny concentrations. Chambers in which appropriate concentrations of radon and other atmospheric constituents can be established and maintained for extended periods of time exist in only a few locations in the country. Even the few existing chambers were not designed for testing of large numbers and varieties of instruments and devices. In addition to the limited number of test chambers, the very nature of the measurements restricts the number of tests that can be accommodated in a single chamber. To minimize uncertainties in the determination of the true average radon concentration to which a device is exposed, it is desirable to maintain a nearly constant radon concentration during the testing period. The most commonly used radon measurement devices are passive devices such as charcoal canisters and alpha track detectors. Since most of the passive measurement devices require exposure times of several days, it is preferable for most applications to change the test atmosphere no more often than weekly.

The older of the two radon chambers at the EERF is quite small (3.6 cubic meters) and access to the test atmosphere is by means of only a few ports and a small panel. Air flows through the chamber in a single pass, with radon being injected into the incoming air and the outlet being exhausted to the outdoor atmosphere. The new chamber has a volume of 42 cubic meters and the air is recirculated. Operators may walk into the new chamber to install or exchange devices, and the capacity is many times greater than that of the old chamber. The new chamber also has more ports available for sampling the atmosphere from outside the chamber. Such ports are useful for active devices which measure radon concentration in hours rather than days.

The radon concentration in each of the two chambers is controlled by the amount of radon gas injected into the air circulating within or through the chamber. The radon is injected by passing air through a device containing radium-226, the parent of radon-222. The concentration in the test chamber is monitored continuously by measuring with scintillation cell monitoring devices calibrated with radon extracted from a solution containing the radium from a standard obtained from the National Bureau of Standards. The radon concentration during test runs is known to a high degree of accuracy.

The concentration of short-lived radon progeny is not as precisely controlled, since it is governed not only by residence time in the chamber but also by plate-out on all available surfaces, including the devices and instruments being tested, in addition to the chamber and its ductwork. However, the concentration of airborne radon progeny is monitored continuously to assure that the integrated concentration is known accurately for any test period. The monitors for airborne radon progeny are solid-state detectors and associated electronics that measure

accumulated activity. The temperature and humidity of the atmosphere in each chamber can also be controlled, as can the concentration of small airborne aerosols, i.e. condensation nuclei.

4.0 PROFICIENCY TESTING OBJECTIVES

4.1 Performance Standards

In order to demonstrate proficiency in making radon measurements, participants and measurement devices must be tested against an appropriate performance standard. The test procedure must be appropriate to ascertain that the measurement device or method does, in fact, meet the performance standard. The following two questions posed by the EPA relate directly to the performance standard and the means for demonstrating measurement proficiency.

EPA Question 1: "The sample design was selected to insure that a measurement company could, within 80 percent confidence, identify a radon level as being greater than 4 pCi/L when in fact the true level is 8 pCi/L, with a single measurement in a house. Is the sample design now in use sufficient to meet RMPP program objectives?

EPA Question 2: "EPA presently evaluates all devices by the same measurement criteria, i.e. four measurement results must be within 25 percent of the known chamber levels. EPA is considering changing this criteria (sic) to obtain better confidence in companies' abilities. Are the criteria outlined in the RMPP Background Document scientifically sound?"

The Subcommittee agrees that, at concentrations of the same order of magnitude as the EPA's present radon concentration guideline (RCG), a screening measurement made with a passive device solely to determine whether follow-up measurements are warranted should produce a result within a factor of 2 of the known test value almost all (e.g. 90%) of the time. Although a possible error of a factor of 2 may appear to be excessively large, the Subcommittee believes this degree of uncertainty is acceptable for <u>screening</u> measurements because: (1) the measurement protocol inherently introduces bias on the high side of the true annual average concentration by more than a factor of 2, and (2) greater precision is unnecessary and could result in increased costs to homeowners. Since many decisions regarding radon mitigation may be based on a very small number of measurements, the total uncertainty accepted in the measurement should include the uncertainties of both bias and precision.

Since it is possible, under the revised procedures adopted for round five, to deliver independent exposures to four devices within a short time, this should be adopted as the minimum number of measurements used for determining the acceptability of performance. As discussed in Sec. 4.2, the acceptance criteria originally proposed by the EPA, as well as those recommended by

the Subcommittee, are based on statistical assumptions that include independence of test measurements. As additional facilities become available, this minimum number of samples could be increased.

The Subcommittee strongly recommends against stating the RMPP objectives in terms of the RCG for lifetime exposure, i.e. 4 pCi/L, since the value becomes easily misinterpreted in the context of the EPA's screening measurement protocol because conditions in the house are selected deliberately to maximize the radon concentration measured. Too much emphasis has been given to this numerical value already and it is, unfortunately, being interpreted as a hard and fast line between "safe" and "unsafe". The EPA should make a deliberate effort to discourage this regulatory attitude toward radon measurements and mitigation.

