SEC Petition Evaluation Report

Petition SEC-00221

Report Rev Number:	Addendum (1990–1995)
Report Submittal Date:	September 24, 2024
Subject Expert(s):	Robert Burns
Site Expert(s):	N/A

Petition Administrative Summary

Petition Under Evaluation

Petition Number:	SEC-00221 Addendum (1990–1995)
Petition Type:	83.13
Petition Receipt Date:	October 7, 2014
Qualification Date:	January 6, 2015
DOE/AWE Facility Name:	Lawrence Livermore National Laboratory

Petition Class

Petitioner-Requested Class Definition:	All DOE or DOE contractor employees who worked in any area at the Lawrence Livermore National Laboratory within the 7000 East Avenue location in Livermore, California, or within the Site 300 location in Tracy, California, from January 1, 1975, through October 28, 2014.
Class Evaluated by NIOSH (in this addendum):	All employees of the Department of Energy, its predecessor agencies, and its contractors and subcontractors who worked in any area at the Lawrence Livermore National Laboratory in Livermore, California, during the period from January 1, 1990, through December 31, 1995.
NIOSH-Proposed Class(es) to be Added to the SEC:	None

Related Petition Summary Information

SEC Petition Tracking Numbers and Petition Types:	SEC-00092 (83.14) SEC-00163 (83.14) SEC-00221 (83.13)
DOE/AWE Facility Name:	Lawrence Livermore National Laboratory
Petition Status:	SEC-00092: Class added to the SEC for January 1, 1950–December 31, 1973 SEC-00163: Class expanded for January 1, 1950–December 31, 1973 SEC-00221: Class added to the SEC for January 1, 1974–December 31, 1989

Related Evaluation Report Information

Report Title:	SEC Petition Evaluation Report for Petition SEC-00092 SEC Petition Evaluation Report for Petition SEC-00163 SEC Petition Evaluation Report for Petition SEC-00221
DOE/AWE Facility Name:	Lawrence Livermore National Laboratory

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SEC-00221 Addendum (1990–1995) to Lawrence Livermore National Laboratory Special Exposure Cohort Evaluation Report

SEC-00221 Addendum: Purpose

The Evaluation Report (ER) for Special Exposure Cohort (SEC) Petition 00221 for the Lawrence Livermore National Laboratory (LLNL), issued in February 2016, addressed data sufficiency and dose reconstruction feasibility conclusions for internal exposures from uranium-233 (U-233) exposures in Building 251 for the period from January 1, 1974, through December 31, 1989 [NIOSH 2016]. The ER did not address the entire NIOSH-qualified evaluation period (January 1, 1974–December 31, 1995). NIOSH reserved the remainder of the evaluation period (January 1, 1990–December 31, 1995) for further evaluation.

The SEC-00221 ER concluded that the following class should be added to the SEC: All employees of the Department of Energy, its predecessor agencies, and their contractors and subcontractors who worked in any area at the Lawrence Livermore National Laboratory in Livermore, California, during the period from January 1, 1974, through December 31, 1989, for a number of work days aggregating at least 250 work days, occurring either solely under this employment, or in combination with work days within the parameters established for one or more other classes of employees in the Special Exposure Cohort [NIOSH 2016].

The designation of the class by the U.S. Department of Health and Human Services listed the same employee class definition as the SEC-00221 ER. It stated that NIOSH had insufficient information to "…reconstruct internal radiation exposures for LLNL workers during the period January 1, 1974, through December 31, 1989" [Burwell 2016, PDF p. 4].

The purpose of this addendum is to complete the SEC-00221 petition evaluation for U-233, other internal dose contributors, and external dose contributors for LLNL for the period from January 1, 1990, through December 31, 1995.

SEC-00221 Addendum: Summary

Class Evaluated by NIOSH (in this Addendum)

All employees of the Department of Energy, its predecessor agencies, and its contractors and subcontractors who worked in any area at the Lawrence Livermore National Laboratory in Livermore, California, during the period from January 1, 1990, through December 31, 1995.

NIOSH-Proposed Class to be Added to the SEC

Based on its research of the class under evaluation, NIOSH has obtained quantitative information on the composition of U-233 used at LLNL during 1990–1995 and has confirmed that workers with the greatest internal exposure potential from U-233 received appropriate internal monitoring. NIOSH has confirmed the routine *in vivo* bioassays for the affected workers were sufficiently sensitive to the gamma-emitting constituents in the U-233 to allow NIOSH to bound internal doses received by those individuals.

NIOSH has found that sufficient internal and external monitoring data exist for other internal and external exposure sources encountered by LLNL workers from January 1, 1990, through December 31, 1995.

Based on its analysis of the available resources, NIOSH found no part of the class under evaluation for which it cannot estimate radiation doses with sufficient accuracy.

Feasibility of Dose Reconstruction

Per EEOICPA and 42 C.F.R. § 83.13(c)(1), NIOSH has established that it has access to sufficient information to: (1) estimate the maximum radiation dose, for every type of cancer for which radiation doses are reconstructed, that could have been incurred in plausible circumstances by any member of the class; or (2) estimate radiation doses of members of the class more precisely than an estimate of maximum dose. The information available from the site profile and additional resources is sufficient to document or estimate the maximum internal and external potential exposure to members of the evaluated class under plausible circumstances during the specified period.

Health Endangerment Determination

Per EEOICPA and 42 C.F.R. § 83.13(c)(3), a health endangerment determination is not required because NIOSH has determined that it has sufficient information to estimate dose for the members of the evaluated class.

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Revised Excerpts of the Evaluation Report

NOTE: From this point forward, for the purpose of completing the SEC-00221 evaluation for uranium-233 (U-233), other internal dose contributors, and external dose contributors for LLNL for the period from January 1, 1990, through December 31, 1995, this SEC-00221 Addendum only addresses corresponding sections of the SEC-00221 ER that require discussion. **Therefore, the section numbering is not contiguous. When deemed helpful to the reader, additional text from the SEC-00221 ER (issued February 2016) is included for context.**

3.0 SEC-221 LLNL Class Definitions

The following subsections address the evolution of the class definitions for SEC-00221, LLNL. When a petition is submitted, NIOSH reviews the requested class definition as submitted. Based on its review of the available site information and data, NIOSH will make a determination whether to qualify for full evaluation all, some, or no part of the petitioner-requested class. If some portion of the petitioner-requested class is qualified, NIOSH will specify that class along with a justification for any modification of the petitioner's class. After a full evaluation of the qualified class, NIOSH will determine whether to propose a class for addition to the SEC and will specify that proposed class definition.

3.2 Class Evaluated by NIOSH

Initially, NIOSH qualified the following class for evaluation under SEC-00221: All employees of the Department of Energy, its predecessor agencies, and its contractors and subcontractors who worked in any area at the Lawrence Livermore National Laboratory in Livermore, California, during the period from January 1, 1974, through December 31, 1995.

The SEC-00221 ER added a class to the SEC that included all LLNL workers, including those at Site 300, for the period from January 1, 1974, through December 31, 1989, and reserved the remaining period (January 1, 1990–December 31, 1995) for further evaluation. Therefore, the class evaluated in this addendum is: All employees of the Department of Energy, its predecessor agencies, and its contractors and subcontractors who worked in any area at the Lawrence Livermore National Laboratory in Livermore, California, during the period from January 1, 1990, through December 31, 1995.

3.3 NIOSH-Proposed Class to be Added to the SEC

NIOSH has obtained quantitative information on the composition of U-233 used at LLNL during 1990–1995 and has confirmed that workers with the greatest internal exposure potential from U-233 received appropriate internal monitoring. NIOSH has confirmed the routine *in vivo* bioassays for the affected workers were sufficiently sensitive to the gamma-emitting constituents in the U-233 to allow NIOSH to bound internal doses received by those individuals.

NIOSH found that sufficient internal and external monitoring data exist for other internal and external exposure sources encountered by LLNL workers from January 1, 1990, through December 31, 1995.

Based on its analyses of the available resources, NIOSH found no part of the class under evaluation for which it cannot estimate radiation doses with sufficient accuracy.

4.0 Data Sources Reviewed by NIOSH to Evaluate the Class

To locate information relevant to determining the feasibility of dose reconstruction for the class of employees under evaluation in this addendum, NIOSH continued its site research activities after completing the SEC-00221 ER in February 2016. For this addendum, NIOSH used a combination of broad and specific site research actions.

NIOSH's broad data capture activities included reviewing site records to footprint radionuclides of concern with respect to where and when those materials might have represented internal exposure potential. NIOSH performed these reviews at the LLNL site. NIOSH captured and reviewed records from the following LLNL facilities and collections:

- The Building Files collection maintained by the Hazards Control group,
- The LLNL Archives,
- The LLNL Records Center, and
- Material Control and Accountability (MC&A) records.

Information obtained from MC&A records prompted keyword-based searches in the LLNL Archives and the Records Center. Those searches were iterative, where NIOSH used results from initial searches to define more specific search criteria.

NIOSH used a listing of Environmental Safety and Health (ES&H)-related records provided by the LLNL Radiation Protection group to identify records of interest for physical review at the LLNL Records Center. Records obtained from those reviews included radiation control technician logs for various facilities (including Building 251), radiation survey reports, radiological control program documentation, facility safety procedures, incident reports, environmental sampling results, etc.

NIOSH needed information on specific site research activities to fully evaluate potential internal exposures in Building 251. The LLNL Nuclear Test Data group provided information on the concentration of trace constituents in U-233 used to fabricate tracer sets. NIOSH also formally interviewed the individual who served as the [Redacted per Privacy Act] during the 1990–1995 evaluation period [ORAUT 2024a] (see Section 4.3).

4.3 Facility Employees and Experts

In January 2024, NIOSH interviewed the [Redacted per Privacy Act] responsible for [Redacted per Privacy Act] and other activities involving U-233 in LLNL Building 251 during the 1990–1995 evaluation period. The interview took place in a secure conference room in LLNL Building 155. The interview team consisted of the NIOSH site lead for LLNL, a member of the LLNL Work Group, and two ORAU Team health physicists [ORAUT 2024a].

The individual confirmed that U-233 tracer sets were fabricated within manipulator cells. There was no internal exposure potential until the tracer capsules were removed from the cells. Respiratory protection was used during those pass-out operations. The individual did not recall any contamination events involving U-233 [ORAUT 2024a].

The individual stated the staff at Building 251 did a lot of their manipulator repairs and maintenance, so the workers with the greatest internal exposure potential were the radiochemists. The staff in Building 251 received chest counts annually and whole body counts every other year. They also submitted routine urine samples [ORAUT 2024a].

4.4 Previous Dose Reconstructions

NIOSH reviewed its Claims Tracking System to locate EEOICPA-related dose reconstructions that might provide information relevant to this addendum. Table 4-1 summarizes the results of this review. (Claims Tracking System data available as of March 28, 2024)

Table 4-1: Number of LLNL Claims Submitted Under the Dose Reconstruction Rule

Description	Totals
Total number of claims submitted for dose reconstruction	1444
Total number of claims submitted for energy employees who worked during the period under evaluation (January 1, 1990–December 31, 1995)	676
Number of dose reconstructions completed for energy employees who worked during the period under evaluation (i.e., the number of such claims completed by NIOSH and submitted to the Department of Labor for final approval)	190
Number of claims pulled* for energy employees who worked during the period under evaluation (January 1, 1990–December 31, 1995)	97
Number of claims for which internal dosimetry records were obtained for the period under evaluation (January 1, 1990–December 31, 1995)	215
Number of claims for which external dosimetry records were obtained for the period under evaluation (January 1, 1990–December 31, 1995)	659

* Refers to claims withdrawn from NIOSH by the Department of Labor with no dose reconstruction for various reasons (e.g., death of a claimants or survivor, creation of an SEC class, etc.)

NIOSH reviewed each claim to determine whether internal and/or external personal monitoring records could be obtained for the employee. From Table 4-1, of the total number of claims submitted for energy employees who worked within the period under evaluation in this addendum, 215 (32%) contain internal monitoring data and 659 (97%) contain external monitoring data.

4.5 NIOSH Site Research Database

NIOSH also examined its Site Research Database (SRDB) to locate documents supporting the assessment of the evaluated class. There were 8,235 documents in this database identified as pertaining to LLNL. They included radiation safety program requirements, both in general and for specific facilities or operations; internal monitoring requirements for specific facilities or operations; periodic radiation safety summary reports; facility safety procedures; operational safety procedures; radiation survey reports; radiation control technician (RCT) logs; personnel exposure reports; incident

and occurrence reports; program reviews and assessments; etc. NIOSH used these references throughout the evaluation process to identify pertinent information.

