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TECHNICAL STANDARDS ACTIVITIES

DOE Handbook DOE-HDBK-XXXX-202X, *Handbook of Biokinetic and Dosimetric Models Used to Derive DOE's Updated 2022 Derived Technical Concentration Standards*

The Office of Public Radiation Protection (EHSS-22) has posted a draft Handbook entitled, "DOE -HDBK-XXXX-202X, *Handbook of Biokinetic and Dosimetric Models Used to Derive DOE's Updated Derived Concentration Standards*" for 60-day review in TSP RevCom. This new draft Handbook documents the radiation dosimetry models used to develop the update to DOE-STD-1196-2022, *Derived Concentration Technical Standard*, December 2022. HDBK XXXX-202X will document the biokinetic and dosimetric models used to calculate the dose coefficients and derived concentration standard (DCS) values currently tabulated in DOE-STD-1196-2022, and will also serve as a compendium to the Standard.

The 2022 Standard provides DCS values and age-specific effective dose coefficients (radiation dose estimators for exposure to radionuclides) that are used in environmental radiation protection programs around the DOE complex to provide radiation protection to the public and the environment. The DCS values for external exposure to airborne radionuclides are based on radiological dose coefficients for this exposure pathway tabulated in Federal Guidance Report 15, *External Exposure to Radionuclides in Air, Water and Soil* (2019). The DCS values and dose coefficients for internally deposited radionuclides are based on the latest dosimetry models of the International Commission on Radiological Protection (ICRP) for public exposure to environmental radionuclides. The ICRP's latest suite of dosimetry models reflects a large body of information developed since its previous suite of models last published in the mid-1990s. A Handbook documenting the dosimetry models applied in the updated DOE-STD-1196-2022 is needed for the reproducibility of DCS values and dose coefficients in the Standard.

The dosimetric models documented in the Handbook are divided into two categories: (1) age-specific biokinetic models that predict the time-dependent distribution and excretion of individual radionuclides in the human body, and (2) age-specific "dosimetric" models (a naming convention identifying a specific type of dosimetry model) that convert the predicted distributions of radionuclides in the body into

radiation doses received at the tissue level. Most of the Handbook is devoted to descriptions of biokinetic models in accordance with the many element-specific biokinetic models required in the ICRP's dosimetry scheme. The dosimetric models are more generic in nature, as they are based on radiation transport modeling within the body for a few different types of radiation, e.g., alpha particles, beta particles, and gamma rays.

The Handbook provides comprehensive documentation for all three types of models used in the ICRP's current dosimetric scheme and has been applied in the update to DOE-STD-1196-2022: (1) respiratory tract models, (2) alimentary tract models, and (3) systemic models. The respiratory tract models describe the deposition and retention of different forms of inhaled material in the respiratory tract and its subsequent clearance from the respiratory tract to blood or the alimentary tract by moving up the tracheobronchial tree and swallowing. The alimentary tract models provide the movement of swallowed or internally secreted material through the alimentary tract and the rate and extent of absorption of the radionuclide from the alimentary tract to the blood system. Each systemic model is specific to the element (and need not be developed for individual radioisotopes of an element) and describes the time-dependent retention, distribution, and excretion of the element after it reaches the blood system.

As discussed in the Handbook, the dosimetric models are built around two sets of anatomical regions: the "source regions" used by the biokinetic models to predict the time-dependent distribution of a radionuclide in the body and "target regions" representing radiosensitive tissues of the body. The source regions are used to describe the time-dependent distribution of the radionuclide taken into the body by inhalation or ingestion and any radioactive progeny produced in the body by radioactive decay after intake of the "parent" radionuclide. The target regions are the tissues for which dose estimates are derived. A set of 79 source regions estimate the distribution of an internally deposited radionuclide and ingrowing progeny in the body at any given time. Radiation doses are calculated for 43 target regions, such as red marrow, breast, liver, kidneys, pancreas, and brain.

For a given radionuclide and mode of intake, estimated doses to individual tissues are reduced to an effective dose coefficient calculated as a weighted sum of doses to radiosensitive tissues. The weights represent the relative contribution of the different tissues to the total risk for the case of uniform irradiation of the whole body. Age-specific effective dose coefficients for a given radionuclide and exposure pathway (e.g., submersion in air, inhalation, ingestion of water, or ingestion of milk) are the critical components of the DCS value for that radionuclide and pathway. The DCS value is calculated by dividing the pertinent constraint between the annual effective dose by the weighted sum of effective doses for six age groups at intake: infancy, one year, five years, ten years, fifteen years, and adulthood. It is essential that each DCS value and hence each effective dose coefficient in DOE-STD-1196-2022 be reproducible.

The intent of the Handbook is to document the biokinetic and dosimetric models used to calculate the dose coefficients and DCS values currently tabulated in DOE-STD-1196-2022. The values presented in the Handbook will serve as a compendium to the DCS Standard. They will allow the reproducibility of the data that can be used as required for future updates of the DCS Standard.

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Department of Energy, Office of Nuclear Safety Basis & Facility Design, (EHSS-31) Standard 1189 Listening Tour and Workshop

Does your team find itself implementing DOE-STD-1189-2016, *Integrating Safety into the Design Process*, (or the 2008 version) and having questions about what something means, or comments about something that is not working for you? ***EHSS-31 wants to know!*** Since May 2022, EHSS-31 has been listening carefully to contractor and Federal subject matter experts (SMEs) who are implementing DOE-STD-1189, collecting data on past and current use, identifying areas where more guidance would be helpful, and developing a workshop to support effective future use.