To remain listed as proficient in measurements, a company should be required to repeat its performance testing periodically since performance may change over time due to factors such as aging or new equipment, changes in operators and analysts, etc. The exact interval for retesting should be developed by the EPA staff on the basis of cumulative performance data and availability of facilities. The Subcommittee recommends that participants that are new to the program be retested within a year after first being listed as proficient. The retesting interval could be increased after a participant has demonstrated competence two or three times. In fact, the retesting interval could easily be determined by the cumulative performance over the past two or three tests on the basis of total error (accuracy plus precision).

The Subcommittee considers that separate objectives, and testing protocols may be appropriate for different types and conditions of measurements. Because of the much greater cost, sampling devices and methods that require an operator should produce measurements of much better quality than can be obtained by passive devices. Also, measurements made to determine the need for, and/or extent of, mitigation activities should, because of the potential cost to the homeowner, be of higher quality than screening measurements made simply to determine if further assessment is necessary. For passive devices that may be distributed in various ways and returned by mail, the emphasis should be placed on the consistency of instructions to the user, handling, processing and reporting procedures. For active devices that require an operator, both the adequacy of the device and the competence of the operator should be evaluated.

Passive devices used for dosimetry, i.e. for determining long-term average concentrations, should produce results that are within 25 percent of the known test value at least 90 percent of the time. This level of uncertainty is achievable with devices currently available and should be required to assure homeowners that mitigation costs are truly justified.

The EPA should separate education and calibration assistance from proficiency testing because the support activities appropriate to the first two activities are not appropriate to an objective testing program. A company, or individual operator, should be allowed to participate in the RMPP only after demonstrating understanding of the devices or methods intended for use and after some type of calibration has been performed. Because of the lack of commercial calibration facilities EPA may wish to continue to allow its chambers to be used for calibrations, but this function should not be conducted simultaneously with that of proficiency testing.

4.2 Statistical Methods

The current EPA testing procedure, as stated in the program reports and as presented to the Subcommittee, requires that the average of four measurements fall within 25% of the test chamber value. The Subcommittee learned, however, that all four measurements were normally made simultaneously in the same atmosphere. Beyond the fact that the test measurements could not be considered to be independent, thus invalidating the statistical assumptions on which proficiency was based, the Subcommittee was concerned that the procedure allowed too many opportunities for unscrupulous participants to obtain the results by means other than actual measurement.

The current performance criteria do not take into account uncertainties in both precision and accuracy in determining proficiency. Changes to the procedures initially proposed by the EPA would require a larger number of measurements and would consider both precision and accuracy, but the measurements would still not be independent and, consequently, the evaluation of accuracy and precision would be incorrect. The dilemma lies primarily in the batch mode of operation and in the small number of truly independent measurements that can be made at any one time.

Until additional testing facilities are available, the Subcommittee recommends that the EPA test fewer devices, if necessary, but assure that tests are independent, i.e., at different concentrations. Analysis of the results in previous rounds which examine the within-round and between-round variability within companies may help to answer questions about sample sizes.

The statistical methods initially proposed for the EPA's testing program are inappropriate in view of the physical and economic constraints on the EERF testing facility. Developing a set of statistical performance criteria and methods for running a proficiency program requires commitment from professional personnel with statistical expertise who can interact closely with the EPA's laboratory staff. Close interaction is necessary to ensure that the statistician clearly understands the objectives of the program and the limitations of the testing

environment. Likewise, the laboratory staff needs input from statisticians as to the appropriateness of the procedures from a statistical point of view. The Subcommittee strongly recommends that a statistician be assigned on a full-time, on-site basis until the program is well established.

All of the performance criteria discussed above are based on independent test measurements. To ensure this, the measurements should be made of different chamber atmospheres, either at different times in the same chamber or in different chambers. The range of radon concentrations should represent values of most interest but varied unpredictably, and devices should be assigned for exposure in the different test atmospheres such that the participant cannot anticipate or predict the result. To achieve the required number of independent test measurements within the limitations of the facility may require that tests be conducted at different times.

The Subcommittee commends the EPA for the changes made to the testing procedures for round five. Both test chambers are being used and the radon concentrations have been reduced and are changed periodically. Measurement devices from any participant may be exposed in either chamber and at different times. The selection of both the chamber and the time of exposure are randomized such that the measurements are independent.

