

OES 2022-02

April 2022

DOE Occupational Radiation Exposure Monitoring for CY 2020

Purpose

This Operating Experience Summary (OES) document provides an overview of occupational radiation doses at Department of Energy (DOE) sites, including the National Nuclear Security Administration (NNSA), for calendar year (CY) 2020. The *U.S. Department of Energy (DOE) Occupational Radiation Exposure Report for CY 2020*, recently published in February 2022, provides an analysis of current and historical trends in the collective total effective dose (TED), including the effective dose from external radiation sources and the committed effective dose (CED) from the internal uptake from radioactive materials due to work activities. It contains a description of work activities in relation to occupational radiation doses for each DOE facility.

The purpose of the OES is to give greater visibility to DOE line managers into the key highlights from the CY 2020 report for awareness. This brief summary of the broader collection of DOE-wide data further enables the sharing and application of lessons across programs and sites, supporting DOE goals in continuous improvement and organizational learning.

Background

DOE Order 231.1B, *Environment Safety and Health Reporting*, requires the Office of Environment, Safety and Health (ES&H) Reporting and Analysis to report annually on radiation exposure monitoring data to the Radiation Exposure Monitoring System (REMS) database before March 31 of the following year. The *U.S. Department of Energy Occupational Radiation Exposure Report for CY 2020* provides a detailed evaluation of DOE-wide performance in compliance with Title 10, Code of Federal

Regulations, Part 835, *Occupational Radiation Protection*. The regulation includes occupational dose limits, as well as the principle of reducing radiation doses to levels *as low as reasonably achievable* (ALARA). The report provides data to DOE organizations responsible for developing policies for protecting individuals from the adverse health effects of radiation. The occupational radiation dose information over the past 5-year period is analyzed in terms of dose to individuals, dose by site, and aggregate data. The data in this analysis represent the data reported to REMS as of July 31, 2021.

Discussion

The occupational radiation dose records for CY 2020 show that DOE facilities complied with DOE dose limits and administrative control levels (ACLs) and worked to minimize doses to individuals.

Information on collective TED is an indicator of the overall amount of radiation dose received during the conduct of work activities at DOE. The TED is comprised of the effective dose from external sources (which includes neutron and photon radiation) and the internal CED, which results from the intake of radioactive material into the body.

Highlights between CY 2019 and CY 2020:

- The collective TED decreased at DOE by less than 1 percent from 752.3 person-rem (7,523 person-mSv) in CY 2019 to 750.8 person-rem (7,508 person-mSv) in CY 2020.
- The number of workers with measurable TED increased by 25 percent from 13,824 in CY 2019 to 17,329 in CY 2020.

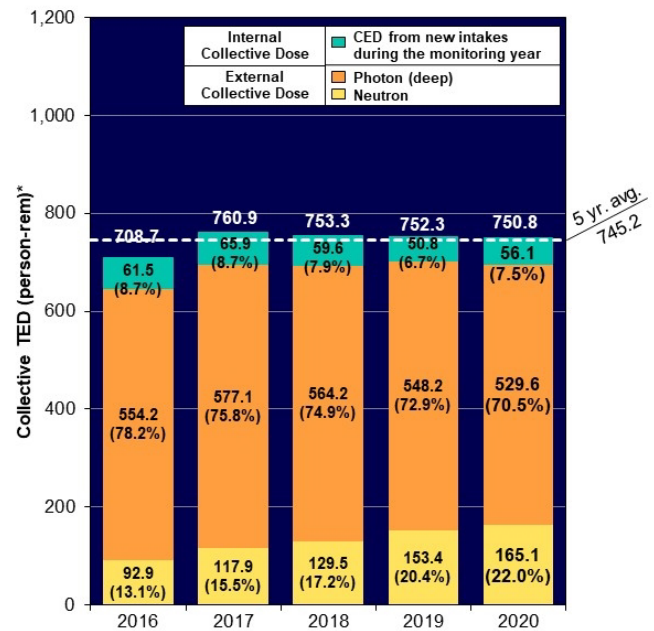
- The average measurable TED decreased by 20 percent from 0.054 rem (0.540 mSv) in CY 2019 to 0.043 rem (0.430 mSv) in CY 2020.
- The collective CED (internal dose from U-234) increased by 10 percent from 50.8 person-rem (508 person-mSv) in CY 2019 to 56.1 person-rem (561 person-mSv) in CY 2020.
- The number of individuals with measurable CED decreased by 8 percent from 1,413 in CY 2019 to 1,303 in CY 2020.
- No individual was reported to have exceeded the TED regulatory limit (5 rem [50 mSv]) from CY 2016 through 2020.
- One individual was reported to have exceeded the TED ACL (2 rem [20 mSv]) in CY 2020.
- The collective photon dose decreased by 3 percent from 548.2 person-rem (5,482 person-mSv) in CY 2019 to 529.6 person-rem (5,296 person-mSv) in CY 2020.
- The neutron component of the collective TED increased by 8 percent from 153.4 person-rem (1,534 person-mSv) in CY 2019 to 165.1 person-rem (1,651 person-mSv) in CY 2020.