4.6 Other Technical Sources

A review of daily logs maintained by the Building 251 RCT during the 1990–1995 evaluation period showed that fabrication of U-233 tracer capsules continued beyond 1989 [LLNL 1987–1989; LLNL 1989–1990; LLNL 1990–1991; LLNL 1991–1992]. This prompted an evaluation to determine if NIOSH could bound internal doses from U-233 potentially received by workers in Building 251 during calendar years 1990 through 1992 when operations ended in Building 251. Specifically, NIOSH evaluated whether inhalation intakes of U-233 would have been detected in routine lung counts.

On its own, U-233 does not emit any gamma radiation that a lung count could detect. However, U-233 contains trace quantities of U-232, the decay products of which include significant gamma emitters. Therefore, the sensitivity of lung counting to intakes of U-233 depends on the amount of U-232 present.

NIOSH had a discussion with LLNL's [Redacted per Privacy Act] to determine if trace constituent information was available for the U-233 used in LLNL's tracer capsules. The individual confirmed that detailed information on the composition of tracer materials was present in classified reports. Through coordination between NIOSH, its contractor, the LLNL Nuclear Test Data group, and the LLNL Classification Office the LLNL Nuclear Test Data group produced an unclassified document containing consolidated trace constituent data for bomb fraction tracer isotopes used in Building 251 during the 1990–1995 evaluation period [Kerlin and Rose 2022].

5.0 Radiological Operations Relevant to the Class Evaluated by NIOSH

The following subsections summarize the information available to NIOSH to complete the SEC petition evaluations for U-233, other internal dose contributors, and external dose contributors for LLNL from January 1, 1990, through December 31, 1995. The information included within this evaluation report is intended only to be a summary of the available information for January 1, 1990–December 31, 1995, and it is not intended to discuss the entire LLNL site history.

5.1 LLNL Plant and Process Descriptions

LLNL is a multi-program laboratory operated for the Department of Energy (DOE). LLNL was formally established in 1952, approximately 40 miles east of San Francisco, in southern Alameda County, California. LLNL is comprised of two sites: (1) the 1.5-square-mile Main Laboratory Site located at 7000 East Avenue in Livermore, California, and (2) the nearly 11-square-mile Explosive Test Site, also known as Site 300, located 15 miles southeast of Livermore, near Tracy, California.

The original mission at LLNL was to develop thermonuclear weapons. By 1957, the mission was expanded to include diverse scientific and engineering research activities. Past research activities have included the development and testing of the nuclear weapons lifecycle, strategic defense research, development of arms control and treaty verification technology, fusion research, atomic vapor laser

isotope separation (AVLIS) for defense and commercial applications, magnetic fusion, energy research in basic energy sciences, atmospheric sciences, fossil energy, and commercial nuclear waste [NIOSH 2007, PDF p. 10].

The current LLNL mission is to serve as a national resource of scientific, technical, and engineering capability with a special focus on national security. This mission includes research and development, strategic defense, arms control and treaty verification technology, energy, the environment, biomedicine, the economy, and education.

5.1.1 Building 251

As confirmed in a January 2024 interview, Building 251 housed specialized equipment designed by in-house researchers specifically for manufacturing tracer sets [ORAUT 2024a]. Most of the tracer sets used in the U.S. Nuclear Testing Program were manufactured in Building 251 [Sullivan and Ullrich 2002].

Room 1235 of Building 251 contained the uranium tracer line used to fabricate tracer sets containing U-233 and U-235. The tracer fabrication process included pressing oxide powders into pellets and then soldering them into brass containers [Gray et al. 2006].

Basic research involving transplutonic materials, including rare isotopes, was also performed in Building 251. Work in the facility involved numerous exotic isotopes, notably curium (Cm) and americium (Am). The curium building inventory included Cm-242, Cm-243, Cm-244, Cm-246, and Cm-248. Am-241, Am-243, and Am-242m were also present. As an indication of how rare some of these isotopes are, only a few milligrams of Am-242m had ever been purified. Work in Building 251 also involved isotopes of californium (Cf-249 and Cf-252) and berkelium, and other higher actinides such as einsteinium. Pure forms of Pu-238 and Pu-242 were routinely used, and weapons-grade plutonium was also present [Gray et al. 2006, PDF p. 13].

In 1992, the United States ended its underground nuclear testing program, and Building 251 lost its principal mission. A decision was made in 1993 to cease programmatic operations in Building 251 [Gray et al. 2006], and the facility was placed in standby mode in 1995 [Sullivan and Ullrich 2002].

5.2 Radiological Exposure Sources from LLNL Operations in Building 251

Facilities and operations that represented sources of potential internal dose to LLNL workers from January 1, 1990, through December 31, 1995, included the following:

- Work with plutonium in the Plutonium Facility (Building 332) [ORAUT 2005, PDF p. 17] — The plutonium included varying concentrations of americium.

- Work with tritium in the Tritium Facility (Building 331) — The facility housed the Tritium Research Facility and associated laboratories. The bulk of the tritium inventory was in elemental form or adsorbed into metal hydrides [ORAUT 2005, PDF p. 17].

- Nuclear chemistry work — This included the processing of debris from underground nuclear device tests in Building 151 and fabrication of tracer sets for nuclear device testing in Building 251. Small-scale nuclear chemistry research was also performed in Building 281 [LLNL 1993, PDF p. 8].

- Work with depleted, normal, and slightly enriched uranium to develop the AVLIS process — AVLIS work occurred in Buildings 175, 177, 490, 491, and associated facilities [ORAUT 2005, PDF pp. 13, 17].

- Materials development and engineering activities, including nuclear materials management — Both mechanical engineering and nuclear materials management activities were performed in Buildings 231, 232, and 233. Nuclear materials management activities included receipt and packaging of controlled nuclear materials, decontamination of equipment contaminated with uranium or fission products, and the use of burn boxes for oxidizing depleted and enriched uranium [LLL 1981, PDF p. 6].

- Mechanical and electrical engineering research in the Building 131 complex — The complex included shops and laboratories that housed microelectronics and microfabrication work. Building 131 included a high bay facility that contained laboratory and fabrication capabilities [ORAUT 2005, PDF pp. 10–11].

- General chemistry research activities in the Building 222 complex — Some research activities involved small quantities of radioactive materials. [ORAUT 2005, PDF p. 15]

- Materials fabrication operations in the Building 321 complex: Buildings 321, 321A, 321B, and 321C — Operations in this complex included natural and depleted uranium machining. Hot pressing and heat treating of uranium components was also performed. Machining of radioactive materials was performed in Building 321C [ORAUT 2005, PDF p. 16].

- Non-nuclear explosives testing at Site 300 — Work at Site 300 included detonations of surrogate nuclear materials in bunkers equipped with high-speed cameras, data acquisition systems, linear accelerators, etc. [LLNL 1981, PDF p. 7; ORAUT 2005, PDF p. 19]

- Component testing in the High Pressure Laboratory (HPL), Building 343 — The Nuclear Explosives Engineering Division of the Mechanical Engineering Department operated the HPL. Test components sometimes included radioactive materials [LLNL 1990, PDF pp. 6, 11].

- Biological/biotechnological research occurred in the Building 361 complex (Buildings 361, 362, 363, 364, 365, 366, and 367) [ORAUT 2005, PDF p. 16].

- Radiological waste management activities occurred in Buildings 419, 514, 612, and related facilities [LLNL 1988a,b; LLNL 1998].

- Radiological control activities, which included bioassay and other radioanalytical services, occurred in Buildings 253 and 254, in addition to field health physics [ORAUT 2005, PDF p. 15].

5.2.1 Internal Radiological Exposure Sources

The principal sources of internal exposure potential for LLNL workers during 1990–1995 were plutonium (with americium), various actinide isotopes (including U-233), mixed fission products, uranium (depleted through slightly enriched), and tritium. See ORAUT-TKBS-0035-2, *Lawrence Livermore National Laboratory – Site Description* [ORAUT 2005] and ORAUT-TKBS-0035-5, *Lawrence Livermore National Laboratory – Occupational Internal Dose* [ORAUT 2020a] for additional information.

5.2.2 External Radiological Exposure Sources

The principal source of external radiation doses for members of the evaluated class included a wide variety of radioactive materials and radiation-producing machines such as electron accelerators, X-ray machines, cyclotrons, neutron generators, and a research nuclear reactor. Table 2-2 in ORAUT-TKBS-0035-2, *Lawrence Livermore National Laboratory – Site Description* [ORAUT 2005] summarizes building activities and radionuclides that workers could have encountered.

6.0 Summary of Available Monitoring Data for the Class Evaluated by NIOSH

The following subsections provide an overview of the state of the available internal and external monitoring data for the LLNL class under evaluation.

6.1 Available LLNL Internal Monitoring Data

The internal monitoring program in place during the 1990–1995 evaluation period is described in the *LLNL Internal Dosimetry Program Manual* [Mansfield 1989]. The manual prescribed the workplace and worker monitoring programs required for compliance with DOE Order 5480.11, "Radiation Protection for Occupational Workers."

6.1.1 *In Vitro* Bioassay (General)

LLNL maintains its official *in vitro* bioassay records in the form of hard copies stored in personnel files. LLNL has also used various electronic systems to store and manipulate occupational *in vitro* monitoring data. These include MAPPER, Symphony, and the Bioassay Laboratory Information Management System (BLIMS) database. Data from predecessor datasets were carried over to subsequent data systems (e.g., data from the MAPPER dataset are included in the Symphony dataset).

NIOSH has obtained exports of the MAPPER and Symphony data. The MAPPER dataset contains in vitro bioassay results from 1957 through 1996, and it overlaps with the Symphony dataset, which contains data from 1988 through 1996.

LLNL maintains tritium urinalysis results in a separate dataset, though some tritium urinalysis results also appear in the Symphony dataset. NIOSH has an export of an LLNL tritium dataset that contains results through October 1991.

NIOSH used exports of LLNL's *in vitro* bioassay datasets to examine internal monitoring practices for workers in a given facility, within a given period, etc. NIOSH does not use these datasets for dose reconstruction.

6.1.3 *In Vivo* Bioassay (General)

The "official" *in vivo* records are in the form of hard copies stored in personnel files. However, LLNL provided a chronological log of *in vivo* counts from 1988 through 1995 [Hickman 2015]. Each entry identifies the individual counted and the type of count performed, e.g., whole body scan, lung count for uranium, lung count for plutonium, etc. The log allowed NIOSH to determine if specific

individuals received in vivo bioassay during the 1990–1995 evaluation period and the type of counts performed.

6.2 Available LLNL External Monitoring Data

Details regarding LLNL's external monitoring practices and the associated records may be found in the *Lawrence Livermore National Laboratory – Occupational External Dose*, ORAUT-TKBS-0035-6 [ORAUT 2010a]. DOE provides external dosimetry records for energy employees who are the subject of EEOICPA claims. NIOSH uses those records to reconstruct the employee's measured and missed external doses.

For medical X-ray exposure, NIOSH has descriptions of the program, including the type and frequency of the required X-rays [ORAUT 2010b; LLNL 1991] and the types of machines used and their settings [Graham and Williams 1975; Myers and Williams 1979]. Details regarding the various analyses used and the associated minimum detectable activities are presented in *Lawrence Livermore National Laboratory – Occupational External Dose*, ORAUT-TKBS-0035-6 [ORAUT 2010a].

7.0 Feasibility of Dose Reconstruction for the Class Evaluated by NIOSH

The feasibility determination for the class of employees under evaluation in this report is governed by both EEOICPA and 42 C.F.R. § 83.13(c)(1). Under that Act and rule, NIOSH must establish whether or not it has access to sufficient information either to estimate the maximum radiation dose for every type of cancer for which radiation doses are reconstructed that could have been incurred under plausible circumstances by any member of the class, or to estimate the radiation doses to members of the class more precisely than a maximum dose estimate. If NIOSH has access to sufficient information for either case, NIOSH would then determine that it would be feasible to conduct dose reconstructions.

7.1.1 Internal Monitoring Data Pedigree Review

NIOSH has found LLNL's internal monitoring data to be of sufficient quality and quantity to represent internal doses for the 1990–1995 evaluation period. The data were generated from a comprehensive internal dosimetry program designed to meet the requirements of DOE Order 5480.11 (see Mansfield [1989]). NIOSH reviewed LLNL's *in vitro* and *in vivo* bioassay records and determined internal monitoring was appropriate for the internal dose contributors present in various work locations. In particular, NIOSH found internal monitoring for potential intakes of U-233 in Building 251 to be sufficient. Routine *in vivo* monitoring was confirmed for the workers with the greatest exposure potential from U-233.

