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June 28, 2017

MEMORANDUM TO: Joseph G. Giitter, Director
Division of Risk Assessment
Office of Nuclear Reactor Regulation

FROM: Michael J. Case, Director (K. Webber for M. Case) ***/RA/***
Division of Systems Analysis
Office of Nuclear Regulatory Research

SUBJECT: TRANSMITTAL OF THE CONTROL ROOM DOSE EVALUATION USING ICRP 103 DOSE CONVERSION FACTORS LETTER REPORT FOR USER NEED REQUEST NRR-2009-002

Under User Need Request NRR-2009-002 (ADAMS Accession No. ML090290284), the Office of Nuclear Regulatory Research (RES) is transmitting the deliverable report on the evaluation of control room doses. Enclosure 1, "Control Room Dose Evaluation Using ICRP 103 Dose Conversion Factors," letter report (ADAMS Accession No. ML17156A603), of this memorandum provides a report that describes the results of the calculations and the findings from the analysis. For this work, RES staff worked closely with the contractor, Information Systems Laboratory (ISL) Inc., and staff from your office's Division of Risk Assessment.

The staff initiated this study in response to the Staff Requirements Memorandum (SRM) for SECY-08-0197, dated April 2, 2009 (ADAMS Accession No. ML090920103). The Commission approved the NRC staff's recommendation to begin engagement with stakeholders and interested parties to initiate development of the technical basis for a possible revision of the NRC's radiation protection regulations (primarily set forth in 10 CFR part 20), as appropriate and where scientifically justified, to achieve greater alignment with the recommendations in the International Commission on Radiological Protection (ICRP) Publication 103.

NRR-2009-002 requested that RES deliver a letter report regarding an exploratory study to understand the effect new dose conversion factors (DCFs) for only the iodine isotopes derived from the 2007 recommendations contained in ICRP Publication 103 would have on design basis radiological consequence analyses. The total effective dose equivalent (TEDE) doses were calculated for control room personnel and compared to calculations using typically accepted DCFs derived from the data provided in ICRP Publication 26, "Recommendations of the ICRP." These DCFs are applied in various radiological consequence analyses to demonstrate compliance, in part, with several regulations. In 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," Section 50.34, "Contents of Applications; Technical Information," requires that each applicant for a construction permit or operating license provide an analysis and evaluation of the design and performance of structures, systems, and

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components of the facility with the objective of assessing the risk to public health and safety resulting from operation of the facility. Applicants are also required by 10 CFR 50.34 to provide an analysis of the proposed site. In 10 CFR Part 100, “Reactor Site Criteria,” Section 100.11, “Determination of Exclusion Area, Low Population Zone, and Population Center Distance,” provides criteria for evaluating the radiological aspects of the proposed site.

In 2008, the ICRP issued its new general recommendations in ICRP Publication 103. These recommendations updated the previous recommendations issued as ICRP Publication 60 in 1991. Coincidentally, it was in 1991 that the NRC completed work on the last major revision of 10 CFR part 20, “Standards for Protection against Radiation.” The multi-year effort resulted in the current NRC regulations which moved from the ICRP Publication 2, “Permissible Dose for Internal Radiation,” system of dosimetry based on critical organ doses to the ICRP Publication 26 system of dosimetry using the double weighted quantity, effective dose equivalent.

The dosimetry changes from ICRP 26 to ICRP 103 included both changes in the values of the radiation and tissue weighting factors and changes in the underlying biokinetic models used to determine organ doses following intakes of radionuclides. Changes to the biokinetic models since ICRP 26 have included a new respiratory tract model (ICRP Publication 66) and more recently, a new human alimentary tract model (ICRP Publication 100). In addition, the cancer risk estimates in ICRP Publication 103 were derived from incidence data whereas the ICRP Publication 26 were derived from mortality data. To achieve this, a factor was applied to the non-lethal fractions of cancers to produce an adjusted lethality. The ICRP Publication 103 detriment adjusted nominal risk coefficient for fatal cancer is taken for a population of all ages is $5.54 \times 10^{-2}\ Sv^{-1}$.

In design basis radiological consequence analyses, iodine isotopes are a major contributor to the estimated thyroid dose. ICRP Publication 26 assigns a thyroid tissue weighting factor of 0.03. ICRP Publication 103 assigns a thyroid tissue weighting factor of 0.04. It is seen therefore that the estimated fatal cancer for the thyroid is about 33 percent higher in the ICRP Publication 103 recommendations compared to ICRP Publication 26 recommendations. The evaluation of the application of the ICRP 103 iodine DCFs as compared to the ICRP 26 DCFs results in an increase in control room TEDE of approximately 23 to 25 percent.

On January 31, 2016, in SECY-16-0009, “Recommendations Resulting from the Integrated Prioritization and Re-Baselining of Agency Activities,” (ADAMS Accession No. ML16028A208), the NRC staff requested Commission approval to implement recommendations on work to be shed, de-prioritized, or performed with fewer resources. Two of the items listed to be shed (i.e., discontinued) were the rulemakings that would have amended the radiation protection regulations in 10 CFR Part 20, and the reactor effluents regulations in 10 CFR Part 50, Appendix I. The NRC staff’s decision to discontinuing the rulemaking activities associated with potential changes to the radiation protection and reactor effluents regulations was based on the knowledge that the current NRC regulatory framework continues to provide adequate protection of the health and safety of workers, the public, and the environment. In the SRM for SECY-16-0009, dated April 13, 2016 (ADAMS Accession No. ML16104A158), the Commission approved discontinuing the two rulemaking activities. However, since all of the technical work for this task had been completed prior to the Commission’s decision above, RES and NRR mutually decided to finish the report.

RES has established an online quality survey with which requesting offices can evaluate the usefulness of RES products and services. This survey can be found on the right-hand side of

http://www.internal.nrc.gov/RES/, under the link for “RES Quality Survey.” If your office has not yet completed this brief survey, I would appreciate your support in ensuring its completion (which will take about 5 minutes) within the next 10 working days.

Enclosure:

1. Mlynarczyk D., Arcieri W., “Control Room Dose Evaluation Using ICRP 103 Dose Conversion Factors,” Information Systems Laboratory (ISL) Inc., Rockville, MD, May 2017.

TRANSMITTAL OF THE CONTROL ROOM DOSE EVALUATION USING ICRP 103 DOSE CONVERSION FACTORS LETTER REPORT FOR USER NEED REQUEST NRR-2009-002 DATED JUNE 28, 2017.

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