EHSS-31 has spoken with over 30 SMEs around the DOE complex. The major conclusion thus far is that ***STD-1189-2016 is working for people and, generally, the method and function of the Standard is effective in its goal of integrating safety into the design process.*** From the listening tour, EHSS-31 has developed a few areas for clarification that would benefit groups that are using the Standard. Methods of delivery for these lessons learned are currently under consideration, but the most frequently mentioned areas for clarification include change control; preliminary technical safety requirements; design upgrade analysis; required correspondence and timeframes; and major modification determinations. If your organization has any feedback in these areas or others that you'd like to share, please contact Lyndsey Fyffe at the address below.

Based on information generated by field interviews and requests for training on the Standard, EHSS-31 has developed a DOE-STD-1189 Implementation Workshop for ongoing projects and delivered the inaugural session at Sandia National Laboratory. The workshop provides an overview of the Standard and its relationship to 10CFR830, *Nuclear Safety Management,* DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets* and DOE O 420.1C, *Facility Safety*. The workshop can be tailored to the specific needs of your site project(s) and any unique challenges you are facing. It also provided lessons learned from the listening tour, along with practical examples. If you are interested in hosting an 1189 Implementation Workshop, contact Lyndsey Fyffe at Lyndsey.fyffe@hq.doe.gov.

Author: Lyndsey Fyffe, PhD, EHSS-31, Office of Nuclear Safety Basis & Facility Design

DOE Technical Standards Updates

The following is an overview of recent Technical Standards actions for March, April, and May 2023. A complete list of on-going DOE Technical Standards actions can be found on the "Monthly Status Reports" posted on the Technical Standards Program website: www.standards.doe.gov and in the Monthly TSMC Minutes posted on Organizational Excellence (energy.gov).

Project Justification Statement (PJS) Posted in RevCom for 15-day Review:

Proposed Revision of DOE-STD-1234-YR, *Nuclear Material Packaging*
POC: Brendan Burns, EHSS-32, Office of Quality Assurance & Nuclear Safety Management Programs, Phone: 202-586-2671

Proposed Revision of DOE-STD-1027-2018, *Hazard Categorization of DOE Nuclear Facilities*
POC: Jessica Kratchman, EHSS-31, Office of Nuclear Safety Basis & Facility Design, Phone: 301-903-7089

Proposed Revision of DOE-STD-1104-2016, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents* (Invoked Standard)
POC: Caroline Garzon, EHSS-31, Office of Nuclear Safety Basis & Facility Design, Phone: 301-903-8275

In RevCom for 60-Day Review:

Proposed New Standard DOE-STD-1239-YR, *Chemical Safety Management*
POC: April Brown, EHSS-11, Office of Worker Safety and Health, Phone: 301-903-0370

Proposed New Standard DOE-STD-XXXX-YR, *Protective Force Firearms Qualification Technical Standard*
POC: Kevin Webber, EHSS-51, Office of Security, Phone: 301-903-4291

Proposed New Handbook DOE-HDBK-XXXX-YR, *Biokinetic and Dosimetric Models Used in DOE-STD-1196-2022, Derived Concentration Technical Standard*
POC: Carlos Corredor, EHSS-22, Office of Radiation Protection of the Public and the Environment, Phone: 202-586-0471

Final Concurrence:

Proposed Revision of DOE-STD-1066-YR, *Fire Protection*
POC: Jim Bisker, EHSS-31, Office of Nuclear Safety Basis & Facility Design, Phone: 301-903-6542

Published:

DOE-HDBK-1169-2022 Chg Notice 1, *Handbook for Use with DOE-STD-1269-2022, "Air Cleaning Systems in DOE Nuclear Facilities"*
POC: Patrick Frias, EHSS-31, Office of Nuclear Safety Basis & Facility Design, Phone: 301-903-1774

DOE-STD-1241-2023, *Implementing Release and Clearance of Property Requirements*
POC: Mike Stewart, EHSS-22, Office of Public Radiation Protection, Phone: 202-586-6444

Upcoming Events and Workshops

ASME Aerospace Structures, Structural Dynamics, and Materials Conference
When: June 19-21, 2023
Where: San Diego, CA/Westin San Diego Bayview

NFPA Conference & Expo
Conference & Expo - June 19-21
Technical Meeting - June 2
When: June 19-23, 2023
Where: Las Vegas, NV/Mandalay Bay Conference Center

ASME 17th International Conference on Energy Sustainability (ES 2023)
When: July 10-12, 2023
Where: Washington, DC/The Madison Hotel

ANS 13th Nuclear Plant Instrumentation, Control & Human-Machine Interface Technologies (NPIC&HMIT 2023)
When: July 15-20, 2023
Where: Knoxville, TN/Knoxville Convention Center

ANS Utility Working Conference and Vendor Technology Expo (UWC 2023)
When: August 6-9, 2023
Where: Marco Island, FL/Marriott Marco Island

ASME Power 2023-Power Applied R & D - Power Division Conference Responsible. Reliable. Power for All
When: August 6-9, 2023
Where: Long Beach, CA/Hilton, Long Beach

ANS 20th International Topical Meeting on Nuclear Reactor Thermal Hydraulics (NURETH-20)
When: August 20-25, 2023
Where: Washington, D.C./Washington Hilton

ANSI Executive Standards Council (EXSC) Meeting
When: September 19, 2023
Where: ANSI NY Office

NFPA Fire Prevention Week
When: October 9-15, 2023
Where: Las Vegas, NV/Mandalay Bay Conference Center

ANS 2023 ANS Winter Meeting and Technology Expo
When: November 12-15, 2023
Where: Washington, D.C./Washington Hilton

For more information on the listed meetings or events, please see the organization's website listed below:
http://www.ans.org/
https://www.ansi.org/
https://www.nfpa.org/
https://www.asme.org

To learn more about the DOE Technical Standards Program or to view the *Standards Actions* newsletters, visit the website: www.standards.doe.gov