Abstracts for 2006 RETS-REMP Workshop

Implications of Tritium Dose Conversion Factors in Deriving Regulatory Limits for Drinking Water and Effluent Compliance

Ken Sejkora
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ABSTRACT

Recent events in the nuclear industry have focused attention on tritium contamination in groundwater. Although such events typically fall under the purview of NRC regulation, much of the current guidance and requirements is based on the EPA Safe Drinking Water Standard. Both the lower limit of detection and reporting level specified in NUREG-1301/1302 are based on the EPA drinking water standard of 20,000 pCi/liter, as specified in 40CFR141. This presentation will discuss the historical derivation of the EPA standard, as well as some of the differences between the EPA standard, NRC effluent limits, and ICRP recommendations. These factors can become very important considerations when establishing a groundwater monitoring strategy, as well as in determining compliance with the various limits that may be imposed by state and federal regulators.

Paper presented at the 16th Annual RETS/REMP Workshop, June 26-28, 2006, Mashantucket, CT.

Atmospheric Sources of Tritium and Potential Implications to Surface and Groundwater Monitoring Efforts

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ABSTRACT

Recent focus on tritium in groundwater requires an understanding of potential natural and man-made sources of tritium in the environment. This presentation will discuss the occurrence of naturally-produced tritium in the atmosphere, as well as that generated from nuclear weapons testing during the 1950s through 1970s. Both sources result in detectable tritium in precipitation, which can vary depending on time of year and geographic location, and the effect of these factors on expected concentrations will be discussed. The concept of the “tritium unit” as a standard measurement of tritium in precipitation, surface water, and groundwater will be presented.

This presentation will also address implications of atmospheric tritium as a source for measurable concentrations of tritium in surface water, storm water, and groundwater monitoring efforts. Airborne releases of tritium in the form of tritiated water vapor have been characterized at all operating nuclear power plants. Often, such airborne tritium is re-condensed to the liquid form by building air conditioning units, which are often routed to sanitary or storm water drain systems. Airborne tritium can also be subject to localized precipitation “washout”, which has the potential to result in high concentrations in surface water, storm water, and groundwater in the immediate vicinity of the power plant. Such detectable levels could easily be mistaken as arising from a different source term, such as a leaking pipe.

Paper presented at the 16th Annual RETS/REMP Workshop, June 26-28, 2006, Mashantucket, CT.

Modeling Atmospheric Releases of Molecular Tritium

Atmospheric releases of tritium are assumed to be in the form of tritiated water vapor (HTO) although molecular (HT) and organic tritiated forms can also exist. The highest dose impact results from the HTO. The industry has recently expressed interest in using electrolytic decomposition to maximize the release of HT over HTO in order to reduce dose. This presentation examines the environmental transport of HT and provides a proposed methodology for assessing atmospheric releases of HT. Methodology is presented for estimating concentration in environmental media as well as pathway dose.

Jim Key, Key Solutions, Inc.

Abstracts for 2006 RETS-REMP Workshop

REMP Ramblings

The current REMP issues across the country have their origins in “business as usual.” Cutbacks in REMP programs, failure to understand the fundamental purpose of the REMP program, failure to incorporate additional pathways to man have the potential to undermine the credibility of the current industry REMP program. This presentation examines some fundamental REMP concepts, questions on analytical sensitivity and other issues that are important to the REMP process.

Jim Key, Key Solutions, Inc.

Abstracts for 2006 RETS-REMP Workshop

ANSI/ANS-3.11-2005

American National Standard for Determining Meteorological Information at Nuclear Facilities

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Meteorological monitoring program design is based on the needs and objectives of the facility involved and the guiding principles for making accurate and valid meteorological measurements. Meteorological data collected at commercial nuclear power plants are used to estimate potential radiation doses to the public resulting from actual routine or accidental releases of radioactive materials to the atmosphere or to evaluate the potential dose to the public and control room as a result of hypothetical reactor accidents. These data may also be used to assess potentially adverse environmental effects of a non-radiological nature resulting from the construction or operation of a nuclear power plant such as the impacts of the plant's heat dissipation system.