7.1.2 External Monitoring Data Pedigree Review

As determined previously, NIOSH has found LLNL's external monitoring data to be of sufficient quality and quantity to represent external doses measured. No external monitoring data pedigree issues exist for the 1990–1995 period. NIOSH has not observed any data quality issues during claims processing or otherwise during this SEC evaluation.

7.2 Evaluation of Bounding Internal Radiation Doses at LLNL

The principal sources of internal exposure potential for LLNL workers during 1990–1995 were plutonium (with americium), various actinide isotopes, including U-233; mixed fission products, uranium (depleted through slightly-enriched), and tritium [ORAUT 2005; ORAUT 2020a]. The following subsections address the ability to bound internal doses, methods for bounding doses, and the feasibility of internal dose reconstruction.

7.2.1 Evaluation of Bounding Process-Related Internal Doses

The following subsections summarize the extent and limitations of information available for reconstructing the process-related internal doses of members of the evaluated class.

7.2.1.1 Urinalysis Information and Available Data

During the 1990–1995 evaluation period, workers included in LLNL's routine urinalysis program were monitored for one or more analytes: gross alpha, gross beta, plutonium, elemental uranium, or tritium. Urinalyses for additional analytes were used as needed in response to known or potential intakes associated with radiological incidents. Workers were identified for bioassay by the radiation control staff assigned to a given facility. Routine monitoring frequencies ranged from weekly to annually.

The Symphony dataset was used to examine urinalysis results for LLNL workers with respect to the monitored analytes and work locations.

Table 7-1 shows the urinalysis data in the Symphony dataset for the calendar years 1990–1995. The data are given as numbers of results and the corresponding numbers of individuals by analyte for each year. In each table, the routine analytes are followed by additional analytes reported in the Symphony dataset. Results reported as "plutonium" were included with those for plutonium-239 (Pu-239). Results reported as "U238" were included with those for elemental uranium.

The tritium urinalysis results in the Symphony dataset are not complete. As discussed in Section 6.1.1, a separate electronic dataset apart from the Symphony system was used for tritium urinalysis results. NIOSH has an export of the tritium dataset, but it does not cover all of the 1990–1995 period considered in this addendum. A comparison of the tritium results from the two datasets shows the tritium results in the tritium dataset are primarily for workers in Building 331, the LLNL tritium facility. The tritium results in the Symphony dataset are primarily for workers in the hazardous waste complex and Building 222, the analytical and physical chemistry facility. Therefore, the data in Table 7-1 do not represent the entirety of tritium urinalysis results for the 1990–1995 evaluation period.

Table 7-1: Urinalysis Results by Analyte from the Symphony Dataset

Analyte	Number of Results: 1990	Number of Workers: 1990	Number of Results: 1991	Number of Workers: 1991	Number of Results: 1992	Number of Workers: 1992	Number of Results: 1993	Number of Workers: 1993	Number of Results: 1994	Number of Workers: 1994	Number of Results: 1995	Number of Workers: 1995
Gross alpha	174	91	208	176	222	194	319	224	327	180	303	203
Gross beta	315	130	379	238	346	259	487	271	398	184	331	191
Uranium	1133	296	1412	543	1439	663	1536	531	842	301	970	386
Pu-239	332	183	319	261	398	357	481	364	440	258	385	270
Tritium	0	0	15	15	157	126	295	169	255	120	239	148
Am-241	0	0	[number redacted]	[number redacted]	[number redacted]	[number redacted]	[number redacted]	[number redacted]	14	[number redacted]	0	0
Cm-242	0	0	0	0	11[a]	[number redacted]	0[a]	0	0[a]	0	0	0
Cm-244	0	0	0	0	33	[number redacted]	[number redacted]	[number redacted]	[number redacted]	[number redacted]	0	0
Np-237	0	0	0	0	0	0	0	0	0	0	71[a]	[number redacted]
Pu-238	14	11	12	[number redacted]	[number redacted]	[number redacted]	[number redacted]	[number redacted]	[number redacted]	[number redacted]	0	0

Note: Some numbers were redacted due to Privacy Act concerns.

[a] The urinalysis results for curium isotopes in 1992–1994 were associated with a radiological incident that occurred in 1992. The 1995 neptunium-237 (Np-237) results were associated with an incident in 1995. Both incidents (1992 and 1995) involved internal exposure from puncture wounds to the fingers.

Tables 7-2 through 7-7 show the numbers of urinalysis results for each of the five routine analytes and the totals for all analytes for each calendar year from 1990 through 1995. The facilities and operations listed for each year are those that accounted for ≥95% of the total urinalysis results in the Symphony dataset. The ≥95% criterion resulted in some variability in the facilities and operations listed for each year. In particular, the Tritium Facility (Building 331) was not included for 1991 through 1995 because the tritium urinalysis results for Building 331 workers are not included in the Symphony dataset. The tritium facility is included among the facilities for 1990, but that was due to urinalysis results for analytes other than tritium.

NIOSH has an export of the LLNL tritium urinalysis dataset that contains results up to mid-November 1992. The dataset includes 1749 results from the calendar year 1990, of which 1358 (78%) were from workers in Building 331, the Tritium Facility. The next largest group was 109 results (6%) from the Building 361 complex (biological research). The data for 1992 do not cover the entire year but are similar to 1990. 80% of the results were for Building 331 workers. The next largest groups were 5% of results from the Building 361 complex and 4% from the Building 222 complex.

Footnotes to Tables 7-2 through 7-7 have been included for cases where the difference between the totals for all analytes versus the routine analytes was 10 or more.

Table 7-2: Urinalysis Results by Analyte for Principal Facilities/Operations for 1990

Facility/Operation	Gross Alpha	Gross Beta	Uranium	Pu-239	Tritium	Total for Routine Analytes	Total for All Analytes
AVLIS	0	0	641	0	0	641	641
Hazards Control	[number redacted]	[number redacted]	46	[number redacted]	0	64	64
Hazardous Waste Management	83	88	97	84	0	352	355
Material Fabrication	0	0	182	0	0	182	182
Mechanical Engineering/Nuclear Materials Management	15	15	24	15	0	69	69
Nuclear Chemistry	58	192	[number redacted]	[number redacted]	0	256	256
Plutonium Facility	12	12	14	224	0	262[a]	272[a]
Site 300	0	0	58	0	0	58	58
Tritium Facility	0	0	46	0	0	46	46

Note: Some numbers were redacted due to Privacy Act concerns.

[a] The difference is due to 10 Pu-238 results.

Table 7-3: Urinalysis Results by Analyte for Principal Facilities/Operations for 1991

Facility/Operation	Gross Alpha	Gross Beta	Uranium	Pu-239	Tritium	Total for Routine Analytes	Total for All Analytes
AVLIS	0	0	901	0	0	901	901
General Chemistry	35	69	64	35	[number redacted]	206	206
Hazards Control	[number redacted]	[number redacted]	34	[number redacted]	0	51	51
Hazardous Waste Management	75	75	93	75	12	330	330
Material Fabrication	0	0	148	0	0	148	148
Mechanical Engineering/Nuclear Materials Management	23	22	28	24	0	97	97
Nuclear Chemistry	57	195	12	[number redacted]	0	267[a]	279[a]
Plutonium Facility	10	10	19	181	0	220	222
Site 300	0	0	60	0	0	60	60

Note: Some numbers were redacted due to Privacy Act concerns.

[a] The difference is due to 12 Pu-238 results.

Table 7-4: Urinalysis Results by Analyte for Principal Facilities/Operations for 1992

Facility/Operation	Gross Alpha	Gross Beta	Uranium	Pu-239	Tritium	Total for Routine Analytes	Total for All Analytes
AVLIS	0	0	893	[number redacted]	0	894	894
General Chemistry	30	77	68	30	56	261	261
Hazards Control	[number redacted]	[number redacted]	26	[number redacted]	[number redacted]	61	62
Hazardous Waste Management	90	90	101	93	89	463	463
Material Fabrication	0	0	144	0	0	144	144
Mechanical/Electrical Engineering	[number redacted]	[number redacted]	16	12	0	38	38
Mechanical Engineering/Nuclear Materials Management	37	37	51	41	0	166	166
Nuclear Chemistry	43	120	[number redacted]	[number redacted]	[number redacted]	168[a]	219[a]

Facility/Operation	Gross Alpha	Gross Beta	Uranium	Pu-239	Tritium	Total for Routine Analytes	Total for All Analytes
Plutonium Facility	[number redacted]	[number redacted]	12	196	0	224	225
Site 300	0	0	95	[number redacted]	0	97	97

Note: Some numbers were redacted due to Privacy Act concerns.

[a] The difference is due to 44 curium results and 7 Pu-238 results.

Table 7-5: Urinalysis Results by Analyte for Principal Facilities/Operations for 1993

Facility/Operation	Gross Alpha	Gross Beta	Uranium	Pu-239	Tritium	Total for Routine Analytes	Total for All Analytes
AVLIS	0	0	880	0	0	880	880
General Chemistry	54	145	111	54	100	464	464
High Pressure Lab	0	0	46	0	0	46	46
Hazardous Waste Management	172	174	194	172	171	883	883
Material Fabrication	0	0	139	0	0	139	139
Mechanical Engineering/Nuclear Materials Management	33	33	38	35	0	139	139
Nuclear Chemistry	38	111	[number redacted]	[number redacted]	[number redacted]	158	165
Plutonium Facility	12	12	13	196	0	233	239
Site 300	0	0	76	[number redacted]	0	77	77

Note: Some numbers were redacted due to Privacy Act concerns.

Table 7-6: Urinalysis Results by Analyte for Principal Facilities/Operations for 1994

Facility/Operation	Gross Alpha	Gross Beta	Uranium	Pu-239	Tritium	Total for Routine Analytes	Total for All Analytes
AVLIS	[number redacted]	0	299	0	0	300	300
General Chemistry	48	94	83	39	75	339	339
Hazards Control	[number redacted]	10	28	[number redacted]	[number redacted]	64	64
Hazardous Waste Management	169	184	194	169	168	884	884

Facility/Operation	Gross Alpha	Gross Beta	Uranium	Pu-239	Tritium	Total for Routine Analytes	Total for All Analytes
Material Fabrication	0	0	110	0	0	110	110
Mechanical Engineering/Nuclear Materials Management	27	29	37	26	0	119	119
Nuclear Chemistry	65	72	12	15	[number redacted]	166	170
Plutonium Facility	[number redacted]	[number redacted]	[number redacted]	170	0	192[a]	212[a]
Site 300	0	0	61	[number redacted]	0	64	64

Note: Some numbers were redacted due to Privacy Act concerns.

[a] The difference is due to 14 Am-241 results and 6 Pu-238 results.

Table 7-7: Urinalysis Results by Analyte for Principal Facilities/Operations for 1995

Facility/Operation	Gross Alpha	Gross Beta	Uranium	Pu-239	Tritium	Total for Routine Analytes	Total for All Analytes
AVLIS	0	0	293	0	0	293	293
General Chemistry	50	69	61	19	48	247	247
Hazards Control	[number redacted]	[number redacted]	14	[number redacted]	[number redacted]	35	35
Hazardous Waste Management	183	204	205	184	183	959	959
Material Fabrication	0	0	78	0	0	78	78
Mechanical Engineering/Nuclear Materials Management	19	20	34	18	0	91	91
Nuclear Chemistry	35	23	179	13	0	250[a]	333[a]
Plutonium Facility	[number redacted]	[number redacted]	[number redacted]	127	0	149	149
Site 300	0	0	71	[number redacted]	0	73	73

Note: Some numbers were redacted due to Privacy Act concerns.

[a] The difference is due to 71 Np-237 results and 12 results where the analyte field was null.

The information in Tables 7-2 through 7-7 and the tritium dataset indicate that routine urinalyses were performed across the breadth of the LLNL facilities conducting operations that represented sources of potential internal exposure during the 1990–1995 evaluation period. The provided information also indicates the routine urinalysis program properly considered the sources of potential internal exposures that were present.

7.2.1.2 *In Vivo* Counting Information and Available Data

No database or similar compendium of *in vivo* monitoring data for LLNL workers currently exists. A review of LLNL *in vivo* monitoring data included in claim files shows LLNL workers were monitored using chest/lung counting, whole-body scans, or both. Workers in Building 251 were included in the routine *in vivo* monitoring program.

NIOSH obtained documents from its LLNL site research activities after the initial ER, including daily logbooks kept by the lead RCT for Building 251. The logbooks covered the period November 23, 1987, through December 1992. Programmatic operations in Building 251 ended in 1993 [Gray et al. 2006].

