2021 North American ISOE ALARA Virtual Symposium Generic Symposium Report

January 4 - 6, 2021

Symposium Theme: Resilience of Safe Nuclear Power Operations During Covid-19 Pandemic: Sharing of Good Practices & Lessons Learned

Executive Summary:

The first virtual North American ISOE ALARA Symposium was held on January 4-6, 2021 hosted on the University of Illinois ZOOM platform license. The theme of the 2021 Symposium was focused on sharing RPM experience with COVID-19 and sharing solutions to RPM identified problems in 2020 outages. The attendees were able to experience the virtual symposium presentations, award recognitions, vendor new technology videos and questions/comment sharing. Participants were visible to others and were able to mute their microphones and hide their video.
About 100 attendees participated in the virtual symposium. The technical presentations were focused on RP management and ALARA good practices and lessons learned. Ten vendors provided video presentations of new technology between technical presentations. Attendees were from six countries including Canada, Mexico, France, Switzerland, Japan, and USA.

Highlights of 2021 Symposium:

Day 1, January 4, 2021 Presentation Summaries-

Dr. John Palms, Honorary NATC Board Chair and Colin Pritchard, NATC Board Chair moderated the first NATC Virtual Symposium. The plenary session featured the BWR source term reduction challenges of the LaSalle County, Exelon nuclear plant, as presented by Joe Jaegers. Joe Jaegers presented an excellent discussion of the use of High Efficiency Ultrasonic Mitigation of CRUD on BWR plant components to significantly reduce dose rates and save the need to replace piping and components. Ultrasonic transducers are utilized in liberation of surface contaminants during nuclear fuel cleaning. The transducers have been observed to remove both tenacious and non-tenacious crud. They are also used to resuspend contaminants in AMFM filtration systems to allow consolidation of material, extending life of filters and reducing radwaste costs.

Chemical decontaminations or replacements of components are often difficult to cost justify. This has proven even more difficult in the current economic situation of the Nuclear Industry. This emerging technology opens the door to a new era of cost-effective dose reduction with a reusable solution that can be complimented with mobile regenerable filtration to minimize costs associated with disposing of liberated activated corrosion products. External ultrasonic cleaning allows liberation of corrosion layer from inside subject piping and suspension in solution to be sent to filter or tank for processing without system breach. For larger components, or when access is available inside a system such as an open valve after breach, introduction of ultrasonic transducers allows internal mitigation resulting in significant reduction of the radiological hazard with decon factors similar to chemical decontamination.

Mr. Jaeger, John Moser, and the LaSalle County team were awarded the John M. Palms Outstanding Innovation Award for the remarkable results of the HE-UMS at LaSalle County. Joe Jaegers was awarded the 2021 ISOE Young Professional's Distinguished Paper Award.

World Class Performance Award-
The 2020 World Class ALARA Performance Award was presented to Nathan Hogue, RP & Chemistry Director, Palo Verde Nuclear Generating Station, Arizona Public Service. The Palo Verde ALARA staff and station employees completed the last three outages in record low occupational dose:

2020 Refueling Outages: U2R22 – 15.996 rem, U1R22 – 14.336 rem
2019 Refueling Outages: U1R21 – 21.932 rem, U3R21 – 13.631 rem
2018 Refueling Outages: U3R20 – 20.126 rem, U2R21 – 18.168 rem

The reasons for the ongoing improvements in CRE for 2R22 as well as all recent PVGS refueling outages include:

1. Optimized As Low As is Reasonably Achievable (ALARA) Planning based on lessons learned from past performances, and
2. Improved radiation worker performance and increased participation by work groups.

Microreactors New Technology-
Prof. Caleb Brooks from University of Illinois described the design and nuclear safety aspects of the microreactor demonstration plant proposed for electricity generation on campus (see YouTube Microreactor for details).

