U.S. Department of ENERGY | Office of Environment, Health, Safety & Security

Operating Experience Summary

OES 2025-01 January 2025

DOE Occupational Radiation Exposure Monitoring for CY 2023

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) 2023. The *U.S. Department of Energy (DOE) Occupational Radiation Exposure Report for CY 2023* 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 2023 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 2023 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 2023* 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, 2024.

Discussion

The occupational radiation dose records for CY 2023 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.

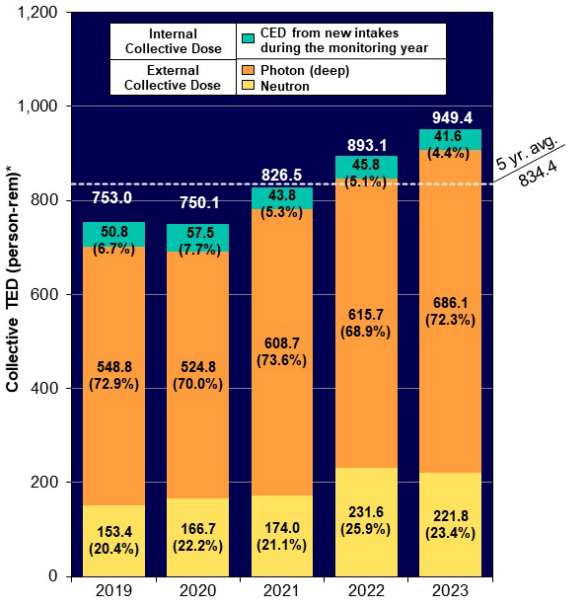
Highlights between CY 2022 and CY 2023:

- The collective TED increased at DOE by 6 percent from 893.1 person-rem (8,931 person mSv) in CY 2022 to 949.4 person-rem (9,494 person-mSv) in CY 2023.
- The number of individuals with measurable TED increased 10 percent from a value of 16,774 in CY 2022 to a value of 18,469 in CY 2023.
- The average measurable TED decreased by 4 percent from 0.053 rem (0.530 mSv) in CY 2022 to 0.051 rem (0.510 mSv) in CY 2023.
- The collective CED (internal dose from U-234) decreased by 9 percent from 45.8 person-rem (458 person-mSv) in CY 2022 to 41.6 person-rem (416 person-mSv) in CY 2023.
- The number of individuals with measurable CED increased less than 1 percent from 1,327 in CY 2022 to 1,333 in CY 2023.
- No individual was reported to have exceeded the TED regulatory limit (5 rem [50 mSv]) from CY 2018 through 2023.
- No individual was reported to have exceeded the TED ACL (2 rem [20 mSv]) in CY 2023. 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 11 percent from 615.7 person-rem (6,157 person mSv) in CY 2022 to 686.1 person-rem (6,861 person-mSv) in CY 2023.
- The neutron component of the collective TED decreased by 4 percent from 231.6 person-rem (2,316 person mSv) in CY 2022 to 221.8 person-rem (2,218 person mSv) in CY 2023.

Figure 1 shows the components of the collective TED from CY 2019–2023, including the external dose contributions from photon and neutron, as well as the internal dose from intakes.

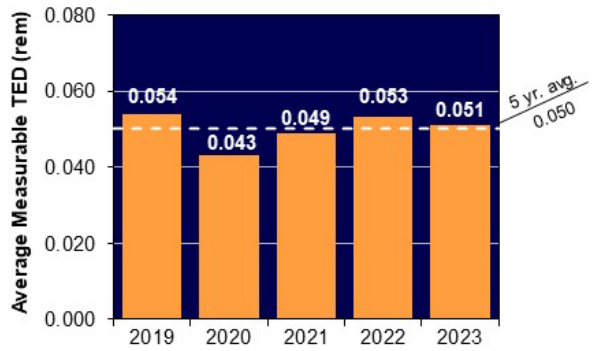
Figure 2 shows the average measurable TED, which normalizes the collective dose over the population of workers who received a measurable dose from CY 2019–2023. The average measurable TED decreased by 4 percent from 0.053 rem (0.530 mSv) in CY 2022 to 0.051 rem (0.510 mSv) in CY 2023. In CY 2023, the five sites that contributed significantly (86 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 2019–2023.



