An Overview of the

NIST

Radon Measurement Standards Program

presented by

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to

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PRIMARY OBJECTIVES

Maintain national standards for ^{226}Ra and ^{222}Rn

Develop new transfer standards and applications

Disseminate standards, and provide mechanisms for insuring the quality of radon measurements

IMPORTANT CONSIDERATIONS

Most important function is maintaining national standards

Have limited resources

Therefore, interact principally only with "important" secondary labs and with "reference class" methodologies in transferring standards

Our Services must be cost recoverable and are expensive

Some History

ANCIENT HISTORY

Science Era

1898 - 1913

MEDIEVAL HISTORY

I. Radium-Craze Era

1914 - c.1940's

II. Dark Ages

c. 1950's - 1970's

MODERN HISTORY

Neo-Radon-Craze Era

c.1980 - now

Radium Standards (highlights)

^{226}Ra standards are still important for ^{222}Rn calibrations

NIST is only lab in the world that distributes ^{226}Ra solution transfer stds that are directly relatable to international Curie (1911) and Honigschmid (1934) standards

Long history of SRM series: 1940, 1947, 1957, (1965), 1967, 1978, (1984), and 1992

Many labs gave up their primary capability for ^{226}Ra (NIST never did) over the years -- during dark ages.

Some national metrology labs are now trying to get capability back. In past 2 years, NIST transferred special radium sources to UK (NPL) and Italia (ENEA) that will serve as their national standards

Recently verified 1992 Ra series against 1947, 1967 (inferentially), 1978 and 1984; and unravelled past (unrecorded) history

In past 2 years, independently verified ^{226}Ra and ^{222}Rn calibrations based on LS counting. Consistent with international stds to comparable measurement uncertainty. Could now re-do to reduce to decrease uncertainty and completely remove dependence on the old artifact stds.

Radon Background (some highlights)

Large active program at NIST from 1914 through 1940's

Primary PIC measurement system still the world's standard

Prior to current radon craze (10 to 15 years ago), the radon program was very limited (only maintaining minimum capability) with increasingly deteriorating primary system

Before the craze really took off (pre Reading Prong), NIST foresaw that without an increased and active program we would have big problems in the future. ("National Needs" and Role of NBS/NIST papers published in 1978 -1980)

In 1979, NIST held a "Radon in Buildings" symposium that brought together for the first time experts in radiation science , health physics, building technology, etc. (These kind of meetings later became a popular pastime)

NIST planned a new radon program and began to seek funding (took 8 years to obtain)

Several significant accomplishments in past decade, particularly in past few years.

Radon Program (some selected activities)

Began investigating new measurement methods, applications, facilities -- e.g., flow systems, solid sources, test manifolds, etc.

Built new primary PIC system -- extensive tests, calibrations, etc.

At request of EPA conducted a major review and assessment of radon transport through and exhalation from building materials (NBS Tech. Note 1139). Was a starting point for many other subsequent research groups.

Distributed calibrated set of alpha sources (8) for Rn daughter measurements to major labs in US. Their primary daughter meas. stds. still.

Started to do informal measurement intercomparisons with major radon labs (EML, EPA, Bureau of Mines, etc). At the time some meas. discrepancies. Now in reasonable agreement.

Began to address needs for other and more "practical" kinds of radon transfer standards. Research and development on

-- solid sources

-- radon-in-water standard generator

-- flux density standard

-- NaI(Tl)/bulb secondary system for intercomparisons

-- encapsulated/emanation standards

-- calibrated flow sources

Recent Activities (highlights)

issued new 1992 series of ^{226}Ra solution standards (SRMs)

validated relatability of all ^{226}Ra solution standards issued by NIST from 1947 to 1992.

provided special ^{226}Ra sources to NPL and ENEA to serve as their national radon standards

developed new transfer standard/secondary measurement system (bulb/NaI(Tl))

used new system for international intercomparison of 11 laboratories (1991)

continue informal intercomparisons with other laboratories, e.g., NPL and Euromet network

through an interagency agreement provide proficiency/traceability tests of two EPA laboratories

conducted an international marine-atmospheric ^{222}Rn measurement intercomparison (provided standardized sample additions relatable to national standards down to 2.5 $Bq \cdot m^{-3}$ with overall uncertainties of about 10%)

developed new encapsulated-$^{226}Ra/^{222}Rn$-emanation standards

new capsules to be issued as SRMs in 1992

demonstrated utility and efficacy of using the capsules to calibrate electret monitors for integral measurements

have ongoing collaboration with EML to independently evaluate 9 of the capsules

have informal collaborations with other radon laboratories to evaluate capsules in other application modes

evaluated (over 4 years) the long-term performance of the NIST radon-in-water standard generator

Possible Future Directions

* Continue close interactions with EPA, EML, Euromet, etc.

* Investigate other calibration applications for radium capsules, e.g., in flow-through stream lines.

* Develop formalized cooperative research and development agreements (CRADAs) with key members of the commercial radon measurement community.

* Investigate developing a simplified radon-in-water calibration protocol using the radium capsules.

* Investigate resolving the possible discrepancies in the EPA radon-in-water LS calibration.

* Consider new avenues of collaborative research in terms of applying our radium and radon standards and attendant measurement applications to other basic research disciplines, e.g., atmospheric and hydrospheric sciences, geochemistry, radiogeology, etc.