

OES 2024-01

February 2024

## DOE Occupational Radiation Exposure Monitoring for CY 2022

### 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) 2022. The *U.S. Department of Energy (DOE) Occupational Radiation Exposure Report for CY 2022* provides an analysis of the collective total effective dose (TED), including the effective dose from external radiation sources and the committed effective dose (CED) from the internal intake of radioactive material during 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 provide DOE line managers with key highlights from the CY 2022 report for awareness, evaluation, and potential site-specific action. The OES provides high-level DOE-wide summary information. Line managers are encouraged to review the CY 2022 report for detailed information about the distribution of radiological dose across DOE, including at a program- and site-specific level.

### Background

DOE Order 231.1B, *Environment Safety and Health Reporting*, requires DOE sites to annually report radiation exposure monitoring data to the Radiation Exposure Monitoring System (REMS) database before March 31 of the following year. The Office of Environment, Safety and Health (ES&H) Reporting and Analysis uses this information to develop a DOE-wide annual report.

The *U.S. Department of Energy Occupational Radiation Exposure Report for CY 2022* 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 current data and any updated or changed data reported to REMS as of July 31, 2023.

### Discussion

The occupational radiation dose records for CY 2022 show that DOE facilities complied with DOE dose limits and administrative control levels (ACLs) and worked to minimize doses to individuals.

Collective TED is an indicator of the overall amount of radiation dose received during the conduct of work activities at DOE. It 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 2021 and CY 2022:

- The collective TED increased at DOE by 8 percent from 823.833 person-rem (8,238 person mSv) in CY 2021 to 890.673 person-rem (8,906 person-mSv) in CY 2022.

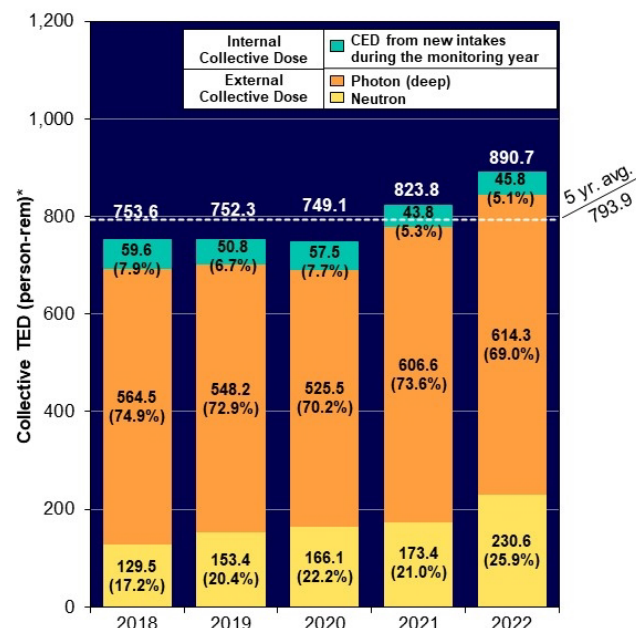
- The number of individuals with measurable TED decreased by less than 1 percent from a value of 16,883 in CY 2021 to a value of 16,767 in CY 2022.
- The average measurable TED increased by 9 percent from 0.048 rem (0.480 mSv) in CY 2021 to 0.053 rem (0.530 mSv) in CY 2022.
- The collective CED (internal dose from U-234) increased by 5 percent from 43.8 person-rem (438 person-mSv) in CY 2021 to 45.8 person-rem (458 person-mSv) in CY 2022.
- The number of individuals with measurable CED increased by 7 percent from 1,240 in CY 2021 to 1,327 in CY 2022.
- No individual was reported to have exceeded the TED regulatory limit (5 rem [50 mSv]) from CY 2018 through 2022.
- No individual was reported to have exceeded the TED ACL (2 rem [20 mSv]) in CY 2022. Previously, one monitored individual received an annual TED of 3.8 rem (38 mSv) in CY 2018, and another individual received a single dose of 3.0 rem (30 mSv) TED in CY 2020.
- The collective photon dose increased by 1 percent from 606.6 person-rem (6,066 person mSv) in CY 2021 to 614.3 person-rem (6,143 person-mSv) in CY 2022.
- The neutron component of the collective TED increased by 33 percent from 173.4 person-rem (1,734 person mSv) in CY 2021 to 230.6 person-rem (2,306 person mSv) in CY 2022.

Figure 1 shows the components of the collective TED from CY 2018–2022, 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 2018–2022. The average measurable TED increased by 9 percent from 0.048 rem (0.480 mSv) in CY 2021 to 0.053 rem (0.530 mSv) in CY 2022.

In CY 2022, the five sites that contributed significantly (89 percent) to the collective TED in descending order were Los Alamos National Laboratory (LANL), Savannah River, Oak Ridge, Idaho, and Hanford.