The U.S. Nuclear Regulatory Commission (NRC) first issued its regulatory guidance concerning acceptable criteria for a onsite meteorological monitoring program in 1972 with the publication of Safety Guide 23 (Regulatory Guide 1.23), "Onsite Meteorological Programs." In the aftermath of the 1979 Three Mile Island nuclear power plant accident, the NRC proposed updating it meteorological monitoring regulatory guidance to more specifically address emergency response applications with the issuance of the Proposed Revision 1 to Regulatory Guide 1.23 in September 1980. Many aspects of this proposed regulatory guide were eventually incorporated into the 1984 publication of ANSI/ANS-2.5, "Standard for Determining Meteorological Information at Nuclear Power Plants." This standard was subsequently endorsed in April 1986, with some minor exceptions, by the Second Proposed Revision 1 to Regulatory Guide 1.23. Note, however, that neither of the two proposed revisions was adopted. Thus, the original version of Regulatory Guide 1.23 (i.e., Safety Guide 23) remains the official NRC regulatory guidance document.

ANSI/ANS-2.5 was primarily intended for use in supporting licensing requirements for commercial nuclear power plants. In response to a Department of Energy (DOE) initiative to operate under voluntary standards, the Nuclear Utility Meteorological Data Users Group (NUMUG) and the Department of Energy (DOE) Meteorological Coordinating Council (DMCC) undertook a comprehensive review of ANSI/ANS-2.5 in the late 1990's to expand its applicability to nuclear facilities in the public sector and address refinements in such areas as technological advances for in situ and remote sensing instrumentation, instrumentation siting, system performance, and nuclear facility life cycle considerations. The standard was subsequently moved from the ANS-2 Site Evaluation Subcommittee to the ANS-3 Reactor Operations Subcommittee and published in 2000 with the reassigned designation ANSI/ANS-3.11, "Determining Meteorological Information at Nuclear Facilities."

Faced with a December 2005 sunset, the ANSI/ANS-3.11 working group reconvened to issue a 2005 version of the standard with enhanced definitions, revised instrumentation specifications, and a method for calculating channel accuracies. The NRC staff intends to include consideration of the 2005 standard as a basis for the development of a third proposed revision to Regulatory Guide 1.23 in support of the upcoming expected applications for new reactor licensing.

The Changing Faces in Effluent and Environmental Monitoring

Douglas Wahl, Exelon Nuclear
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This is the sixteenth year that practitioners in effluent and environmental monitoring have assembled. Since that first meeting in 1991 at Baltimore's Inner Harbor, this workshop has grown both in size and expertise. The many experiences and contributions from the participants have added to our collective knowledge effluent and environmental monitoring. At the last few meetings I have noticed newer, younger faces in attendance. These are the faces of those who are now responsible for implementing these programs. This transition from old to young, experienced to less experienced, is not limited to us, the nuclear generator. These same demographics are affecting those responsible for providing regulatory oversight.

What has happened to that knowledge base, the expertise that the "old timers" possessed? Is this knowledge is being lost? New interpretations to the words of our primary guidance document, the Branch Technical Position Paper are being made. What happened to the original intent of this document? Where is the science that was used in developing the BTP?

It is imperative that we in this industry understand the requirements of our guidance documents. How they affect the exiting monitoring programs, as well as, the impact is on future programs. Interpretation of these requirements should not be left up to a few.

This paper presents arguments that illustrate the need for clarification of the requirements used for implementing Radiological Environmental Monitoring in support of the Offsite Dose Calculation Manual.

Abstracts for 2006 RETS-REMP Workshop

Title: STP HAS A DIFFERENT MEANING TO DIFFERENT PEOPLE

Abstract:
A review of the gas laws in relation to the RETS-REMP air sampling applications and a discussion of the various reference temperature and pressure standards utilized by different geographical or industry groups.