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

Figure 2. Average Measurable TED, CY 2019–2023



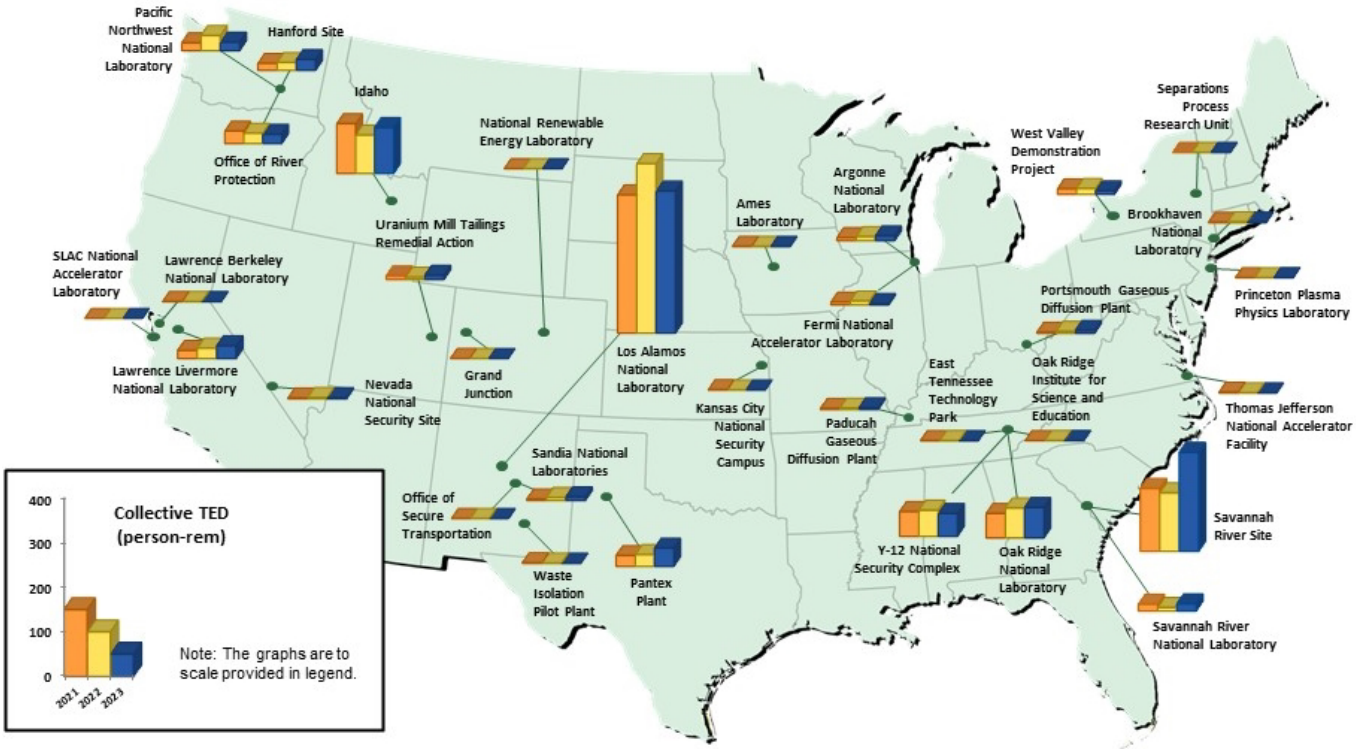
Savannah River and Idaho had increases in collective TED in CY 2023, while collective TED decreased at LANL, Oak Ridge, and Hanford.

At Savannah River, the site set a single-year record by processing nearly 3.2 million gallons of radioactive salt waste and sent the first shipment of down blended plutonium from the site to the Waste Isolation Pilot Plant (WIPP), which resulted in an increase in collective TED. The increased dose at Idaho was the result of completing several significant tasks in high dose rate areas.

At LANL, there was an atypical reduction in demand for programmatic heat source work, which contributed greatly to the observed reduction in dose in CY 2023. In addition, there was a significant reduction in dose associated with craft labor performing construction activities at the plutonium facilities. While Oak Ridge experienced a 2 percent increase at Oak Ridge National Laboratory (ORNL) due to an increase in operations and monitored individuals, overall, Oak Ridge had a decrease in CY 2023 dose values associated with continued cleanup efforts in radiological areas and the downsizing of the removable contamination area footprint at the site. While there was a small increase in dose at the Hanford Site due to the increased number of personnel entries in building 324 and maintenance at the Solid Waste Operations Complex, overall, Hanford experienced a decrease in dose during CY 2023 due to the completion of hot cell refurbishment work that began in CY 2022, a change in work scope, and technology changes in tank farm activities.

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 2021–2023



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 individual received a single dose of 3.0 rem (30 mSv) TED in CY 2020 which exceeded the 2 rem (20 mSv) DOE ACL.

Only 22 percent of the monitored individuals in CY 2023 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 2023* 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 2023, ALARA activities at DOE, REMS Query Tool, and other information on occupational radiation doses at DOE, visit the DOE EHSS Occupational Radiation Exposure website at:

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

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.

Operating Experience Summary

Operating Experience Summary (OES): An informative operating experience-based article published by the Office of Environment, Health, Safety, and Security (EHSS) and distributed across the DOE complex through the DOE Corporate Operating Experience Program to promote safety and mission success through the open exchange of valuable experiences, good practices, and performance summaries.

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