**Figure 1.** Components of TED, CY 2018–2022.



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

**Figure 2.** Average Measurable TED, CY 2018–2022



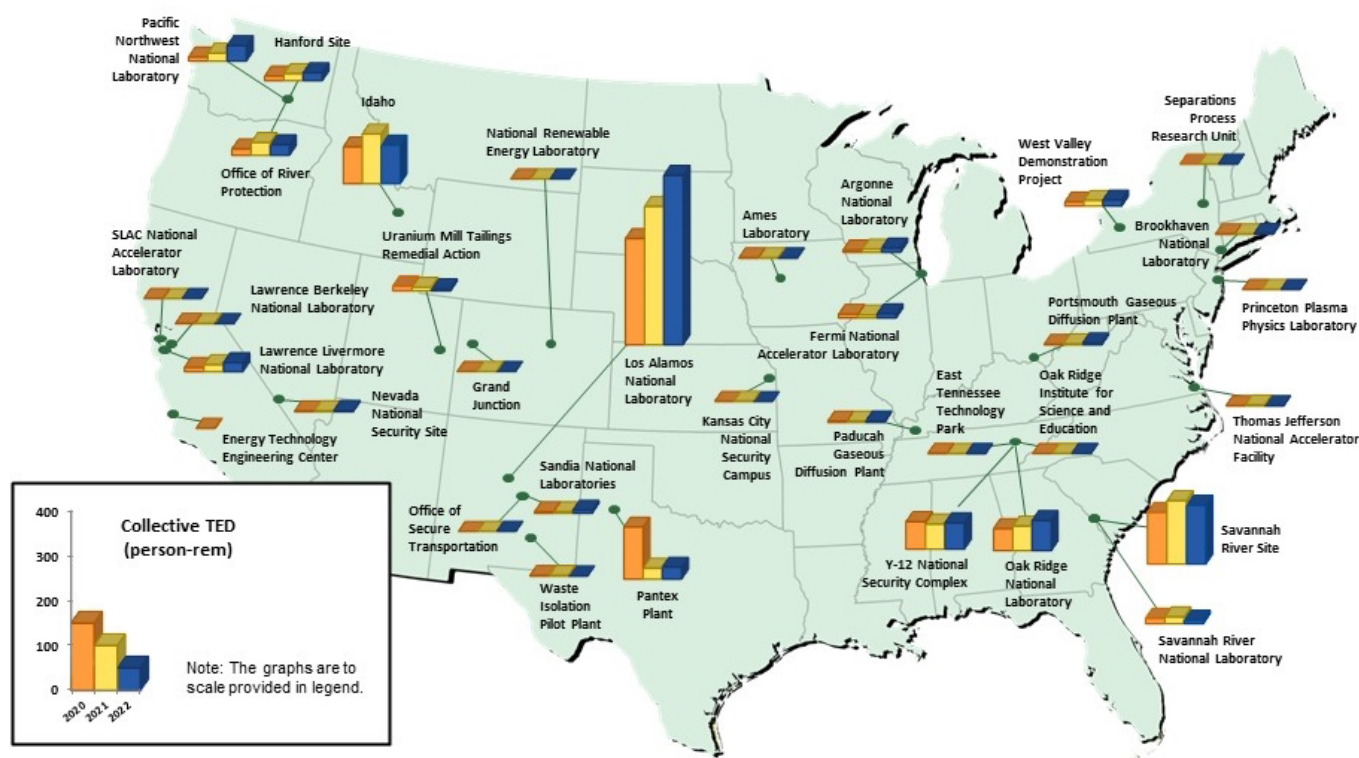
The collective TED increased at three of the five sites with the largest collective TED: LANL, Hanford, and Oak Ridge. Collective TED decreased at Idaho and Savannah River.

At LANL, a primary contributor to dose in CY 2022 was work with Pu-238, producing general purpose heat sources, and other infrastructure support for radiological work at the TA-55 plutonium facility. In addition, increased work at TA-55 led to an increase in the number of personnel, and subsequently, an increase in collective dose. The dose at Savannah River decreased in comparison with CY 2021 as deactivation work was completed. For Idaho, the decrease in CY 2022 was due to monitored individuals being primarily involved with contractor oversight in areas with minimal potential for occupational radiation exposure. The increased dose at Hanford was attributed to an increase in the

volume of elevated risk high-dose radiological work performed during CY 2022. Oak Ridge saw only a negligible/slight increase in collective TED even though there were increases in operations activities and radioisotope production, particularly radioisotope production for industrial sponsors. Additionally, the number of ORNL monitored individuals increased by 28 percent over CY 2021.

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 2020 – 2022



## Conclusion

Over the past 5-year period, 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 an annual TED of 3.8 rem (38 mSv) in CY 2018, and another individual received a single dose of 3.0 rem (30 mSv) TED in CY 2020. Both doses exceeded the 2 rem (20 mSv) DOE ACL.

Only 22 percent of the monitored individuals in CY 2022 received a measurable dose, and of those, the average measurable dose received was less than 1 percent of the 5 rem (50 mSv) TED limit.

While the number of individuals with measurable dose and the collective dose increased in CY 2022, the average measurable dose remains lower than pre-pandemic levels and does not constitute an increase of risk to the DOE workforce from radiation exposure.

## Reference

The *U.S. Department of Energy Occupational Radiation Exposure Report for CY 2022* 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](#) - Provides an 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 2022, 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 (202) 586-0183 or by email at [katharine.mclellan@hq.doe.gov](mailto:katharine.mclellan@hq.doe.gov).