Title:
Pros and Cons of Various Air Sampling System Designs to Facilitate REMP Monitoring Programs to Correct Measured or Calculated Volumes to a Reference Temperature and Pressure.

Frank Gavila

Abstract:
A review of the various traditional air sampling systems and modern technology systems implementing advanced electronics and microprocessor technology and their ability to facilitate the users ability to correct measured or calculated volumes to a reference temperature and pressure.

An analysis of the various factors affecting actual flow conditions at the flow measurement location will be presented to increase the understanding of the complexity of the task.

Frank Gavila

North American Technical Center Public Radiation Safety Research Program REMP Study

Jason T. Harris

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North American Technical Center, Public Radiation Safety Research Program, Urbana, IL 61801

The North American Technical Center (NATC) has developed and continues to maintain the official U.S. effluent database for gaseous and liquid releases from U.S. nuclear power stations as part of its Public Radiation Safety Research Program. Components of this program include trend analyses, benchmarking, international comparisons, expert group meetings and web-based electronic database development. All of these research activities continue to receive support and interest from government, industry, and scientific organizations. Recently the program was expanded to develop a database for nuclide specific effluent and radiological environmental monitoring data.

Initial research in the area of environmental monitoring done over 25 years ago did not address potential release changes or public health impact due to power up-rates, operating license extensions, or new power plant construction. Because of these reasons, current dose models, predictions and pathways need to be reinvestigated. Also, due to increased scrutiny related to nuclear power plant emissions, REMP data tracking is another way to validate effluent releases. The purpose of this paper is to present recent findings, trends, and models related to the radiological environmental monitoring data for the entire U.S. nuclear power plant fleet for the ten year period of 1995-2004. The author will also make suggestions regarding program changes and updates.

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Investigation of Tritium in Groundwater at the Pickering Nuclear Generating Station, Ontario Power Generation Inc., Pickering, Ontario

A Tritium in Groundwater Study (TIGS) has been conducted by CH2M HILL Canada Limited at the Pickering Nuclear Generating Station (PNGS) for Ontario Power Generation Inc. Tritium had been identified in the groundwater at several locations under the station most notably as a seep into a break in a sewage line in the area of the Unit 1 Reactor Building. This paper provides an overview of the investigations conducted to identify the extent of the tritium in groundwater beneath the site and the potential sources of tritium release to the groundwater. The investigation techniques have widespread applications to other nuclear generating stations.

The objectives of the study were to evaluate and define the extent of radionuclides, primarily tritium, in groundwater, investigate the causes or sources of contamination, determine impacts on the natural environment, and provide recommendations to prevent future discharges. To achieve these objectives, a multi-phase, iterative study was implemented by a team of investigators. Investigations were primarily focused on the Unit 1 Reactor Building and surrounding area, as this was the area of known tritium in groundwater entering the sewage line break. Tritium contamination in groundwater was as high as 11,000,000,000 pico-curies per litre in the groundwater beneath the Unit 1 Auxiliary Bay.

Major investigations included the following:

- Radiological Source Term Assessment
- Groundwater Monitoring System
- Process Assessments and Preventive Measures
- Video Inspections
- Assessment of Tritium Migration Through Concrete
- Tritium Atmospheric Deposition Modeling
- Hydrostatic Tracer Tests
- Tritium/Helium-3 Residence Times and Tritium Dating

The investigations were comprehensive and were modified with increases or decreases in scope depending on results of previous investigations. The investigation programs were thorough in the delineation of contamination and in the identification of potential sources of tritium contamination in groundwater.

Since 1999, tritium concentrations beneath the Unit 1 Auxiliary Bay have decreased 10 fold but the extent of contamination has spread outward. The generic screening criteria for non–potable water were established by the Ontario Ministry of the Environment at 100,000,000 pico-curies per litre. Concentrations above this level are considered to potentially have an adverse impact on the environment. At Pickering, the background concentration for tritium in groundwater is 10,000,000 pico-curies per litres. However, the drinking water criteria is 200,000 pico-curies per litre. There is a real difference in tritium concentrations associated with Canadian Candu Nuclear Reactors in comparison with nuclear reactors used in the U.S.