A review of the RCT logbooks showed that work with U-233, and bomb fraction tracer sets in general, was infrequent during the 1990–1995 evaluation period. [Redacted per Privacy Act] individuals were identified who routinely worked with U-233. A review of the *in vivo* log compiled by Hickman [2015] confirmed all [Redacted per Privacy Act] individuals received routine lung counts, including counts following the end of routine operations in Building 251.

As discussed in Section 4.3, an interview was held with the [Redacted per Privacy Act] responsible for [Redacted per Privacy Act] and other activities involving U-233 in Building 251 during 1990–1995. The individual stated that the workers with the greatest internal exposure potential were radiochemists [Redacted per Privacy Act]. [Redacted per Privacy Act] confirmed that the Building 251 staff received chest counts annually and whole body counts every other year. [Redacted per Privacy Act] did not recall any contamination events involving U-233 [ORAUT 2024a].

7.2.1.4 Alternative Data Sources for Bounding Internal Dose

NIOSH had a discussion with the [Redacted per Privacy Act] for LLNL to determine if trace constituent information was available for the U-233 used in LLNL's tracer capsules. The individual confirmed detailed information on the composition of tracer materials was present in classified reports. Through coordination between NIOSH, its contractor, the LLNL nuclear test data group, and the LLNL classification office the LLNL test data group produced an unclassified document containing consolidated trace constituent data for bomb fraction tracer isotopes [Kerlin and Rose 2022]. The data were used to evaluate the detectability of gamma-emitting trace constituents in routine bioassays for workers in Building 251.

7.2.2 Evaluation of Bounding Ambient Environmental Internal Doses

The technical basis document, ORAUT-TKBS-0035-4, *Lawrence Livermore National Laboratory – Occupational Environmental Dose* [ORAUT 2020b], provides maximum annual median air concentrations and intakes for significant internal dose contributors over the 1990–1995 period. Data are provided for plutonium, uranium, and tritium for both the LLNL main campus and Site 300.

7.2.3 Methods for Bounding Internal Dose at LLNL

The following subsections summarize the methods for bounding internal dose at LLNL.

7.2.3.1 Methods for Bounding Operational Period Internal Dose

The principal sources of internal exposure potential for LLNL workers during 1990–1995 were plutonium (with americium), various actinide isotopes, including U-233; mixed fission products, uranium (depleted through slightly-enriched), and tritium.

For plutonium, uranium, mixed fission products, and tritium, NIOSH has determined that data from the LLNL routine bioassay program will allow the estimation of internal radiation doses with sufficient accuracy from January 1, 1990, through December 31, 1995. The information presented in Section 7.2.1.1 shows routine and incident-related urinalyses across the facilities and operations that represented sources of potential internal dose to LLNL workers. The routine urinalysis program properly considered the sources of potential internal exposure that were present.

A particular focus of this addendum was the evaluation of dose reconstruction feasibility for potential intakes of U-233 by workers fabricating tracer sets in Building 251. The routine bioassay for those individuals included annual lung counts (see Section 7.2.1.2 and ORAUT [2024]). On its own, U-233 does not emit any gamma radiation that a lung count could detect. However, U-233 contains trace quantities of U-232. The U-232 decay series includes the significant gamma-emitting isotopes Pb-212-, Bi-212, and Tl-208. Therefore, the sensitivity of lung counting to intakes of U-233 depends on the amount of U-232 present.

As discussed in Sections 4.6 and 7.2.1.4, the LLNL nuclear test data group provided a document containing consolidated trace constituent data for bomb fraction tracer materials used during the 1990–1995 evaluation period [Kerlin and Rose 2022]. The trace constituent data included the range of U-232 concentrations in U-233. The U-232 concentration data were used in an evaluation to determine the intake that corresponded to an amount of U-232 in the lung that would have been detected by the LLNL chest counter. The evaluation considered an acute inhalation intake of U-233 six months prior to a routine chest count. To be conservative, the lower bound of the range of U-232 in U-233 was used [ORAUT 2024b]. NIOSH determined the routine chest counts received by LLNL workers involved with tracer set fabrication would have detected an intake of U-233 that represented a reasonable bound for internal doses hypothetically received by those individuals.

To follow up on the determination that internal dose from U-233 could be bounded based on routine lung counting, NIOSH reviewed records to determine if the workers involved with tracer set fabrication received routine lung counts. NIOSH reviewed the Building 251 RCT logbooks to identify individuals who worked with U-233 during 1990–1995. There were only [Redacted per Privacy Act] individuals. A review of the *in vivo* log compiled by Hickman [2015] confirmed all [Redacted per Privacy Act] individuals received routine lung counts, including counts following the end of routine operations in Building 251.

As discussed in Section 4.3, an interview was held with the [Redacted per Privacy Act] responsible for [Redacted per Privacy Act] other activities involving U-233 in Building 251 during 1990–1995. The individual stated that the workers with the greatest internal exposure potential were radiochemists [Redacted per Privacy Act]. [Redacted per Privacy Act] confirmed that the Building 251 staff received lung counts annually and whole body counts every other year. [Redacted per Privacy Act] did not recall any contamination events that involved U-233 [ORAUT 2024a].

The evaluation of dose reconstruction feasibility for U-233 from January 1, 1990, through December 31, 1995, found that routine lung counting was sufficient for bounding internal dose that might have

occurred and the individuals with the highest exposure potential received routine counts. Site data obtained subsequent to the initial evaluation for SEC-00221 showed that the preparation of U-233 tracer sets was an infrequent, as-needed operation performed within manipulator cells. Internal exposure potential was limited to pass-out operations from the cells when respiratory protection was used. U-233 intake potential was limited to three individuals. Internal exposure from U-233 would only have occurred in the event of a significant radiological incident. No such incidents are documented in the Building 251 RCT logs, and the [Redacted per Privacy Act] responsible for the preparation of tracer sets stated that no such incidents had occurred. Given the lack of exposure potential for other employees, access control measures were not an issue. Therefore, NIOSH has found that it can estimate internal radiation doses from hypothetical intakes of U-233 from January 1, 1990, through December 31, 1995, with sufficient accuracy.

In summary, NIOSH has found no internal dose contributors for which it cannot estimate internal radiation doses with sufficient accuracy for all members of the evaluated class.

7.2.3.2 Methods for Bounding Ambient Environmental Internal Dose

As discussed in Section 7.2.2, ORAUT-TKBS-0035-4, *Lawrence Livermore National Laboratory – Occupational Environmental Dose* provides maximum annual median air concentrations and intakes for significant internal dose contributors for both the main campus and Site 300 during the 1990–1995 evaluation period [ORAUT 2020b]. Therefore, NIOSH found that it can estimate ambient environmental internal doses with sufficient accuracy for all members of the evaluated class.

7.2.4 Internal Dose Reconstruction Feasibility Conclusion

This evaluation concludes that NIOSH can reconstruct internal dose with sufficient accuracy for all members of the evaluated class. NIOSH found that LLNL's in vitro bioassay program sufficiently covered the facilities and operations that represented sources of potential internal dose and properly considered the sources of potential internal exposure. Trace constituent data obtained for U-233 used in tracer set fabrication in Building 251 were used in an evaluation that showed internal dose from potential intakes of that material could be bounded based on routine in vivo bioassay (lung counting). Records reviews and an interview with LLNL staff confirmed that individuals with the highest potential for internal dose from U-233 received routine lung counts. NIOSH can sufficiently reconstruct the ambient environmental internal dose using the information in ORAUT-TKBS-0035-4, *Lawrence Livermore National Laboratory – Occupational Environmental Dose* [ORAUT 2020b].

7.3 Evaluation of Bounding External Radiation Doses at LLNL

The following subsections address the ability to bound external doses and the feasibility of external dose reconstruction.

7.3.1 Evaluation of Bounding Process-Related External Doses

The following subsections summarize the extent and limitations of information available for reconstructing the process-related external doses for members of the evaluated class.

7.3.1.1 Personnel Monitoring

Photon and Beta

The LLNL site issued thermoluminescent dosimeter (TLD) badges for personal dosimetry during the 1990–1995 evaluation period. Dosimeter types, exchange frequencies, limits of detection, and estimates of missed doses are provided in Table 6-4 in ORAUT-TKBS-0035-6, *Lawrence Livermore National Laboratory – Occupational External Dose* [ORAUT 2010a, PDF p. 18].

DOE provides personnel monitoring data to NIOSH upon request, and external photon and beta dose is reconstructed using the guidance in ORAUT-TKBS-0035-6. Data made available to NIOSH have proven sufficient to estimate external doses from photon and beta exposures for all members of the evaluated class.

Neutron

LLNL site procedures required neutron dosimetry for workers who may have been exposed to neutron radiation. Table 6-5 in ORAUT-TKBS-0035-6, *Lawrence Livermore National Laboratory – Occupational External Dose* lists the time periods for the types of neutron dosimetry, the exchange frequencies, limits of detection, and estimates of missed dose [ORAUT 2010a, PDF p. 19].

The neutron monitoring TLDs and CR-39 Track Etch dosimeters used during the 1990–1995 evaluation period provided adequate results for reconstructing neutron dose. DOE provides neutron monitoring data to NIOSH upon request, and external neutron dose is reconstructed using the guidance in ORAUT-TKBS-0035-6. Data made available to NIOSH have proven sufficient to estimate neutron doses for all members of the evaluated class.

7.3.2 Evaluation of Bounding Ambient Environmental External Doses

NIOSH reviewed and evaluated ambient environmental external exposures for the period 1990–1995 and found that ORAUT-TKBS-0035-4, *Lawrence Livermore National Laboratory – Occupational Environmental Dose* provides annual average and maximum gamma and neutron doses for the main campus and Site 300 over the 1990–1995 evaluation period. NIOSH has determined that these ambient environmental external dose data are sufficient for estimating such doses for all members of the evaluated class.

7.3.3 LLNL Occupational X-Ray Examinations

ORAUT-TKBS-0035-3, *Lawrence Livermore National Laboratory – Occupational Medical Dose* describes the assumptions for estimating medical X-ray exposures at LLNL [ORAUT 2010b]. Table 3-2 in ORAUT-TKBS-0035-3 lists the dates and specific equipment used, along with their operating parameters [ORAUT 2010b, PDF p. 8]. NIOSH therefore concludes it can reconstruct occupational medical dose with sufficient accuracy for all members of the evaluated class.

7.3.5 External Dose Reconstruction Feasibility Conclusion

NIOSH completed a review and evaluation of external exposures for the period 1990–1995 and found the following:

- LLNL replaced film badges with TLDs in the late 1960s.

- The LLNL external dosimetry program has been certified by the DOE Laboratory Accreditation Program (DOELAP) since 1989 [DOE 1990, PDF p. 312; LLNL 2002, PDF p. 2].

- ORAUT-TKBS-0035-6, *Lawrence Livermore National Laboratory – Occupational External Dose* provides facility-specific information for applicable beta/gamma and neutron energy bins, including for Site 300.

- ORAUT-TKBS-0035-4, *Lawrence Livermore National Laboratory – Occupational Environmental Dose* provides annual average and maximum gamma and neutron doses for the main campus and Site 300.

NIOSH concludes that it can estimate external doses for photon, beta, and neutron exposures with sufficient accuracy for all members of the evaluation class. Photon, beta, and neutron exposures were properly monitored using TLDs. The DOE mandated compliance with the DOE Laboratory Accreditation Program for external dosimetry prior to the 1990–1995 evaluation period. ORAUT-TKBS-0035-6, *Lawrence Livermore National Laboratory – Occupational External Dose* provides facility-specific information regarding the applicable photon, beta, and neutron energy bins to use for external dose reconstruction [ORAUT 2010a].

The initial SEC-00221 ER, issued in February 2016, determined that the medical dose could be reconstructed for 1974–1989 using ORAUT-TKBS-0035-3, *Lawrence Livermore National Laboratory – Occupational Medical Dose* [ORAUT 2010b]. Two upgrades to LLNL's occupational X-ray equipment during 1990–1995 are documented and accounted for in ORAUT-TKBS-0035-3. NIOSH concludes that occupational medical dose can be estimated with sufficient accuracy for all members of the evaluated class using the information in ORAUT-TKBS-0035-3, *Lawrence Livermore National Laboratory – Occupational Medical Dose* [ORAUT 2010b].

7.6 Summary of Feasibility Findings for Petition SEC-00221

This report evaluates the feasibility of completing dose reconstructions for employees at LLNL from January 1, 1990, through December 31, 1995. NIOSH found that the available monitoring records, process descriptions, and source term data are sufficient to complete dose reconstructions for the evaluated class of employees.

Table 7-8 summarizes the results of the feasibility findings at LLNL for each exposure source during the evaluated time period from January 1, 1990, through December 31, 1995.