COVID 19 Pandemic RPM Experiences-
Rich LaBurn, Fermi 2 started a panel discussion on COVID 19 impacts on refueling outages in 2020. He discussed the problems at Fermi 2 with reduction in contract RP Technicians reporting and staying for the duration of the outage, hot bunking, and the impact on job coverage due to loss of RP technicians due to quarantine mandates. A summary of global RPM discussions of COVID 19 management initiatives can be found on the ISOE website (isoe-network.net).

Bruce Power Refurbishment ALARA Program Highlights-
Colin Pritchard provided a detailed discussion of the extensive ALARA planning for the Bruce refurbishment. He discussed the new magnetic shielding installed on the boiler for feeder tube removal. New shielding was designed and installed to permit the online refueling trolley to transfer on the track below the refurbished unit to not affect continuous refueling of the operating units during the two-year refurbishment. The COVID 19 pandemic necessitated a two-month hold on the project while a pandemic health and safety program was instituted on site. Most Bruce staff are working remotely from home. The company provided computer and internet connections to facilitate an efficient and productive home office work environment.

Douglas Chambers discussed the international initiative to assess the long-term health risks of gamma ray, long-lived radionuclide (via inhalation), and radon and radon progeny exposures among uranium processing workers. One objective is to harmonize the dose assessment protocols. Canada, UK, France, Germany, Russia, Kazakhstan, and US participate in the study.

Dennis Chamberland, NASA Principal Investigator, discussed the domination of space frontier in 2021 including the significant
achievements of SpaceX in achieving reusable rockets. The exploration of the Moon and Mars were discussed, including the technological challenges due to cosmic radiation and the need to find sources of water to support human habitation.

Day 2, Tuesday, January 5, 2021 Presentation Summaries-

Juan Jesus Giron, Laguna Verde Plant, Mexico, presented the achievement in reduction of the BWR BRAC Point dose rates based on the use of high efficiency ultrasonic cleaning and metal filter technologies.

Scott Stafford, Darlington ALARA Refurbishment Director, OPG, Canada provided an explanation of the CANDU design, the results of the Unit 2 completed refurbishment and the current achievements and challenges for the Unit 3 refurbishment. The CANDU refurbishment will allow the CANDU fleet to provide carbon-free electricity for Ontario until 2064.

David Goodman and Weiyi Wang, H3D, discussed the 6-year study of the Palisades plant to identify and improve characterization of Ag-110m in the Charging Pump and other plant components. The pixelated CZT 3D mapping instrumentation was first used during the fall 2016 refueling outage. Health physicists from Cook, Prairie Island and Palisades used 5 Polaris H units to make measurements on the charging pump cubicle during changing refueling source term conditions and characteristics. It was discovered that approximately 50% of the charging cubicle worker dose was from Ag-110m. Mr. Goodman showed pixelated CZT coolant measurements during outage evolutions during the fall, 2020 Palisades refueling outage. Trends in Ag-110m, Co-58 and Co-60 in plant piping were discussed. Preliminary analysis indicated new behaviors in Ag-110m in PWR piping were observed and will be validated with additional Ag-110m studies with pixelated CZT mapping technology.

Steven Garry provided the US Nuclear Regulatory Commission update during the Tuesday, January 5, 2021 regulatory update. The North American ALARA Symposia have served as the premier regulatory forum for US RPMs and attendees since 1997.

The NRC attendance at the symposium included 2 headquarters representatives, 3 Branch Chiefs, 2 inspectors from Region I, 3 inspectors from Region III and 5 inspectors from Region IV. The sharing of ALARA findings from the regional health physics inspectors was appreciated by the attendees due to the value of candid, neutral ground discussion of the individual events with emphasis on understanding the events, instrumentation and human behaviors and corrective action to avoid reoccurrence at other licensees' sites.

Ed Stutzcage discussed the NRR ALARA update. He indicated that the separate ALARA inspections every two years will continue, based on the current perspective on this topic from NRC senior management.

Always the highest interest session of the ALARA symposium was the individual health physics inspector's discussion of the recent RP and ALARA NRC findings from licensees during the past several years. Over 35 findings were discussed by HP inspectors from Region I, III and IV.