Abstracts for 2006 RETS-REMP Workshop

Robinson Dry Fuel Storage Direct Dose Experience

Ray Crandall (Progress Energy – Robinson Nuclear Plant)

RETS/REMP Workshop – June, 2006

Abstract

During 2005, the Robinson Nuclear Plant loaded a new NUHOMS®-24PTH dry fuel storage facility with some of the highest burnup fuel ever placed into dry storage. This was the first use of a system with augmented heat removal and shielding designed for higher burnup fuel. This presentation will discuss the refinements needed in the design basis direct dose analyses to obtain acceptable dose consequences. Even with such refinements, onsite ALARA considerations were not acceptable with projected dose rates from a full facility. The need for augmented shielding was delayed until decisions could be made based on the actual dose rates observed after the loading of four modules in 2005. Actual dose rates were significantly lower than projected dose rates. This resulted in the ability to perform loading operations with very low occupational dose consequences and alleviated the ALARA concerns associated with long term storage. The reasons for the significant differences between projected and actual dose rates will be explained. Survey and TLD measurements will be provided. The benefits of augmented shielding installed for streaming from the intake vents will also be presented.

Abstracts for 2006 RETS-REMP Workshop

Overview of the EPRI Groundwater Assessment Program

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Since the publication of EPRIs guidance document on groundwater monitoring ("Groundwater Monitoring Guidance for Nuclear Power Plants, Report No. 1011730"), assessments have been performed at several operating nuclear power plants. The objectives of these assessments include the determination of the potential risks of developing an important groundwater plume containing radioactive material. These risks are assessed based, in part, on plant operating history and the likelihood of spills and leaks (characterized and uncharacterized) that could lead to groundwater contamination. The assessments also perform a critical review of the actions taken at a site to develop a site conceptual groundwater flow model and to perform the needed hydrogeologic investigations.

An overview of the results of the assessments is presented. These include the issues that have been common to several sites along with some of the unique attributes that exist. An overview of the magnitude of the potential for site groundwater contamination and for the general approach being implemented to address these issues is also discussed.

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Update on Yankee Rowe Groundwater Contamination Investigation

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Greg Babineau
Yankee Atomic Electric Co.

Yankee Atomic's decommissioning site in Rowe MA, has been actively decommissioning since 1992. During the past year, all the buildings in the industrial area have been removed including some of the deep concrete basements and foundations. In this process, some of the previously installed groundwater monitoring wells were closed to facilitate these removals. Recently, some of these wells have been replaced and sampled and the network of monitoring wells has been expanded to continue the investigation.

During the last 4 years of decommissioning, an aggressive groundwater monitoring program has been implemented. This program included the sampling of over 40 wells, some over 200 feet deep. Analyses of these groundwater samples have included a wide suite of radionuclides including all of the potential "hard-to-detect" radionuclides. To date, the only plant-related radionuclide identified in groundwater has been tritium with approximately 48,000 pCi/L representing the highest concentration. This concentration has essentially gone unchanged throughout the last four years. This may be due to contamination being effectively confined within a perched aquifer with little or no influent or effluent from the aquifer. Since the site has committed to achieving groundwater concentrations as being less than the EPA MCLs (20,000 pCi/L for H-3), considerations must be given to the possible methods that could be used in reducing this concentration.

The history of the groundwater monitoring program, its current conclusions and future efforts are presented.