5.0 PROFICIENCY TESTING PROCEDURES

5.1 Standard Measurement Protocols

EPA Question 4: "To achieve EPA's goal of standardizing measurement procedures and improving the reproducibility of companies measurements, participating companies are required to follow EPA interim measurement protocols. Is this a reasonable request?"

This requirement should be clarified, because it is not clear that the measurement protocol should be directly connected to the measurement proficiency testing, since the two are independent issues. Although it may be desirable for the EPA to require companies to follow EPA protocols for specific purposes and for convenience of comparing data, there are legitimate applications for proficient radon measurements other that those covered by EPA protocols. In order to participate in the proficiency testing program, companies should not be limited to the use of any specific measurement technique.

The EPA should require that the information provided to the client <u>before</u> and <u>after</u> the measurement include clear statements of the purpose and proper interpretation of the measurement. For example, the instructions provided <u>before</u>, and the interpretation and recommendations provided <u>after</u> the measurement, should specify if the location and conditions of the measurement are likely to produce a reasonably conservative estimate of the annual average concentration, which can be compared with the EPA's present radon concentration guide, or a maximized value

that indicates only whether further measurements are desirable, but gives no indication of actual annual exposure.

5.2 Participants' Procedures

EPA Question 6: "Within the parameters of the EPA measurement protocols the RMP strives to follow each company's standard operating procedures for testing. EPA does not set the exposure period, the sampling period or the counting procedures. Accommodating the large variety of standard operating procedures causes logistical and operational problems during performance test. Is this a reasonable and meritorious approach or should EPA set standard RMP test procedures?"

The EPA should assure that a participating company cannot claim that it failed a proficiency test because the test was not conducted in accordance with the company's normal operating procedure. To do this, the EPA should determine the minimum cumulative exposure claimed to be detectable by the company, or the maximum exposure time required for correct response, and assure that tests are within these criteria. As long as the total exposure of the device, i.e. picocurie-days per liter, exceeds the minimum claimed to be detectable by the participant, and the decay or loss of radon from a charcoal canister does not exceed the normal amount, the participant's criteria will be satisfied.

The procedures for exposing, evaluating (counting) and calibrating each passive measurement device, as well as the methods used for calculating the concentration, should be submitted with the application for admission to the proficiency program. The EPA should evaluate and approved the procedures before devices may be submitted for testing.

For active measurement devices, the application should include performance characteristics and calibration data. The qualifications of existing operators, and the training program for future or unidentified operators, should be included with the applications for active devices.

5.3. Blind Tests of Passive Devices

EPA Question 5: "Participants in the RMP include analysis laboratories and distributors, i.e. middlemen operating between homeowners and analysis companies. EPA intends to evaluate distributors' performance in conjunction with, but different from, the current chamber test process. For example, we are proposing distributors undergo a yearly double blind test once they have established themselves with a participating analysis laboratory. We would not require these companies to participate in further laboratory performance tests. This would minimize the impact on these smaller companies and allow for more rigorous testing of true laboratories. Is this reasonable?"

The blind test would be extremely valuable for monitoring the performance of companies that distribute passive devices by

mail or over the counter at retail outlets. It should be noted that these blind tests are also valuable in assessing performance of the primary measurement laboratories. However, some situations cannot be monitored effectively by this technique, e.g. companies that deliver passive devices directly to the home. Because radon decays over time, there is also a time constraint for receiving a passive device at a distant location, sending it to the EERF for exposure, returning it to the surrogate homeowner and then mailing it back to the company who may also have to mail it to an analytical laboratory.

The advantages of blind testing are sufficient that EPA is encouraged to adopt this system as soon as feasible. The advantages of blind testing include: (1) the participant does not know that the device is being tested, nor the exposure, (2) the handling and reporting procedures are tested, as well as the measurement itself, and (3) the procedures of the distributor are tested as well as those of the processing laboratory. The exposures of the passive devices could be carried out throughout the year, allowing for a better distribution of effort with time.

5.4 Testing of Active Devices and Operators

EPA Question 8: "Currently, EPA supports the usage of grab sampling as a screening measurement method by the inclusion of the method in EPA measurement protocols and in the RMP. Given the controversy in the scientific community surrounding its reliability as a screening measurement, should the RMP continue to categorize grab sampling as a screening method or should we, for example, establish a new category for diagnostic methods?"

While grab sampling is more appropriate for diagnostic and remediation purposes, it can be used as a valid screening method particularly when prompt results are required. In spite of some controversy over its reliability, grab sampling is just one of several short-term measurement techniques, which include screening measurements of only a week or two with passive devices. The advantages of on-site grab samples by a qualified operator are that <u>results</u> <u>and</u> <u>interprelations</u> can be available immediately without waiting for mail deliveries. The accepted use of grab sampling should be made conditional on the use of good procedures for sampling, counting and calculation by a qualified operator, since the method can be very easily abused.