Day 3, Wednesday, January 6, 2021 Presentation Summaries-

Dr. Dennis Chamberland, NASA, presented "The Shifting Dynamics of Human Space Exploration in 2021," which was highly rated by attendees on symposium evaluation forms. Dr. Chamberland provided information about the current "space race" by China, Europe, United Arab Emirates and USA to travel to the Moon. The race for commercial outer space flights by SpaceX is closer to becoming a reality. Dr. Chamberland offered "golden tickets" in varying price ranges for space trips to outer space, Mars, and other future destinations. He noted that China is showing shielding on their proposed Mars space station

Marty Phalen, Nuclear Energy Institute RP Manager, provided a detailed summary of new or pending regulatory guidance which is of importance for operating plant RPMs to understand. The status of pending regulatory guidance revisions is as follows:

1. IMC 0609 Appendix D 'Public Radiation Safety', Incorporate 10 CFR Part 37 Physical 'Protection of Category 1 and Category 2 Quantities of Radioactive Material'
2. **Revisions to Regulatory Guide 1.21 'Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Wastes.'** Draft for Public Comment Targeted for 01/31/2021 & Includes Instrument Calibrations to Xe-133 verses Kr-85.
3. **Revisions to NUREG/BR-0204 "Instructions for Completing NRC'S Low-Level Radioactive Waste Manifest" Waste Forms (Version 2 Forms - Version 3 Forms).** NRC is in the process of getting OMB clearance to continue using Version 2 (07/02/2020) forms; so, Version 3 implementation is delayed for now. NRC is planning to hold another meeting BEFORE setting the final Version 3 implementation date (e.g., 03/31/2021).
4. **Petition for Rule Making PRM-50-121, "Voluntary Adoption of Revised Design Basis Accident Dose Criteria,"** The petition requests the NRC to adopt revised accident dose acceptance criteria as an alternative to the accident dose criteria specified in § 50.67, "Accident source term." Specifying a uniform value of 100 milli-Sieverts (10 rem) for offsite locations and the control room. Specifically, Appendix A to Part 50 - "General Design Criteria for Nuclear Power Plants" states that design criterion for the main control room restricts the calculated 30-day accident dose to the annual occupational limit of 5 rem, while 10 CFR Part 100 "Reactor Site Criteria" allows for a calculated dose of 25 rem in 2 hours).
5. **Petition for Rule Making PRM-50-122**, "NRC revise its regulations in § 50.67 of Title 10 of the Code of Federal Regulations (10 CFR), ''Accident source term'' The petition requests the NRC to codify the source term methodologies and corresponding release fractions recommended in a report issued by Sandia National Laboratories Report SAND2008–6601, ''Analysis of Main Steam Isolation Valve Leakage in Design Basis Accidents…''The petition states that that much of the past and present source term methodologies, including release fractions, used by nuclear power plants to perform accident dose calculations are inaccurate and nonconservative. Additionally, the petition requests the NRC to update and finalize Draft Regulatory Guide DG–1199 (Proposed Revision 1 of Regulatory Guide 1.183), 'Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors.'

6. **Draft Regulatory Guide DG-1199 "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors"** (i.e., Update for RG 1.183), RG 1.183 revision 1 (DG**),** Draft for public comment - Fourth quarter 2021. Plans to issue RG 1.183 revision 1 in the second quarter of calendar year 2022. NRC Public Meeting 11/20/2020 Staff Presentation (ML20296A425). Key Messages included:

    a. Incorporate lessons learned from recent license amendment requests (LARs).
    b. Incorporate relevant operating experience.
    c. Respond to changes in regulatory environment (e.g., SRM-SECY-18-0049 & SRM-SECY-19-0036).
    d. Ensure that guidance is in place for licensing advanced light-water reactors, accident tolerant fuel (ATF), high-burnup, and increased enrichment fuel.