Figure 1 shows the components of the collective TED from CY 2016–2020, including the external dose contributions from photon and neutron, as well as the internal dose from intakes.

Figure 2 shows the average measurable TED, which normalizes the collective dose over the population of workers who received a measurable dose from CY 2016–2020. The average measurable TED decreased by 20 percent from 0.054 rem (0.540 mSv) in CY 2019 to 0.043 rem (0.430 mSv) in CY 2020.

In CY 2020, the five sites that contributed significantly (88 percent) to the collective TED in decreasing order were Los Alamos National Laboratory (LANL), Savannah River, Pantex Plant, Idaho, and Oak Ridge.

Figure 1. Components of TED, CY 2016–2020.



The percentages in parentheses represent the percentage of each dose component to the collective TED.

Figure 2. Average Measurable TED, CY 2016–2020.



The collective TED increased at LANL, Pantex, and Idaho, and decreased at Savannah River and Oak Ridge.

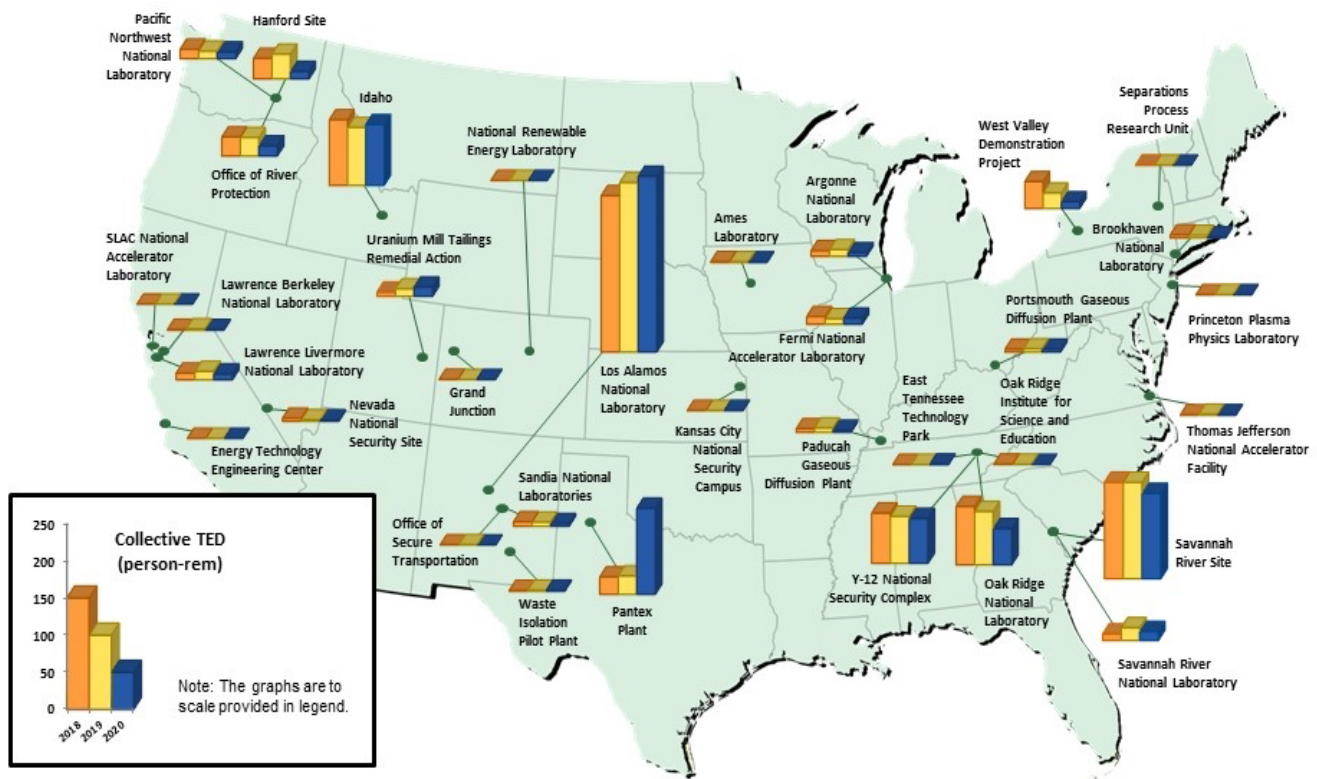
At LANL, a significant portion of the dose was due to programmatic and maintenance work at the TA-53. For Pantex Plant, issues with the dosimetry reading equipment and calculations to correct equipment differences resulted in an elevated dose compared