Table 7-8: Summary of Feasibility Findings for SEC-00221 (January 1, 1990–December 31, 1995)

Source of Exposure	Reconstruction Feasible
Internal	**Yes**
All radionuclides	Yes
External	**Yes**
Gamma	Yes
Beta	Yes
Neutron	Yes
Occupational Medical X-ray	Yes

8.0 Evaluation of Health Endangerment for Petition SEC-00221

NIOSH's evaluation determined that it is feasible to estimate radiation dose for members of the NIOSH-evaluated class (January 1, 1990–December 31, 1995) with sufficient accuracy based on the sum of information available from available resources. Therefore, a health endangerment determination is not required.

9.0 Class Conclusion for Petition SEC-00221

Based on its research of the class under evaluation, NIOSH found no part of the evaluated class for which it cannot estimate radiation doses with sufficient accuracy. This class includes all employees of the Department of Energy, its predecessor agencies, and its contractors and subcontractors who worked in any area at the Lawrence Livermore National Laboratory in Livermore, California, during the period from January 1, 1990, through December 31, 1995.

10.0 References

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Attachment One: Data Capture Synopsis

Table A1-1: Summary of Holdings in the SRDB for LLNL (Collected after February 2016)

Data Capture Information	Data Capture Description	Date Completed	Number Uploaded into SRDB
Primary Site/Company Name: Lawrence Livermore National Laboratory (LLNL) DOE 1952-Present **Physical Size of the Site:** - 7,617 acres (owned) (as of FY23) - 506 buildings/trailers -6.5 million gross square footage (GSF) in active buildings (1) Main site, which is 821 acres housing 497 facilities that cover 6.7 million sq feet. (2) Site 300, which is 7,000 acres housing ~216 facilities that cover 0.4 million sq feet. Site 300 was established in 1953. **Site Population:** (as of FY23) Currently the site has 9,291 employees. - 12 joint faculty - 321 postdoctoral researchers - 144 undergraduate interns -162 graduate students The employee population in 1958 was 3,000.	10 CFR 835 assessments of LLNL, annual report of environmental levels of radioactivity, beta and alpha counter efficiency data, computer printout listing employee numbers and film badge numbers, aerial survey results for SNL/CA and LLNL, bioassay turnaround time report, dose summary, radiation doses in various buildings, radiation safety annual facility report, effluent monitoring report, AVLIS radiological safety, quarterly report on external dosimetry, stack emissions reports, dosimetry records for plutonium building workers, ALARA goals, area air monitoring results, hazard analysis of uranium inhalation at the Lawrence Livermore Laboratory, tritium release from Lawrence Radiation Laboratory (LRL), neutrons inside the containment of a pressurized water reactor, accident investigation report puncture wound by glass contaminated with transuranic material, accidental radon overexposure, accuracy of bioassay analyses, activation experiments at Super-Kukla, air sampling locations - Site 300, air transfers of radioactive materials, area swipe data sheets, AVLIS decontamination and demolition plan, personnel bioassay sample results, NESHAPS report, accidental removal of Cf-252 source from safety shield, perchloric acid tube explosion in glove box, contamination surveys, vault layout with radiation survey readings, background and efficiency data record, bioassay laboratory procedure manual, bioassay results, building floor plans, LINAC Health Physics notes, dosimetry study, radioactive isotope inventory log, special saliva bioassay sample, personnel external dosimetry report, Albedo neutron dosimeter list, Dale Hankins' notebook, neutron yield measurements at Shiva, discipline action plan Health Physics, Am fecal samples, Co-60 and P-32 fecal samples, dosimetry from Tango T-15, E Beam test equipment, environmental backgrounds, environmental monitoring at the Lawrence Livermore Laboratory annual report, estimate of employee whole body radiation exposure with plutonium lab survey, external exposure records, facility safety plan waste storage facilities and building, film badge and pocket dosimeter information, radiation safety report, fluorometric uranium urinalysis, hazard classification, hazards control quarterly reports, Health Physics program review and responses, internal dose assessments, lapel samples, building deactivation, decontamination, decommissioning, and demolition project execution plan, LLNL operational safety procedures, lung counter MDA data, maps of contaminated material burial pits, medical X-ray exposure evaluation, MTX ionizing radiation shielding requirements and facility layout, neutron exposures, neutron shielding, Nevada Test Site (NTS) personnel gamma radiation exposures summary, NTS exposure for LRL personnel, off-site radiation dose from buildings, phantom details and checklist, phoswich source checks, PLUTO quarterly reports, plutonium bioassay sampling, curves for Pu and Am, post shot bioassays, Project Pluto staff meeting minutes, neutron source strength of Tory II, radiation safety inspections, radiological analysis of Special Isotope Separation (SIS) decon facility, radiological hazards survey Astron operations, radiological safety analysis for conducting D-T shots in the nova target vessel, Ramjet Reactor tests begin in Nevada, results of building 321 fire, retention tank log April 1972 and U, Th, Am and Pu extraction calculations, dose from remelting heterogeneous plutonium metal, RML data GAB air spreadsheet, rotating target neutron source radiation safety program, safety analysis for neutron radiography, shielding measurements, Shiva Nova interim report laser fusion program, Site 300/400 air monitoring, skyshine, status of operational safety procedure, facility safety procedures and accident reports, storage of fuel grade plutonium in MBA-100, technical safety appraisal of building, history of radiobioassay analysis at LLNL, Livermore Pool Type Reactor (LPTR) design data, LLNL CR-39 personnel neutron dosimeter, National Ignition Facility Laser and Target Area Building conventional facilities environmental, safety, and health report, thyroid radioiodine intercomparison program, Tiger Team assessment of LLNL, TLD calibration curves, Tory II-A report, Tory IIC reflector thickness total power study, tritium bioassay results, tritium releases from buildings, uranium in urine bioassay results, and whole body count logs.	03/04/2024	3,233

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State Contacted: NA	Contacting the state was not considered necessary since LLNL is an active DOE site and cooperates with relevant data collection.	03/21/2024	0
Argonne National Laboratory East (ANL-E)	Monthly Operation Clean Sweep Status Reports 1983, LMFBR Program Office Weekly Reports February - December 1970, Safety Analysis Report for the Decontamination and Decommissioning of the CP-5 Research Reactor, External Dosimeter Testing 1978-1981, Bioassay Program Reports 1980, Patent Information for Concentration and Separation of Actinides From Biological and Environmental Samples, Internal Exposure Data 1954-1989.	01/27/2020	7
Claimant Provided	Explanatory notes from summary of bioassay results from individual dosimetry records, links between exposure to occupational hazards and illnesses in the DOE contractor workforce, re-suspension and ingestion of radioactive particles in the air, heavy ion fusion program 1999-2002, Spheromak magnets 1999-2001, and the Toshiba Project 1996-1998.	02/14/2019	12
Cincinnati Operation Center (COC) Library	Health Physics Technical Support Team Trip Report Paducah Gaseous Diffusion Plant and Portsmouth Gaseous Diffusion Plant	07/16/2018	1
Division of Compensation Analysis and Support (DCAS) Special Exposure Cohort (SEC) Viewer	Y-12 Continues Missions While Focusing on Environment, Special Exposure Cohort Petition-Form B for SEC-00256 Pinellas Plant, Special Exposure Petition SEC-00256 Pinellas Plant, Case Control Study of Multiple Myeloma Among Workers Exposed to Ionizing Radiation and Other Physical and Chemical Agents - Final, Examples of Types of Accidents or Occupationally-Related Disease That Have Resulted or Could Result in a Workmen's Compensation Claim or Civil Suit.	07/12/2021	5
DOE Environmental Management Consolidated Business Center (EMCBC) – Cincinnati	Activity Reports for Radiation Protection and Health Physics Services, Area and Smear Surveys Building 104 Mass Spectrometer Lab, SSFL Newspaper Articles, Draft Environmental Radiological Protection Plan Guidance, Radiation Articles-Downwind from the Cold War. In: In Health July - August 1990, NESHAP Reviews in DOE Complex, Reports on Diffuse/Fugitive Air Emission of Radionuclides, Analytical Results for Air Samples and NESHAP Effluent Releases, Public Testimony of the University of California on the Proposed Revision 1 of 10 C.F.R. 835, Defective Drum - RHO Waste Shipment SSFL September 15, 1981, Shipping Logbooks, Radwaste monthly reports.	07/03/2023	25
DOE EMCBC, Denver	Investigation of the Tritium Release Occurrence at The Rocky Flats Plant Extract, DOE Performance Indicator Pilot Program, Investigation of Neptunium Crossover July 14, 1967, Production-Scale Plutonium-Neptunium Separation and Residue Recovery at Rocky Flats Plant, History of Buried Transuranic Waste at INEL Including Work Scope for the Retrieval Project of the Buried Waste Program – Draft, Waste Management Program History of Buried Transuranic Waste at INEL Attachment 1, Waste Management Program History of Buried Transuranic Waste at INEL Attachment 2.	04/06/2018	5

Data Capture Information	Data Capture Description	Date Completed	Number Uploaded into SRDB
DOE Legacy Management - Grand Junction Office	Historical Operations Conducted in JN-4, Interview Summary Identifying Defense Projects, Confirming that More Than 93% Enriched Uranium Could Only Be Attributed to Naval Reactor Fuel, Interview Record of George Kirsch and Harley Toy, Miscellaneous DOE and Battelle Columbus Correspondence Relating to Discussions of the Amount of Government Research Performed by Battelle Laboratories and Responsibility of Cost Management of the D&D Operations, Preliminary Summary Describing Work Conducted at Albany Metallurgy Research Center, Preliminary Summary Describing Work Conducted at Albany Metallurgy Research Center, Contact Report: Albany Bureau of Mines, Survey Work Conducted at Albany Metallurgical Research Center, Information on Radioactive Wastes and Contract with Lawrence Livermore Laboratories, National Federal Facility Compliance Agreement (FFCA) on the Storage of Polychlorinated Biphenyls, Concentrations of Plutonium in Soil – Draft, Selection of Survey Points, Pu-239 Activity in Soil Samples, Concentrations of Plutonium in Soil, Site of Initial Discovery of Plutonium Contamination, Preliminary Tritium Investigation - Analyses of Tritium in Soil Moisture From Drill Hole Samples, Plutonium Chemistry Results for Post-Cleanup Samples Tank 138, Septic Tanks - Contaminated and Uncontaminated, General Summary of Environmental Sampling for TA-1 Cleanup Operations, The Current and Planned Low-Level Waste Disposal Capacity Report Revision 2, Transfer of Columbium to Oak Ridge (OR), Containment Practices in Alpha and Alpha-Gamma Facilities, Downdraft Table for Handling High Radiotoxicity Alpha Emitters, Review of ES&H Procedure 3.8 Internal Radiation Dosimetry Program, Review of Revision to ES&H Procedure 3.8 "Internal Radiation Dosimetry Program", Internal Radiation Dosimetry Program, Review of UNC Geotech's Interim Bioassay Program, Review of UNC Geotech's Interim Bioassay Program by LLNL, Evaluation of 1986 Bioassay Data, Technical Basis Document for Bioassay Support Services (ERDI-146-91).	08/15/2019	41