    David Raye, D. C. Cook Nuclear Plant, American Electric Power, presented the practical experience of a 7-year project to replace the Cook Nuclear Plant Units 1, 2 plant-wide radiation monitoring system. Cook was one of the first US utilities to implement like-for-like Radiation Monitoring System Replacement.

Challenges included:

1. Manufacturing in France
2. Calibration of high range noble gas channel with Xe-133. Improved noble gas sample skid design (small inside diameter) and energy compensated detector per Mirion design
3. Scheduling some replacement strategically during refueling outages
4. Even with previous walkdowns, some RMS skids would not fit into the previous Eberline SPING footprint
5. Minimizing installation time in Main Control Room
6. Warehousing delivered monitor skids for two years to facilitate plant scheduling windows
7. Failure of some detectors after storage
8. Change of Air Ejector monitor to 2 pi geometry shielding vs 4 pi which was specified. Later, experiencing alarms during
   Station blowdown which required installation of 4 pi geometry
9. Delivery of Co-60 check sources instead of Tc-99 sources. The short half-life of Co-60 was unacceptable and was rejected.
10. Field installation of tigon tubing for EOF air sample line to monitor skid. Rejected and replaced with ANSI 13.10 tubing
11. Detailed testing of vintage "ribbon" cabling from original Eberline system revealed the need for amp booster to permit proper operation after 40 years of communication link difficulties on "B" communication line. Ribbon cables have a limited distance to properly transmit the signal.
12. Use of existing RMS cabling whenever possible which saved significant installation costs.

Frank Owens, Clinton Power Station, Exelon, discussed the record low on-line annual dose for the Clinton Power Station. Effective plant staff engagement in the ALARA on-line dose minimization initiative in 2020 achieved this significant result. Mr. Owens discussed the Station ALARA Committee actions to maintain the low source term at the BWR Mark III reactor. The RP Department has used gamma imaging detectors to identify in-plant areas for additional temporary shielding or RP controls.

Sanshiro Kobayashi Morimura Bros. & Koji Endo, RASA Industry, has developed truck-mounted mobile radioiodine removal silver zeolite (AgX) filtration systems for use by TEPCo and other nuclear facilities. The installed AgX filtration systems at TEPCo BWRs have allowed restart of reactors following regulatory and local approval.

Dr. Tadashi Narabayashi, Tokyo Institute of Technology, provided a comprehensive status of the restart of the Japanese nuclear plants since the Fukushima accident. He discussed the FCVSA (filtered containment ventilation) Technology developed for nuclear facilities. He showed 4 videos of the use of robots and cranes to decommission the damaged Fukushima units.

Finally, Dr. Narabayashi described the measures adopted at Japanese plants due to the COVID 19 pandemic.

Andreas Ritter, RP Deputy Manager, Leibstadt BWR, Switzerland, discussed the status of the operating Swiss nuclear plants. Unfortunately, the Muhleberg BWR was permanently shutdown on December 20, 2019 because the cost of installing Fukushima backfits was calculated to be prohibitive for continued operation. Zinc, noble metal, and hydrogen injection was maintained to the end of operation to get a minimal source term for the upcoming decommissioning work. The Leibstadt plant continues to experience high source term challenges. RP management is evaluating BWR source term reduction initiatives for possible future implementation.

Colin Pritchard, NATC Board Chair, Bruce Power, discussed the 2021-2022 Preliminary NATC Strategic Plan, including the expansion of the virtual meeting platform to foster more frequent and wider communication of RPM operating events and new technology to global ISOE members.

The 2021 Symposium presentations are posted on the NATC Website. You will be provided with a password to the website to be able to download the papers and vendor update information. Also, videos of each symposium paper will be provided in future months as continuing education course credit for ISOE utility and regulatory members. Finally, the 35 NRC ALARA & RP findings will be formatted for short RPM staff briefing presentations and distributed to the ISOE RPMs and regulators.

If you have any questions, please contact Amy Moeller, almoeller88@gmail.com

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