OFFICE OF INSPECTOR GENERAL

U.S. Department of Energy

INSPECTION REPORT

DOE-OIG-22-24

January 2022

MANAGEMENT OF DOSIMETRY SERVICES AT LAWRENCE LIVERMORE NATIONAL LABORATORY

Department of Energy
Washington, DC 20585

January 27, 2022

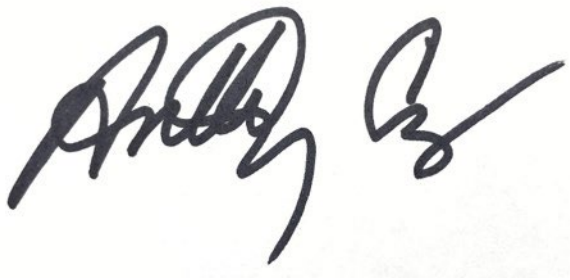
MEMORANDUM FOR THE MANAGER, LIVERMORE FIELD OFFICE

SUBJECT: Inspection Report on Management of Dosimetry Services at Lawrence Livermore National Laboratory

The attached report discusses our review of management of dosimetry services at Lawrence Livermore National Laboratory. This report does not contain recommendations or suggested actions. Therefore, no management response is required.

We conducted this inspection from April 2021 through January 2022 in accordance with the Council of the Inspectors General on Integrity and Efficiency's *Quality Standards for Inspection and Evaluation*.

We appreciated the cooperation and assistance received during this evaluation.



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cc: Deputy Secretary
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Department of Energy
Office of Inspector General

Management of Dosimetry Services at Lawrence Livermore National Laboratory
(DOE-OIG-22-24)

WHY THE OIG PERFORMED THIS REVIEW

Lawrence Livermore National Laboratory's (LLNL) external dosimetry program monitors workers for exposure to sources of radiation and is required to maintain proper records. LLNL may increase the risk to worker health and may increase liability for the Department of Energy by not properly monitoring radiation exposure or properly maintaining records.

We initiated this inspection to determine if the Department's dosimetry program at LLNL adequately protects workers and is managed in accordance with applicable laws and regulations.

What Did the OIG Find?

Based on our inspection, nothing came to our attention to indicate that LLNL did not adequately protect its workers, or the external dosimetry program was not managed in accordance with applicable laws and regulations. We found LLNL identified and monitored workers who may have been exposed to radiation and those not expected to be exposed to radiation. Further, we determined LLNL's policies and procedures complied with Federal Regulations for dosimetry records management and that the dosimetry records we reviewed were retrievable, complete, and accurate according to regulations.

What Is the Impact?

By law, the Department is required to monitor radiological exposures resulting from the conduct of its activities and limit this exposure accordingly. Therefore, an effective dosimetry program is not only a legal requirement but is a factor in advancing the Department's mission of ensuring a safe and secure workplace for its employees, contractors and subcontractors.

What Is the Path Forward?

We did not identify any issues that need to be addressed. Therefore, we made no recommendations at this time.

BACKGROUND

The Department of Energy conducts research utilizing radioactive materials and radiation generating devices to carry out elements of its mission. The Lawrence Livermore National Laboratory (LLNL), under its Environment, Safety, and Health Directorate, is responsible for ensuring the safety and health of its workers. LLNL established an external dosimetry program to monitor occupational radiological exposure in the workplace using thermoluminescent dosimetry and track etch dosimetry systems, each including dosimeters and readers. Dosimetry is the application of principles and techniques involved in the measurement and recording of personnel radiological doses from external sources of radiation.

The Environment, Safety and Health Directorate's External Dosimetry Team provides and maintains dosimeters issued to targeted workers at LLNL, and maintains all records related to radiological monitoring. The Environment, Safety and Health Directorate also utilizes health physicists who are responsible for determining monitoring methods and frequencies, distributing and controlling monitoring devices, and evaluating external radiological doses. In addition to personnel monitoring, LLNL's radiation monitoring program includes a dosimetry-based area monitoring program.

The Department regulates radiological exposure according to Title 10 Code of Federal Regulations (CFR) 835, *Occupational Radiation Protection*. 10 CFR 835 limits the occupational dose of a general worker to a total effective dose of 5 rems[1] annually and requires a radiation protection program to monitor occupational radiological exposure for employees, contractors, and visitors. 10 CFR 835 also requires that LLNL maintain accreditation for personnel dosimetry through the Department of Energy Laboratory Accreditation Program (DOELAP). DOELAP evaluates the quality of Department external dosimetry programs every 3 years through performance testing, evaluations of program-specific calibrations, and onsite assessments. In addition, LLNL employees used the Radiological Control Manual 2050 and Health Physics Field Operating procedures to implement the requirements of 10 CFR 835.

We initiated this inspection to determine if the Department's dosimetry program at LLNL adequately protects workers and is managed in accordance with applicable laws and regulations.

LLNL MONITORED WORKER RADIOLOGICAL EXPOSURE PER REGULATIONS

Based on our inspection, nothing came to our attention to indicate that LLNL did not adequately protect its workers, or the external dosimetry program was not managed in accordance with applicable laws and regulations. We found LLNL identified and monitored workers who may have been exposed to radiation through targeted monitoring and those not expected to be exposed through area monitoring. Further, we determined LLNL's policies and procedures complied with Federal Regulations for dosimetry records management, and that the dosimetry records were retrievable, complete, and accurate according to regulations.

[1] Rem is a standard measurement used to measure the effective dose, which combines the amount of energy deposited in human tissue and the medical effects of the type of radiation.