Active monitoring devices for grab, continuous and integrating sampling are used widely for both screening and diagnostic purposes. Because these instruments are larger in size and in many cases require a trained operator for deployment in the field, they require test criteria different from those required by passive devices. The outcome of the measurement depends largely on the individual operator and on the original calibration of the instrument with sources procured from the NBS or from a laboratory which, in turn, was cross calibrated with an NBS radon and radon progeny reference atmosphere. Submission of one instrument of one type to the EPA RMPP does

not guarantee that all others of the same type will perform satisfactorily. Several things can go wrong in the field requiring specialized training for problem recognition. The qualifications of the operators of active devices must be reviewed periodically by EPA to ascertain the reliability of the measurement results. Commercial devices admitted to the program should be certified as to their original calibration and procedural steps that will be taken by the operator to maintain their original calibration.

The criteria should require the operator to maintain documented quality control and measurement procedures for each type of instrument. Air leakage around a filter and improper counter efficiency are the most common areas where problems may occur. The operator should be able to recognize them and take proper action to correct them. The participant should submit sampling procedures with a check list of operational procedures to be followed before and after exposure. In summary, good procedures for calibration, sample counting, calculation and the qualifications of the operator must be the basis for accepting a company into the RMPP.

EPA Question 3: "Some measurement devices can make multiple measurements in a 24-hour period while others can make a maximum of two a day. Requiring the same number of samples for all types of devices creates logistical and financial problems for EPA and companies. Can any alternatives be recommended?"

Active devices the logistical problems of requiring multiple measurements for devices that require manual reading and resetting may be alleviated by applying testing procedures and criteria different from those used for passive detectors. Instruments and procedures for diagnostic purposes and exposure measurements may require more restrictive criteria than those required for screening measurements.

5.5 Radon Concentration Standard

EPA Question 7: "In the absence of a NBS radon standard, EPA bases their radon chamber calibration procedure on radon values established through national and international intercomparison tests. Does this approach sufficiently substantiate the accuracy of our chamber levels?"

The EERF uses both intercomparison tests and its own laboratory standard for determining radon concentrations and should continue to do so. It is generally accepted within the scientific community that a valid laboratory standard for radon can be prepared from an NBS radium solution primary standard. Careful handling, including opening the NBS vial, dilution and preparing aliquots can give results that are accurate to within one percent. Subsequent transfer of the radon gas to a scintillation cell or ion chamber can be done within approximately the same uncertainty. The accuracy requirements for radon exposure chamber calibration are of the order of five

percent, so a competent laboratory can calibrate its chamber in a manner acceptable to users.

A potential source of error in the standard method of calibrating scintillation cells from a standard radium solution is in the transfer of moisture to the cells as a result of bubbling air through the solution. Condensation in the cells, even when so slight as to go unnoticed, can lead to substantial loss of detection efficiency. One technique for preventing condensation is simply to assure that the radon extraction operation is performed in a room that is substantially cooler than the room in which the cells will be stored for radon progeny ingrowth and subsequently counted. Cooling of the bubbler flask in a refrigerator prior to use may serve the same purpose. Such precautions should be explicitly included in the calibration procedure.

6.0 LONG-TERM PLANNING FOR THE RMPP

6.1 Consensus Standards and Voluntary Accreditation

Because of the recognized voluntary nature of the RMPP, the Subcommittee recommends that serious consideration be given to establishing consensus standards and voluntary accreditation procedures. This approach would utilize a broad range of existing expertise in measurement technology and in statistical analysis through the participation of other agencies and industry representatives. This approach has been used successfully for many years by ANSI, ASME, ASTM, etc. It might be possible to establish a program under, or comparable to, the National Voluntary Laboratory Accreditation Program sponsored by the NBS.

6.2 Financial Support Needed for Adequate Program

The Subcommittee anticipates a continuing and increasing demand for indoor radon measurements and the concomitant requirements for calibration and testing, and encourages the EPA to act now to assure the availability of the necessary facilities and programs. It is essential that adequate funding be provided for the RMPP without depleting support for other important EPA radon programs. The Subcommittee strongly urges the EPA to investigate all avenues to support the Radon Measurements Proficiency Programs. One possibility is through user fees. It should be noted the latter regard that industry presentatives present at the meeting urged the use of such fees particularly if it would help maintain the announced testing schedule. They noted that the delay of several months in starting round 5 has been damaging to companies who have invested in equipment but are not able to conduct business until they are included on the RMPP listing.