Abstracts for 2006 RETS-REMP Workshop

Fe-55 and Te-125m in Liquid Radwaste at Calvert Cliffs

Constellation Energy
Calvert Cliffs Nuclear Power Plant
Richard L. Conatser

Calvert Cliffs has been reporting Fe-55 in liquid radwaste since 1993. At that time, the originally installed radwaste purification system was used to remove mixed fission and activation products. Fe-55 comprised a sizeable but relatively predictable fraction of the total effluents. Over the next 13 years, total effluents were reduced by 90%. During much of that time, the nuclide fraction of Fe-55 remained relatively constant. In February 2003, an advanced liquid radwaste processing system replaced the original plant equipment. The total activity of all mixed fission and activation products decreased dramatically due to the superior processing capability of the new liquid radwaste processing system. Many of the liquid radwaste releases that have been made since employing the advanced radwaste processing system contained no gamma activity (other than noble gases). During this time, however, there appeared to be a shift in the Fe-55 fractional abundance relative to total effluents. The increase in Fe-55 fractional abundance became quite pronounced in calendar year 2006. The author investigates the changes in the Fe-55 concentrations and attempts to explain some of the potential causes for the odd behavior of Fe-55. The author also discusses experiences with an unknown gamma peak at 109 keV. Results of a half-life determination reveal the identity of the nuclide responsible: Te-125m.

Radiation Protection Support and Occupational Dose Assessment of the Radioactivity Release Event at Yonggwang Nuclear Power Plant Unit 5

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The shutdown period in December 2003 was planned for checking the thermal sleeve integrity of nuclear power plant (NPP) Yonggwang Unit 5. During the shutdown period the shutdown cooling system (SCS) was operated. In the SCS mode the shutdown system is connected to the primary reactor coolant system (RCS) at a pressure of approximately 395 psig (29 kg/㎠ absolute). The SCS was operated during 15 hours. The aerosol monitor (RE-054) detected an increased radiation level. The alert status for airborne radiation was reached. The alert was indicated in the technical support center (TSC) and reported to the control room of the plant. The alarm status, that would have required immediate actions to be taken, was not reached.

In the following days the cause for this alert was investigated by operator and health physicist. The aerosol monitor that detected the increased radiation was checked for a possible failure of the installed equipment. In addition the air samples were subsequently analyzed. No airborne radiation was detected and the cause for this alert was not identified at that time. During the investigation the reactor was restarted and 100% power was achieved. The high radiation level was detected in the TSC room. The point of measurement was near the humidifier overflow piping. Because the humidifier is provided with demineralized water system (DWS) it was suggested that the high radiation level was caused by a contamination of the DWS. The DWS is a non-radioactive system that has to be kept free of contamination. To verify the cause of the radiation the piping of the DWS was subsequently measured. Finally a high dose level was detected at a valve in the interface of post accident sample system (PASS). The PASS is connected to the SCS, that can be contaminated by the primary RCS, and to the clean (non-radioactive) DWS.

The unit 5 was shutdown again for additional checks and investigations to detect the cause of the high radiation level. The PASS interface was investigated. The contamination had to be eliminated by cleaning the piping, and in part by exchanging pipes, after the radioactivity release event. Many investigation and measures after shutdown, the causes of the incident, the operator alert response, the measures and modification to avoid reoccurrence, monitoring of uncontaminated systems, the environmental monitoring and the evaluation of environmental consequences, were carried out. This paper is to describe and make a presentation for actions and measures on the radiation protection support and occupational dose assessment of the radioactivity release event at Yonggwang NPP unit 5.

Potential Importance of HTD Nuclide Monitoring for RETS and REMP

John Doroski
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ABSTRACT

Although recent events in the nuclear industry have focused attention on tritium contamination in groundwater, there may be other areas where Industry attention is needed. Draft NRC Inspection Module Attachment 71122.01 is being revised to primarily address the tritium contamination issue. However, it also includes another significant change, the need to address the significance of HTD nuclides. In fact, this has been one of the focus items for recent NRC Inspections. This presentation will discuss the potential importance of several HTD nuclides, including the need to augment both the effluent and radiological environmental monitoring programs.