Data Capture Information	Data Capture Description	Date Completed	Number Uploaded into SRDB
DOE Legacy Management - Morgantown	Hazardous Chemical Defense Waste Management Program FY1984 Status Report, Proposed Standards for Radionuclides, Background Information Documents, Advance Planning Department Monthly Progress Report for January 1984, Advance Planning Department Monthly Progress Report for December 1983, Monthly Progress Reports, Precious Metals Activity FY1990, Beryllium Disease Notification Program, Resumption of Nuclear Materials Shipping and Receipts, SARA 312 Chemical Inventory Report, Thorium Inventory by Location, Summary of Material Description Code, Thorium Inventory by Location, Reporting of Pollution Abatement Projects/OMB Circular A-106 2nd Update for FY1991, Reporting of Pollution Abatement Projects/OMB Circular A-106 2nd Update for FY1991, DOE Instructions 2nd Update of the Circular A-106 Plan FY1991, Guidance for Preparing Federal Agency Pollution Abatement Plans FY1991, Federal Facility Compliance Hierarchy, Control Technology for Radioactive Emissions to the Atmosphere at U.S. DOE Facilities, Advance Planning Department Monthly Progress Report for March 1976, Worker Health Issues at Nuclear Weapons Plants Background History of Health Issues, Epidemiology Project Summary, Human Health Effects of Plutonium Research Program, Environmental, Safety and Health Needs of the U.S. DOE, Volume 2: Site Summaries, Summary of Production Orders, Isotopic, and Additive Contents, September 1985, Changes to the FY1987 Information Technology Resources Long-Range Plan Call, DOE Ohio Sites Recycled Uranium Project Reports, Extrusion Plant (RMI) Receipts and Shipments, Plutonium Urinalysis Information Material, Request for Abney and Casey Pu Sample Results, Intake Retention Charts - Urine - Pu-239, Estimated Eff Dose Equivalent, Minimum Detectable Activity for Fecal Sample for Pu-239 & 238, University of Lowell Intake Tables, Pu-241 Results for Number 1818, Request for Information about POOS, Information to Assist in Interpreting Plutonium Bioassay Results, Planning and Control Division Highlights for March - July 1985, Dosimetry History for multiple personnel, Multiple Personnel Radiation Exposure History, Radiological Analysis Results for Isotopic U and Th in Urine, Technical Basis Document for Internal Dosimetry, Bioassay Results 1989-1995, Internal Dosimetry Considerations for the Thermal Desorption Project, Multiple Bioassay Results, Radiological Analysis Results for Isotopic U and Ra in Urine, Bioassay Report for Grand Junction, Radiochemical Analysis Results TMA Corporation, Bioassay Report 741, Radiochemical Analysis Results TMA Corporation, Bioassay Analysis Results for Isotopic U, Ra-226 and Th-230 in Urine July 1991, Bioassay Analysis Results for Isotopic U, Ra-226, and Th-230 in Urine July 1991, Bioassay Analysis Results for Isotopic U and Th-230 in Urine, Routine TLD Issue Logbook, Review of Preliminary Estimate of Costs and Health Benefits of Applying Alternative Control Levels for Airborne Emissions of Radionuclides, Comments on Battelle's Preliminary Estimate of the Costs of Proposed NESHAPS for Radionuclide Emissions, Estimate of Potential Costs and Benefits of Attaining or Maintaining Compliance at DOE's Facilities, Preliminary Estimate of the Costs and Health Benefits of Applying Alternative Control Levels for Airborne Emissions of Radionuclides From Sites Under DOE's Jurisdiction, Update on Status of EPA Clean Air Act Rulemakings Under 40 CFR Part 61 (Benzene and Radionuclides), U.S. DOE Design Criteria Building 200 Exhaust System Pinellas Plant.	10/06/2022	85
DOE Office of Scientific and Technical Information (OSTI)	Report on survey of irradiation facilities, annual reports of radioactive waste shipments, performance testing of personnel dosimetry services, nuclear science abstracts, electronuclear conversion of fertile to fissile material, stable isotope and heavy element inventories, isotope sales documents, thorium documentation involving thorium oxide, research and development semiannual progress report, uranium 233-235 crossover incident, neptunium processing at the Rocky Flats Plant, ORNL Health Physics appraisal, PLUTO Program quarterly progress report, and possible eye damage from ARGUS shot, Human Radiation Experiments: The Department of Energy Roadmap to the Story and the Records, United States Department of Energy Environmental Restoration and Waste Management Site Maps and Facilities Listings, Annual Reports of Radioactive Waste Shipments to and From NTS, Performance Testing of Personnel Dosimetry Services, Supplementary Report of a Two-Year Pilot Study, annual environmental reports.	07/21/2023	50

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Environmental Protection Agency (EPA)	Southwestern Radiological Health Laboratory Monthly Activities Reports, Western Environmental Research Laboratory Monthly Activities Reports, Monthly Report Southwestern Radiological Health Laboratory.	11/29/2018	27
FRC - Denver	Special radiation work permits, final radiological report for X-tunnel, photodosimetry evaluation book Volume IV, mixed waste streams, and options for recovery of Pu-244 in the MARK 18a targets at the Savannah River Site, Processing and Incidents, Beryllium Purchasing, Usage, Processing and Incidents, Environmental Assessment for the Relocation of the Weapons Component Testing Facility and Finding of No Significant Impact Weapons Component Testing Facility Relocation, Health Study of Plutonium Workers Protocol for a Morbidity and Mortality Study, Multiple Health Physics checklist.	08/19/2019	13
FRC - Lee's Summit	Acceptance of WAPS Radionuclide Release Reports, Hanford Review Comments on: High-Level Nuclear Waste Borosilicate Glass: A Compendium of Characteristics September 15, 1992 Draft, Waste Management Programmatic Environmental Impact Statements, Safety Analysis Reports, DOE Performance Indicators Environment, Safety and Health Period Ending September 1998, Unusual Occurrence Reports and Accident/Incident Reports, High-Level Waste Transfer System Safety Evaluation, Emergency Plans, Whole Body Counter Studies, ORNL Whole Body Counter Evaluation Data 1994, Fire Hazard Analysis Main Process Plant WVNS-FHA-011 Rev. 0 September 3, 1996, EPA Reports, Nuclear Waste Material Monthly Reports, Safety Evaluation Reports, Low-Level Waste Management Reports.	06/08/2016	66
FRC - San Bruno	Multiple Progress Reports, Corrective Action Plan to the Report of the Task Group on Operation of Department of Energy Tritium Facilities, Hazard exposure investigation surveys, Review of Livermore - Safety Procedure Manuals, Radium Sources surveys, Incident investigation reports, Multiple Radiation Safety Programs, Multiple Environmental Sampling Survey reports, Procedure for Preparation, Issuance and Return of Radioactive Sources, Evaluation and Comparison of Materials for Neutron Shielding and Estimation of Exposure Dose Rate From Fission Neutron Point Sources Through Shielding Procedure, Multiple Environmental reports, Health Physics Aspects of Whole Body Radioisotope Therapy - The Use of Y-90, Status of Health Chemistry Sources, Multiple External Dosimetry surveys and reports, Alpha Activity in Air Samples Taken in Conjunction With the Demolition of Room 309, Old Chemistry Building March - May 1957, Summary of Whole Body Radiation Exposures to External Penetrating Radiation Accumulated During the Year 1958, Neutron Monitoring at Livermore, Bldg. 106 LBNL 1953, Design and Use of Uniform High Intensity Co-60 Irradiation Chambers, Operational Safety Procedures and Environmental Impact of Tritium Releases at Lawrence Berkeley Laboratory National Tritium Labeling Facility, Annual Performance Evaluation for Lawrence Berkeley National Laboratory's Thyroid Bioassay Programs in 1997.	02/11/2020	287
Fermi	Forward Neutron Production at the Fermilab Main Injector Fermi 2010	09/07/2022	1
Goldberg, Persky and White PC – Mancuso Collection	AEC Contractors for Which We Have Records in the Master Roster as of July 31, 1973, AEC Health and Mortality Study, Study of Hanford Employee and Controls and Renewal Proposal Contract CH AT(11-1)-3428.	01/17/2017	2
Hanford	Hanford Radiological Protection Support Services Annual Reports, Workshop on Personnel Neutron Dosimetry, Operational Accidents and Radiation Exposure Experience Within the United States Atomic Energy Commission, Gross Beta Urinalysis reports, Standards for Respiratory Protection, Counter Calibrations in the Health Instrument Methods, American National Standard for Dosimetry - Internal Dosimetry Programs for Tritium Exposure - Minimum Requirements, History and Stabilization of the Plutonium Finishing Plant (PFP) Complex, Hanford Site, Summary of Information on Neptunium Oxide Shipment From Hanford To UCRL, History and Stabilization of the Plutonium Finishing Plant (PFP) Complex, Hanford Site, Report Radiation Protection from multiple departments within the site, Americium Recovery From Technical Scrap (November 5, 1951), Hanford Laboratories Operation Monthly Activities Reports, Monthly Report Chemical Processing, Health Division Annual Reports, PUREX Plutonium Oxide Contract.	04/22/2020	65

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Idaho National Laboratory (INL)	Studies of Neutron Dosimetry at the Lawrence Livermore Laboratory, Thermoluminescent Dosimeters, Tritium Experience Reports, Personnel Dosimetry and Exposure Controls, Radiation equipment calibration information, Bioassay Reports, Health Physics Annual and Upgrade Status Reports, Dosimetry monthly reports, Dosimetry Programs, Radioactive Shipment Records, Health Physics Log Sheets, Internal Dose Monitoring Program Upgrade, Safety Analysis Reports, Radioactive Material Shipment Record, ID-127 Solid Radioactive Waste Reports, Nuclear and Chemical Technology Division Technical Program Monthly Progress Report August 1966, Radiation Exposures Which Occurred in the Commission's Activities, Summary of all Incidents, Film Badge Reports, Control of Radioactive Contamination, Health and Safety Personnel and Functional Representatives U.S. AEC and Contractors March 1967, Recommendations for DOE, Bioassay and Treatment, Personnel Dosimetry and Records System, LLNL Visitor Annual Report, The Livermore Phantom as a Calibration Standard in the Assessment of Plutonium in Lungs, Summaries of Epidemiologic Studies of DOE Radiation Workers August 1987, Idaho National Engineering Laboratory Solid Radioactive Waste Management Databases for Waste at the Radioactive Waste Management Complex, Traffic Logs Post records for visitors, Lung Counter Logbooks, Multiple ICPP Visitor Cards.	12/15/2022	159
INL Environmental Data Management System (EDMS)	External Dosimetry Files, Historical Report of Transuranic Waste Pits and Trenches at the Subsurface Disposal Area of Radioactive Waste Management Complex at the INEL, Rocky Flats Information for the AEC Plutonium Storage and Plutonium Processing Task Force Part I - Data Base, Central Characterization Project Acceptable Knowledge Summary Report for Waste Retrieved From Designated Areas Within the Subsurface Disposal Area at the Idaho National Laboratory Rev. 3 November 16, 2006, Determination of Radioisotopic Content in TRU Waste Based on Acceptable Knowledge.	06/28/2017	9
Interlibrary Loan	Environmental levels of radioactivity at Atomic Energy Commission installations, tenth conference on hot laboratories and equipment alpha-gamma-neutron facilities, proceedings of the 1993 Incineration Conference, and proceedings of the Health Physics Society 1956, Radioactive Mixed and Hazardous Waste Thermal Treatment, Radiochemical Separation of Neptunium and Plutonium From Leaching of Reactor Waste Glass in Brine Solutions, Surface Contamination Proceedings of a Symposium Held at Gatlinburg, Tennessee June 1964, Effect of Humidity and Dose on Latent Image Stability.	01/11/2018	25
Internet - ANL	Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth, Ohio, Site Volume 2: Comment and Response.	12/05/2019	1
Internet - CDC	Exposure assessment, Health Consultation: Exposure Assessment of 1965 and 1970 Accidental Tritium Releases at the LLNL, SC&A Draft: Pantex Plant Site Profile Issues and Resolution, United States of America Centers for Disease Control National Institute for Occupational Safety and Health Advisory Board on Radiation and Worker Health 128th Meeting Wednesday April 17, 2019, Centers for Disease Control National Institute for Occupational Safety and Health Advisory Board on Radiation and Worker Health 135th Meeting Thursday, August 27, 2020.	10/14/2020	4