LLNL Identified and Monitored Workers through Targeted and Area Dosimetry

We found that LLNL identified and monitored workers who may have been exposed to radiation through targeted monitoring and those not expected to be exposed to radiation through area monitoring. In general, 10 CFR 835 requires anyone that may be exposed to over 100 millirem to be monitored by an external dosimetry system. LLNL fulfilled this requirement through targeted monitoring of workers who may be exposed to radiation. Targeted monitoring was accomplished by requiring workers assigned near radioactive materials, known radiation areas, or radiation generating devices to complete radiation safety training. Completion of the training enrolled workers in the external dosimetry monitoring program. Once enrolled in the program, they were monitored on a regular basis by a health physicist through the use of whole-body dosimeters. If a positive dose was detected, health physicists investigated the cause of the exposure and determined whether it was a legitimate and expected dose. For workers not enrolled in targeted monitoring, LLNL utilized a dosimetry area monitoring program. One of the objectives of the program was to verify that occupational doses in particular areas remained below the threshold, which required individual monitoring.

To help ensure the protection of workers, 10 CFR 835 requires LLNL to maintain accreditation of its external dosimetry program through DOELAP. Accreditation ensures the competency of dosimetry measurements through calibration intercomparisons, performance testing, onsite assessments, and encourages applied research in areas where there is a technology shortfall. LLNL remained accredited throughout the scope of our inspection and was last reviewed in calendar year 2019. LLNL will undergo its next accreditation review in calendar year 2022.

To continue monitoring workers into the future, LLNL External Dosimetry officials told us that in 2020 LLNL started the process of replacing whole-body dosimeters because its current system was at the end of service by the manufacturer. Prior to using the new dosimeters, LLNL will need to test the dosimeters and have the system accredited, according to an External Dosimetry official.

LLNL's Dosimetry Program Maintained Records as Required

We determined that LLNL's policies and procedures complied with Federal Regulations for dosimetry records management and that the dosimetry records were retrievable, complete, and accurate, according to regulations. Our review found that LLNL's internal policy documents and records management practices aligned with 10 CFR 835 and Department Order 231.1B, *Environment, Safety and Health Reporting*, requirements. For example, parts of LLNL's Radiological Control Manual read verbatim to 10 CFR 835. Further, part of External Dosimetry's accreditation by DOELAP included the review of documents, records, and management of records. In the past 5 years, LLNL's internal assessments of records management policies and procedures confirmed compliance with 10 CFR 835.

To properly manage dosimetry records, LLNL used its Radiation Exposure Monitoring System (REMS) database to store and record dosimetry data in accordance with 10 CFR 835 and Department Order 231.1B. The REMS database tracked dosimeter exchange cycles, pending investigations, preliminary doses, final doses, and was used as the primary reporting tool for all

worker dose results. The system, in tandem with accreditation quality assurance standards, provided Department management and workers with assurance that occupational radiation exposures were accurately reported. In addition, we found that LLNL established a process to collect radiation dose histories from workers' previous employers. 10 CFR 835 requires LLNL to make reasonable efforts to obtain previous employer dose history information for all monitored workers, which LLNL collected and entered into the REMS database for tracking.

Finally, we found that the dosimetry records were retrievable, complete, and accurate. 10 CFR 835 requires that records are maintained for all individuals for whom monitoring was conducted. We randomly sampled 254 Employee Dose Summary Reports from calendar year 2016 and 264 reports from calendar year 2019 to determine whether records were retrievable, complete, and accurate. We found that all records were retrievable and met the requirements set forth by 10 CFR 835. Our analysis also showed that no individual's annual dose exceeded the limit of 5 rems.

Based on the results of our inspection, this report does not contain recommendations or suggested actions.

OBJECTIVE

We initiated this inspection to determine if the Department of Energy's dosimetry program at Lawrence Livermore National Laboratory (LLNL) adequately protects workers and is managed in accordance with applicable laws and regulations.

SCOPE

This inspection was performed from April 2021 through January 2022 and focused on LLNL's external dosimetry program and services managed by the Environment, Safety, and Health Directorate at LLNL located in Livermore, California. The scope was limited to a review of the program's adherence to regulations, policies, procedures, accreditation requirements, prior inspections and/or audits, and internal controls from January 2016 through December 2020. This inspection was conducted under the Office of Inspector General project number S21LL014.

METHODOLOGY

To accomplish our inspection objective, we:

- Reviewed prior inspection reports by the Office of Inspector General, and internal and external reviews.

- Reviewed applicable laws, regulations, policies, and procedures, and checked compliance with key provisions.

- Conducted a random sample of LLNL's external dosimetry records, and analyzed the records for retrievability, accuracy, and completeness. We selected 264 records out of 8,475 from calendar year 2016 and 254 records out of 3,653 from calendar year 2019 to provide a sample at 90 percent confidence interval and a 5 percent margin of error.

- Interviewed key officials from the LLNL External Dosimetry Team and other related Department personnel.

We conducted our inspection in accordance with the *Quality Standards for Inspection and Evaluation* (December 2020) as put forth by the Council of the Inspectors General on Integrity and Efficiency. We believe that the work performed provides a reasonable basis for our conclusions.

We held an exit conference with management officials on December 1, 2021.

Appendix 2: Prior Report

Inspection report on *Management of Dosimetry Services at the Hanford Site* (DOE-OIG-20-23, January 2020). Our review identified multiple issues with record practices and oversight. Specifically, inconsistent dosimetry records practices placed records at risk in the past and posed a risk to the accuracy and completeness of records. The Department of Energy also did not identify oversight responsibilities between the Office of River Protection and the Richland Operations Office. Additionally, there were inconsistencies between Federal requirements and the program's policies and contracts. We recommended that Hanford's Site records program clearly define and document the oversight responsibilities, ensure radiation exposure records requirements are clear and consistent between contracts and manuals, and require Hanford Site contractors to utilize standard forms to prevent inconsistencies in the data entered in the Radiation Exposure Database.

FEEDBACK

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