Paper presented at the 16th Annual RETS/REMP Workshop, June 26-28, 2006, Mashantucket, CT.

Abstracts for 2006 RETS-REMP Workshop

Title:

Implications of a Terrorist Attack at a U.S. Spent Fuel Pool

Authors/Affiliations:

1. D. Favret, Vanderbilt University – Presenting Author
2. M. Stabin, Vanderbilt University
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Abstract:

Since September 11, 2001, the safety and security of the U.S. nuclear reactor complex has become a topic of considerable controversy. Because of the safety features afforded to reactor vessels, most experts agree that the focus of concern should be directed toward the lesser-protected spent fuel pools. Although designed with overlapping safety systems in structures that will withstand a variety of natural events, the ever-increasing fission product inventory in U.S. spent fuel pools make them attractive targets for terrorists. Some groups postulate that a terrorist incident, creating a zirconium fire in a spent fuel pool, would release radionuclides at activities significantly greater than those witnessed at Chernobyl. Utilizing HPAC (Hazard Prediction and Assessment Capability) and RESRAD (Residual Radiation) modeling codes, the potential source term for a zirconium fire are presented with a study of the resulting human health effects as comparable to the Chernobyl accident. Under study conditions, the cesium-137 release fraction from a zirconium fire was found to be similar to the Chernobyl release fraction. Additionally, pathway analysis for strontium-90 indicates a slightly higher dose/source ratio than cesium-137 but is comparatively a minor contributor to overall dose due to a much lower release concentration. Overall, the results of this study indicate that, although significant, a zirconium fire in a spent fuel pool may not be as catastrophic other studies have predicted.

A Historical Survey of Radiochemistry Laboratory Audit Findings

The radiochemistry industry has developed over the last several decades from one that relies primarily on a radiochemist's professional expertise and integrity to produce quality results to one that requires not only the technical defensibility of results but also legal defensibility of the results delivered to the client. The formalization of requirements was undertaken to meet ever more sophisticated end-user data quality requirements and to help provide increased comparability of results between laboratories. Of necessity, laboratories have developed systems to accommodate the diverse requirements imposed by their regulators (State and Federal agencies (e.g., NRC/NUREGS, EPA/NELAC, state drinking water regulations, DOE QSAS, DOD QSM, etc.), and Statements of Work stipulated by their respective clients.

The modern radiochemistry laboratory must develop analytical and quality systems capable of accommodating these diverse and occasionally conflicting requirements. They harmonize quality requirements with operational demands for worker safety and satisfaction, compliance with waste and environmental regulations and long-standing analytical 'traditions' in the laboratory, all while maximizing productivity / profitability. The task for the labs is nothing short of mind-boggling.

Unfortunately, labs are not always successful in implementing the requirements in all their complexity. Occasionally, they may not be aware of requirements or fail to grasp the implications of interplay between certain requirements. Quality shortcomings translate to potential liability for the client.

A historical review of five years' findings/observations from DOE Consolidated Audit Program (DOECAP) radiochemistry lab audits of private and government radiochemistry labs was performed. Findings and observations were classified according to functional areas impacted and quality system concern and then analyzed to determine the frequency of occurrence. Areas where labs consistently meet quality requirements are highlighted and areas where deficiencies are routinely encountered are identified. More detailed discussion focuses attention on those items that have the greatest potential to impact data quality.

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A STUDY ON THE TRITIUM DISTRIBUTION CHARACTERISTICS AROUND THE YONGGWANG NUCLEAR POWER PLANT