Data Capture Information	Data Capture Description	Date Completed	Number Uploaded into SRDB
Internet - Defense Technical Information Center (DTIC)	Occupational Dose Reduction at Department of Energy Contractor Facilities, Bibliography of Selected Readings in Radiation Protection and ALARA, Plutonium Stabilization and Disposition Focus Area FY1999 and FY2000 Multi-Year Program Plan, Establishment of a Facility for Intrusive Characterization of Transuranic Waste at the NTS, Annual Reports to Congress Department of Energy Activities Relating to the Defense Nuclear Facilities Safety Board , Toxicological Profile for Ionizing Radiation, DOE Handbook Nuclear Air Cleaning Handbook, Baseline Environmental Management Reports, Laboratory Design for Handling Radioactive Materials, Shielding and Control Materials for the Gas Cooled Fast Breeder Reactor, Actinides Research-Quarterly Reports, Selected Radionuclides Important to Low-Level Radioactive Waste Management, Nuclear Weapons Testing at the NTS: The First Decade, Life-Cycle Cost and Risk Analysis of Alternative Configurations for Shipping Low-Level Radioactive Waste to the NTS, Compliance Status Report for the Waste Isolation Pilot Plant, The Waste Isolation Pilot Plant Pioneering Nuclear Waste Disposal, Waste Data System User's Manual, NTS Waste Acceptance Criteria, Radioisotopes in Underground Tests, Safety Experiments November 1955 - March 1958, The Heat of Formation of Thorium Tetrachloride, DOE Handbook Radiological Safety Training for Accelerator Facilities Program Management Guide, Stanford Synchrotron Radiation Laboratory Activity Reports, Corrosion of Beryllium Oxide by Water Vapor, Nuclear Forensic Analysis Capabilities and Experience at the Oak Ridge Y-12 National Security Complex.	08/13/2021	55
Internet - DOE EMCBC	Plan for Developing Treatment Capacities, INL	02/25/2021	2
Internet - DOE Office of Health, Safety and Security (HSS)	Report-Radiation Exposure for Contractor Employees	02/07/2017	3
Internet - DOE INL	Report of Environmental Assessments for National Security Test Range, Environmental Impact Statements, Safety Analysis of the U.S. Dual Coolant Liquid Lead-Lithium ITER Test Blanket Module, Nondestructive Identification of Chemical Warfare Agents and Explosives by Neutron Generator-Driven PGNAA.	03/04/2021	4
Internet - DOE Legacy Management Considered Sites	U.S. Department of Energy Interim Mixed Waste Inventory Report: Waste Streams, Treatment Capacities and Technologies, Independent Oversight Inspection of the Radiological Assistance Program, U.S. Department of Energy Interim Mixed Waste Inventory Report: Waste Streams, Treatment Capacities, and Technologies - Volume 2: Site Specific - California Through Idaho April 1993, 2010 Complex-Wide Review of DOE's Radioactive Waste Management, Beryllium assessment reports, DOE Occupational Radiation Exposure reports, Former Worker Medical Screening Program Annual Report 2015, Legacy Management Strategic Plan Comment Resolution Legend, Evaluation of Groundwater Flow and Transport at the Faultless Underground Nuclear Test Central Nevada Test Area, Radionuclide Migration Project 1984 Progress Report, Historic American Engineering Record (HAER CO-83) for the Rocky Flats Plant Historic District Volume 1 of 4, Quarterly Status Report Rocky Flats Cleanup Agreement Implementation Rocky Flats Environmental Technology Site First Quarter FY2001, Final Phase I RFI/RI Work Plan Rocky Flats Plant Present Landfill IHSS 114 and Inactive Hazardous Waste Storage Area IHSS 203 (Operable Unit 7) Volume II – Appendices.	07/09/2020	20
Internet - DOE Noncompliance Tracking System	Incident Radiation Exposure Reports, LANSCE Contamination Events, Environment, Safety and Health Program Reports, Laser Experiment Reports, Radiation Safety Program Violation Reports, Noncompliance Reports Management Concerns, Findings From LLNL Assessments of Internal Dosimetry Program, Evaluation of Internal Dosimetry Program for Compliance.	10/28/2020	9

Data Capture Information	Data Capture Description	Date Completed	Number Uploaded into SRDB
Internet - DOE OpenNet	DOE Facts, Declassification of Today's Highly Enriched Uranium Inventories at Department of Energy Laboratories, Advisory Committee on Human Radiation Experiments Final Report - Supplemental Volume 2, Human Radiation Studies, Plutonium and Environmental Metals in Man Interlaboratory Meeting May 9, 1973, A Summary of Industrial Accidents in USAEC Facilities, A Historian's View of the Lawrence Years, History of U.S. Naval Radiological Defense Laboratory 1967, Stanford Synchrotron Radiation Laboratory Activity Reports, The United States Nuclear Weapons Program: A Summary History, The New Elements - Plutonium and Beyond repot, Press Conference Fact Sheets, Summary of Purchase Order Status Reports, Manufacturing Statement for Weapons Production Schedule of Transfers, History of the Defense Atomic Support Agency Summary , Interviews With Site workers, Site-Divisions Progress Reports, Operation Teapot Radioactivity Concentrations in Water, Cancer Research Program of the Division of Biology and Medicine, Interim Report of the Advisory Committee on Human Radiation Experiments, Report of Health Activities at University of Chicago Metallurgical Laboratory, The U.S. Plutonium Balance report, Counting of Human Subjects Containing Nb-92m, Ba-133 or Sr-85 at the LLNL Whole Body Counter, Californium-252: Uses and Users, Lung Counter Calibration With Inhaled Nb-92m as Mock Plutonium, Mound Pu-238 Shipments , IAEA Nb-92m Inhalation Experiment, Report on 8-Inch Isostatic Press Explosion at Site 300, Whole Body Counter Calibration with Ba-133, Protocol Concerning the Counting of Subjects at the LLNL Whole Body Counter, Ernest Orlando Lawrence Correspondence and Papers 72/117C Report and Key to Arrangement, Proposal for Cleaning and Fabricating Beryllium Scrap Into Weapon Components, Transportation of Radioactive Materials, Minutes of Criticality Instrumentation Meeting Hanford Atomic Products Operation , Interagency Mechanical Operations Group Subgroup on Gaging Minutes of Meeting Thirty, June 23-24, 1971, U.S. AEC Richland Operations Office Monthly Status and Progress Report July 1972, Management Report - Technical Division CY1969, Manufacturing Department Monthly Management Reports January - December 1972, Rockwell Hanford Operations Quarterly Production Forecast First Quarter FY1985, Part II - Fissionable Materials Part III - Weapons Progress Report to the Joint Committee June Through November 1952, Part III - Weapons - Progress Report to the Joint Committee June Through November 1953, Summary of Information on Americium Availability and Curium-242 Production, Lung Counter Calibration, Tritium Handling A Literature Search, Replacement Production Reactor Presentation to DOE on Brookhaven Study of Electronuclear Breeder Reactor Concept, Stanford Synchrotron Radiation Laboratory 1991 Activity Report Facility Developments January 1991 - March 1992, AEC Laboratory Hearings Background Statement for Advance Submission - Draft Peek Street 1959 OUO, Chemical Processing Department Monthly Reports.	10/18/2022	59
Internet - DOE OPEXShare	U.S. Department of Energy Occupational Radiation Exposure Report for CY2020	02/08/2022	1

Data Capture Information	Data Capture Description	Date Completed	Number Uploaded into SRDB
Internet - DOE Occurrence Reporting and Processing System (ORPS)	Emergency Response Reports, Shipment Reports, Radiation Working Permit Reports, Occurrence Report DP-ALO-LA-LANL-CMR-1993-0031 Alpha Contamination of Skin Hand Near Thumb Transuranic Material Skin Contamination TA-3-29 Wing 7 – Final, Occurrence Report DP-ALO-LA-LANL-CMR-1993-0036 Radioactive Contamination Detected on the Personal Clothing of an Experimenter Following Contaminated Equipment Handling Cs-137 Beta Gamma TA-3-29 Wing 9 Room 9163 Hot Cell Area Target Work – Final, Occurrence Report DP-ALO-LA-LANL-CMR-1994-0003 Radioactive Contamination Detected on the Right Index Finger of an Analytical Chemistry (CST-1) Employee U-235 Alpha TA-3-29 Wing 3 Room 3173 Alpha Spectrometer – Final, Occurrence Report DP-ALO-LA-LANL-CMR-1994-0007 Radioactive Contamination Detected on the Right Middle Finger of an Analytical Chemistry (CST-1) Employee Pu-239 Alpha Skin Contamination TA-3-29 Wing 5 Room 5117 – Final, Occurrence Report NA-LFO-LLNL-LLNL-2021-0033 Exceedance of Annual ACL B332/B331 Dosimetry Group – Final, Occurrence Report NA-LSO-LLNL-LLNL-2010-0008 LLNL Employee Dosimeter With Indications of High Exposure B253 Personal Thermoluminescent Dosimeter - Final Occurrence Report DP-ALO-LA-LANL-CMR-1996-0015 An NIS-5 Employee Received an Unplanned, Single Whole-Body External Gamma/Neutron Dose of 0.333 rem While Working in Room S103A of CMR Cf-252 U-235 TA-3-29 – Final, Occurrence Report NA-LFO-LLNL-LLNL-2022-0021 Delayed Return and Analysis of Dosimeters Due to COVID Pandemic Lab wide Dosimetry Exchange Notification System Site 200 Site 300 – Final.	06/30/2022	14

Data Capture Information	Data Capture Description	Date Completed	Number Uploaded into SRDB
Internet - DOE OSTI	Energy Response and Physical Properties of NTA Personnel Neutron Dosimeter Nuclear Track Film, LLNL NESHAP Annual Reports, Pluto Quarterly Reports, Atomic Industrial Progress and Second World Conference, NTS Radiation Protection Program Revision Reports, Proceedings of the Second Conference on Radiation Protection and Dosimetry, Proceedings of the Department of Energy Workshop on Workplace Aerosol Monitoring: October 28-30, 1985 in Napa, California, Sodium-NaK Engineering Handbook Volume I. Sodium Chemistry and Physical Properties, DOE Occupational Radiation Exposure reports, Environmental Aspects of Plutonium and Other Elements, Characterization Report Area 3 Radioactive Waste Management Site NTS, Consolidated Fuel Reprocessing Program Progress Reports, Semi-Annual Report of the Department of Energy, Office of Environmental Management, Quality Assessment Program Revised February 1, 1996, Materials Characterization Capabilities at DOE Nuclear Weapons Laboratories and Production Plants, Resource Directory of DOE Information Organizations, Nondestructive Assay and Nondestructive Examination Waste Characterization Conference, Analyses and Hydrogen-Isotope-Transport Calculations of Current and Future Designs of the LLL Rotating-Target Neutron Source, Semi-Annual Report of the Department of Energy, Office of Environmental Management Quality Assessment Program, Analysis of Personnel Error Occurrence Reports Across Defense Program Facilities, Annual Transuranic Waste Inventory Reports, Instrumentation for Environmental Monitoring Radiation, Introduction to U.S. Nuclear Testing: 1945 to 1992, A Section 110 Evaluation of the Project 57 Rad-Safe Area Personnel Decontamination Building, Nye County, Nevada, Health, Safety, and Environment Division Annual Reports, Life Sciences Division Annual Reports, Isotope and Nuclear Chemistry Division Annual Reports, Conceptual Site Treatment Plan for Pinellas Plant, Analytical Methods for Fissionable Material Determinations in the Nuclear Fuel Cycle October 1, 1976 - September 30, 1977, Laser Fusion Program at LASL January 1 - June 30, 1977, Evaluation of Aqueous and Powder Processing Techniques for Production of Pu-238 Fueled General Purpose Heat Sources, Annual Transuranic Waste Inventory Reports, Los Alamos National Laboratory Fission Basis, Battelle Energy Alliance, LLC (BEA) Annual Reports for Idaho National Laboratory (INL), Understanding Mechanisms of Radiological Contamination, Iodine Standard Materials: Preparation and Inter-Laboratory Comparisons, Nuclear Fuel Cycle and Supply Chain (NFCSC) Technical Monthly reports, Annual Reports-Nuclear Science, Active Neutron Interrogation to Detect Shielded Fissionable Material, Neutron Absorber Considerations for the DOE Standardized Canister, Laboratory Directed Research & Development Annual Reports, LLNL Environmental Reports, Sewer Monitoring Results, LLNL Relativistic Heavy-Ion Physics Annual Reports, , M4SF-22LL010302052-Radionuclide Incorporation Model for Corrosion Products LLNL 2022, 2022 Annual SMOP Report LLNL, IER-501 CED-3b: Experiment Execution Summary for the Pulsed-Neutron Die-Away Experimental Testbed for Thermal Scattering Law Benchmarks (PNDA) LLNL 2022, International Intercomparison for Nuclear Accident Dosimetry Using Godiva-IV LLNL 2022, IER 500: AWE-LLNL Measurement Campaign at DAF 2023, Validating FENDL-2.1 and FENDL-3.2 With a Suite of LLNL Pulsed Sphere Measurements 2022, Impact of Changes in ENDF/B-VII.1 and ENDF/B-VIII.0 U-235 Nuclear Data Indicated by NDSE Studies on LLNL Pulsed Sphere Simulations 2022, Fallout Cloud Regimes LLNL 2020, Multi-Element Isotopic Analysis of Hot Particles From Chornobyl LLNL 2023, LLNL FY21 NCSP Overview Task Manager Report 2022, Neutron Pulsed Die-Away Experiments at LLNL 2022, IER 501: Pulsed Neutron Die-Away Experiments at LLNL 2023.	01/25/2024	170