to prior years. Idaho increased due to the high-dose work at the ATR.

Decreases at Oak Ridge were attributed to COVID-19 protocols. The decrease in dose at Savannah River was primarily due to the implementation of system upgrades.

Figure 3 illustrates the collective TED at DOE sites that are required to report the results of occupational radiation monitoring to the DOE REMS Program.

Figure 3. Collective TED by DOE Site for CY 2018 – 2020



Conclusion

Over the past 5-years, measurable doses to all monitored individuals were well below the annual DOE regulatory limit of 5 rem (50 mSv) TED; however, one monitored individual received a single dose of 3.0 rem (30 mSv) in 2020, exceeding the 2 rem (20 mSv) DOE ACL.

For CY 2020, the collective TED decreased by less than 1% from the value in CY 2019. The number of individuals receiving measurable TED increased by 22%, primarily due to a dosimetry processing issue at Pantex Plant that resulted in a substantial increase in the site collective TED and the number of individuals receiving a measurable TED.

The dosimetry issue required a calculation of individual doses that tended to be overly conservative in order to ensure that doses were not underestimated. The slight decrease in the total DOE collective TED along with the 22% increase in the number with measurable TED, resulted in a 20% decrease in the average measurable TED. The combination of changes in these values is unusual and the contribution of the dosimetry issue at Pantex should be considered when assessing the CY 2020 data.

Reference

The *U.S. Department of Energy Occupational Radiation Exposure Report for CY 2020* contains a description of work activities in relation to occupational radiation dose for each DOE facility.

The annual report is located at:

<https://www.energy.gov/ehss/occupational-radiation-exposure-publications>

Additional Sources of Information

REMS System Tools: REMS includes a database with over 4 million dose records. REMS system tools below provide access to summary data for research and interactive data visualization products.

- [Occupational Exposure Dashboard](#) - Illustrated and Interactive Overview of Radiation Exposure at DOE Sites.
- [REMS Query Tool](#) - Provides access to REMS summary data for analysis.
- [10 Year Summary](#) - Provides descriptions and trends of dose data over the last 10 years.

To access annual reports from CY 1974 to CY 2020, ALARA activities at DOE, REMS Query Tool, and other information on occupational radiation doses at DOE, visit the DOE ES&H website at:

<https://www.energy.gov/ehss/occupational-radiation-exposure>

The Office of Environment, Health, Safety and Security, Office of ES&H Reporting and Analysis publishes OESs to promote safety throughout the DOE complex by encouraging the exchange of lessons learned information among DOE facilities.

For further information or assistance related to this OES, please contact Katharine McLellan, REMS Program Manager, at (301) 903-1257 or by email at katharine.mclellan@hq.doe.gov.