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The tritium is a very important gaseous effluent of the nuclear power plants, because it gives the most individual exposure dose to the surrounding public members during normal operation. According to the operational experiences of Korean nuclear power plants (KNPP's), more than 50% percents of total individual doses are due to the release of the gaseous tritium effluents. In contrast to the carbon-14, which has high background level, the natural background level of tritium is very low compared to the amount of normal tritium release. And the activity level of tritium in the environment is easier to measure than the carbon-14. The measured activity level around the nuclear power plants can be used either to estimate the atmospheric diffusion coefficient or to estimate the individual exposure dose rate based on the measurements. In this paper, degree of conservatism of the atmospheric diffusion coefficients based on the Gaussian plume model is evaluated using the actual tritium release data and the measured tritium activity level around the KNPP's. The results show that the Gaussian plume model based diffusion coefficients give at least 20 times larger values than the measurement based diffusion coefficients. In this paper, the procedures to effectively measure the background tritium activity level and the environmental tritium activity level are studied. By using the developed procedures, the background tritium activity levels and the environmental tritium activity level are measured. The measured background tritium is used to evaluate the increased tritium activity level by the tritium release during normal operation. The results of this paper can be used to determine the more realistic gaseous dilution factors, and can be contribute to calculate the more accurate individual exposure dose due to the normal operation of nuclear power plants.

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NEI/NIST Measurements Assurance Program

In April 1987, the Atomic Industrial Forum (AIF) (now the Nuclear Energy Institute, NEI) in cooperation with the National Bureau of Standards (now the National Institute of Standards & Technology, NIST) began a measurement assurance program for radionuclide reference standards – used for calibration of radiation measurement systems in the nuclear power industry.

The stimulus for development of this program came from two directions. A quality assurance conference in Las Vegas in the fall of 1985, sponsored by the Environmental Protection Agency (EPA) and at the same time, the Radioactivity Group at NIST felt that a measurements assurance program at NIST could better utilize the limited manpower available to demonstrate measurement traceability of the source suppliers and utilities. As a result of this, representatives from eight source suppliers and utilities, as well as other interested parties from the Nuclear Regulatory Commission (NRC) and EPA were invited to meeting at NIST on February 3, 1986 to discuss their problems and suggest possible remedies. The program began the following April with 12 participants, at an annual cost of $9,950.00 per participant.

It has under gone change since 1987 today the program has been broken into two parts. One part services the source manufactures and suppliers and the second part services the utilities and the laboratories. The present cost of the NEI/NIST program for utilities is $15,000 per year for each participant. The source manufactures are paying $25,000 per year. The participation fee pays for Research Associates to implement the program, as well as for the cost of materials and other expenses involved in the preparation and distribution of the sources sent to the participants and measurements performed in accordance with NIST requirements. In years past part of the participation fee was used to pay for development of new types of test materials.

The utility participants receive six test sources each year, approximately bimonthly. The sources are prepared and calibrated at NIST and then distributed with the NIST-measured activity undisclosed. The participants measure the source and complete a questionnaire by way of the internet to NIST where their measured value is compared to the NIST value. A Report of Traceability is then issued by NIST stating the difference between the participant's value and the NIST value. A Report of Test is also issued, which provides the NIST value and other pertinent information so that the source may then be used as a calibration source by the participant. Additionally, the utilities may receive the same sample at multiple reactor sites and have one sent to the utility's contract laboratory for cross checking, at no additional charge.

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ALARA for Radioactive Effluents: Regulatory History and Application for Next Generation Power Reactor Licensing

The Federal Regulations governing the implementation of ALARA for radioactive effluents for nuclear power reactors are contained in Title 10 of the Code of Federal Regulations, Chapter 50, Appendix I. The ALARA concept for radioactive effluents was originally promulgated in December 3, 1970, with the final rule issued May 5, 1975. These regulations not only address allowable releases of radioactive effluents during operations but also specify radwaste system design requirements. It has been 30 years since the rule was promulgated and 20 years since NRC last implemented these regulations for the initial licensing of a nuclear power plant. Since that time, there have been two (2) major changes in dosimetric modeling (ICRP-30 and ICRP-68) as well as improvements in environmental modeling and radwaste processing capabilities. This course will provide a brief overview of regulatory requirements, a historical perspective on the development of the 10CFR50, Appendix I rule and a perspective of what it may mean for the licensing of the next generation nuclear power plants.

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