Data Capture Information	Data Capture Description	Date Completed	Number Uploaded into SRDB
Internet - DOE OSTI SciTech Connect	Annual Health Physics 2009, analysis of the technical capabilities of DOE sites for disposal of residuals from the treatment of mixed low-level waste, characterization of the neutron fields in the LLNL Radiation Calibration Laboratory low scatter calibration facility, creating the Nuclear Weapons Laboratory, environmental monitoring plan, history and reflections of engineering at LLNL, identification of buried structures, annual environmental report, NESHAPS annual report, Radiation Protection Program (RPP), low-level plutonium bioassay measurements, plutonium decontamination, qualifying radioactive waste forms for geologic disposal, review of mixed waste streams, semi-annual report on strategic special nuclear material inventory differences, and technical safety requirements for the waste storage facilities, reactor development program-progress report, LLNL Chronic Beryllium Disease Prevention Program (CBDPP).	08/29/2018	161
Internet - Google	A 2013 site annual environmental report LLNL, LLNL - facts and figures, ALARA analysis of radiological control criteria associated with alternatives for disposal of hazardous wastes, site 300 contour maps, annual transuranic waste inventory report, Building 331 tritium operations documented safety analysis, depleted uranium hexafluoride management program, occupational radiation exposure, report to Congress, laboratory accreditation program for personnel dosimetry systems, toxicological profile for uranium, environmental assessment conducted at the Kansas City Plant, environmental monitoring at the Lawrence Livermore Laboratory annual report, federal shipments of transuranic radioactive waste in California, final environmental impact statement and environmental impact report for continued operation of LLNL and Sandia National Laboratories Livermore, site-wide environmental impact statement, finding aid for the K.Z. Morgan papers, groundwater contamination, in-situ chelation/reduction process, investigation of tritium in groundwater at Site 300, LLNL experimental test Site 300 compliance monitoring program, environment, safety and health manual, NESHAPS annual report, prototype TLD badge, mixed analyze performance evaluation program, Paducah Gaseous Diffusion Plant site profile, plutonium storage, puncture wound causes internal plutonium contamination, radionuclide air emission report, RCRA facility investigation report, report on low-level nuclear waste shipments, review of environmental monitoring for radionuclides, Rocky Flats Plant Metal Research and Development Laboratory Building 865 photographs, record of decision LLNL Site 300, annual site environmental report, determination of curium in fecal and chelated urine samples, portable tritium processing system, transuranic waste baseline inventory report, and a worker contaminated while working in a glovebox.	08/13/2023	686
Internet - International Atomic Energy Agency (IAEA)	ANL Chemical Technology Division Annual Technical Report 1991, Summary of Annual Site Environmental Report Radiological Doses and Releases 2015-2018 Peek Street.	07/25/2022	2
Internet - INL	Rector operation reports general information, Visit Reports, Report on Advanced Detector Development, Final Report for the Contractor Readiness Assessment of the Transient Reactor Test Facility Resumption of Transient Testing Activity at the Idaho National Laboratory, Waste Stream Designations Reports, Idaho National Laboratory Preferred Disposition Plan for Sodium-Bonded Spent Nuclear Fuel, Operating Experience Weekly Summary Reports, Site Treatment Plan Reports, Annual Reports, Operating Experience Weekly Summaries 1995, Advanced Mixed Waste Treatment Project Draft Environmental Impact Statement, Idaho National Engineering Laboratory Technical Site Information, Source Term Quality Control Tasks (Episodic Releases) #66 CERT, Final Environmental Impact Statement Reports, Occupational Safety Reviews.	12/13/2021	34
Internet - LLNL	Environmental Reports, LLNL Environmental Monitoring Plans, Radioactivity in Surface and Drinking Water, Tritium Activities in Rain Water Samples on the Livermore Site and Radioactivity in Surface and Drinking Water in Livermore Valley repots.	10/02/2019	38
Internet - NIOSH	Report on Residual Radioactive and Beryllium Contamination at Atomic Weapons Employer Facilities and Beryllium Vendor Facilities, Special Exposure Cohort Petition Evaluation Reports, DCAS Program Evaluation Report OTIB-0079 Rev. 02, Off-Site X-Ray Guidance.	08/25/2021	28

Data Capture Information	Data Capture Description	Date Completed	Number Uploaded into SRDB
Internet - Nuclear Regulatory Commission (NRC) Agencywide Document Access and Management (ADAMS)	Annual report to congress on federal government energy management and conservation programs, characterization project at LLNL, audit report of the civilian radioactive waste management, quality assurance surveillance report, DOE office of civilian radioactive waste management office of quality assurance audit report, environmental restoration wastes, export license for transport logistics international to export natural uranium to Canada, Hanford site solid waste program environmental impact statement, high-level waste quality assurance task force summary of activities, Nevada Nuclear Waste Storage Investigations (NNWSI) project weekly highlights, NRC safety evaluation for quality assurance program plan, quality assurance audit plan, Savannah River Site long range comprehensive plan, surplus plutonium disposition final environmental impact statement summary, National Ignition Facility management, plutonium spill , Waste Isolation Pilot Plant annual report, USAEC byproduct material license 6-550-2, Yucca Mountain Project Argonne National Laboratory annual progress report, Yucca Mountain Project status report, Yucca Mountain quality assurance division quality assurance surveillance report of LLNL.	05/03/2023	233
Internet - NNSA	Nevada National Security Site History - Plowshare Program - Fact Sheet, Final Environmental Impact Statement for the NTS and Off-Site Locations in the State of Nevada - Vol. 1 Appendices A-F August 1996, Final Environmental Impact Statement for the NTS and Off-Site Locations in the State of Nevada - Vol. 1 Appendix I Transportation Study August 1996, Stockpile Stewardship - Joint Actinide Shock Physics Experimental Research (JASPER) - Fact Sheet, Atmospheric Nuclear Weapon Testing 1951-1963.	04/14/2016	6
Internet - National Technical Report Library (NTRL)	Incident Investigation Reports-Plutonium Incident With Multiple Uptake Events, Environmental, Safety and Health Vulnerability Assessments.	01/16/2023	6
Internet - Stanford Linear Accelerator Center (SLAC)	Analysis and Mitigation of X-Ray Hazard Generated From High Intensity Laser-Target Interactions, Radiation Dose Measurement for High-Intensity Laser Interactions with Solid Targets at SLAC, Measurements of Radiation Doses Induced by High Intensity Laser Between 1016 and 1021 W/cm2 Onto Solid Targets at LCLS MEC Instrument, Two-Mile Accelerator Project Quarterly Status Reports, Internal Radiation Protection Program Repots.	08/26/2016	11
Internet - Savannah River Site (SRS)	Fact Sheet Savannah River Site K Area Complex, No Date	02/14/2023	1
Internet - US Environmental Protection Agency National Environmental Publications Information System (NEPIS)	Superfund record of decision.	06/29/2017	17
Internet - University of North Texas (UNT)	Multiple Radiation Experimental Reports, Neutron Production Reports, Tritium Labeling of Amino Acids and Peptides With Liquid and Solid Tritium LLNL 1988, Personnel Neutron Dosimetry Applications of Track-Size Distributions on Electrochemically Etched CR-39 Foils LLNL 1988, Mixed Waste Management Reports, Case Studies Among Employees Reports, Site Safety Plans, Radiation Instrumentation Reports, Environmental Restoration/Waste Management Applied Technology Semiannual Report for January-June 1992 LLNL, Treatment of Difficult Wastes With Molten Salt Oxidation LLNL 2003, Environmental Survey Reports, Safety Analysis Reports, Waste Management Reports, Annual Reports for Small Scale Treatment Laboratory Sites, Emergency Exercise Reports, Development of a Real-Time Radiological Area Monitoring Network for Emergency Response at LLNL 2004, Tritium Monitoring in Natural Waters - Interlaboratory Comparison Program Results for Round Two LLNL.	03/05/2024	541

Data Capture Information	Data Capture Description	Date Completed	Number Uploaded into SRDB
LANL	Reasonable Search Procedure: Employee Records, Other Personnel Records, Medical Records, Exposure Data and Industrial Hygiene Records, Radioactive Waste Disposal and Related Issues, Accelerator Health Physics Characterization Report of DOE Laboratories, Neptunium Oxide Requested by LLNL, Shipment of Pu-239 and Np-237 to SLAC, Actinide Experiments at SSRL, Experiments and Calculations, Employee Health Physics Checklists, Extremity Monitoring TA-48, Annual Self-Assessment.	10/14/2019	25
NARA - Chicago	Mound Organization Charts Quarter Reports for 1973 and 1974	06/29/2021	7
NARA - Kansas City	Survey and certification document of Gilman Hall, Transuranic Waste Baseline Inventory Report Vol. 1 Rev. 2 December 1995.	07/11/2016	4
NARA - Seattle	Incidents and Health and Safety Record Reports, Radioactive Shipment Records for U-235, Mixed Fission Products and Contaminated Respirators, Drums of Radioactive Waste From UCLRL Containing Liquid Upon Unloading at NRTS Burial Ground, Order for Disposal of Solid Packed Radioactive Wastes (Other Than Federal Agencies) Rocky Flats Waste Burial April 27 - July 25, 1962, Radioactive Shipment Records.	08/24/2017	12
NIOSH	Annual and Semiannual Report of the Atomic Energy Commission, Plutonium Working Group Report on Environmental Safety and Health Vulnerabilities Associated With the Department's Plutonium Storage, Volume II, Appendix A: Process and Protocol, Claim files, Environmental impact statements, ICRP 1990 Recommendations for Neutron Radiation Weighting Factors, Protocol for the Epidemiological Evaluation of Cancer and Occupational Exposures at the Rocky Flats Environmental Technology Site, DCAS Assessment Report Review of SEC Class Definitions, SC&A Review of the NIOSH Site Profile for the Pinellas Plant Site, Los Alamos National Laboratory Tritium Technology Deployments Large Scale Demonstration and Deployment Project.	08/31/2023	70
Nevada Test Site (NTS)	Closure report for corrective action at NTS, double play Operation Flintlock on-site radiological safety report, final environmental impact statement for the NTS and off- site locations, final environmental impact statement for the NTS, LLNL NTS underground radionuclide source-term inventory, Plowshare Program Project Chariot an outline of phase iv activities, radionuclides in surface soil at the NTS, Radionuclides in Surface Soil at the NTS reports, LLNL NTS Underground Radionuclide Source-Term Inventory, REECO Tunnel workers' statements, Transuranic Waste Sub-Project Overview and Update, Radiological Safety Reports, Survey reports-Yuba Air Samples December 1962 Through February 1964, Radiological Considerations Nuclear Weapons Testing Source Documents, Release of Radioactivity Resulting From the Baneberry Test, Safety operation procedures, Radiological control manuals, Uranium Contamination Event, Assessment reports, External Dosimetry Program, Limits for the Embryo/Fetus, Area Radiation Monitoring, Emergency Exposure Situations, and Nuclear Accident Dosimetry, ALARA Program and Radiological Work Planning, Radiological Material Control and Accountability Extent of Condition Review Results, Internal Dosimetry Program, Airborne Radioactive Monitoring, and Respiratory Protection, Contamination Monitoring and Control and Release of Materials and Equipment, Radiation Safety Training, Technical Basis Document Internal Dosimetry at the NTS Rev. 6 August 2006, Radiological Survey Report, Instrument Calibration and Maintenance Internal Audit NTS-RCM-06-002, Internal Dosimetry, Technical Basis for Internal Dosimetry, Radiation working permits, RadCon Assessment, LLNL-NV RPP Assessment Report LLNL-N-835.102-97 March 1997.	06/16/2022	203
NIOSH DCAS Claims Tracking System (NOCTS)	Tiger team action plan, Special Separations Logbook - F. Scheitlin.	11/17/2016	2

Data Capture Information	Data Capture Description	Date Completed	Number Uploaded into SRDB
NRC Public Document Room	Analysis of the terminal waste form selection for the West Valley Demonstration Project, audit report of the civilian radioactive waste management system management and operating contractor at the LLNL, briefing on AVLIS uranium enrichment deployment plan, heap leach reclamation plan UMETCO Mineral Corporation, meeting summary - AVLIS meeting with U.S. Enrichment Corporation, Portsmouth GDP compliance plan for National Emission Standards For Hazardous Air Pollutants, quality assurance for gamma knives, safeguards research at Lawrence Livermore Laboratory, Safety Evaluation Report by the Division of Fuel Cycle and Material Safety Related to the License Renewal of the Babcock & Wilcox, Nuclear Materials Division Parks Township Facility Leechburg, PA Docket 70-364 License SNM-414 February 1979, Compliance plans, Uranium 233 Waste Definition Disposal Options, Safeguards, Criticality Control and Arms Control, NRC Inspection Report 40-0299/97-02 July 30, 1997, Assessment of RDA Report "Some Hydrogen Control Considerations for Ice-Condenser Nuclear Plants", Analysis of the Terminal Waste Form Selection for the West Valley Demonstration Project, Quality Assurance for Gamma Knives, Heap Leach Reclamation Plan UMETCO Mineral Corporation, Hazards Evaluation the Explosives Detection System, Briefing on AVLIS Uranium Enrichment Deployment Plan, Low-Temperature Oven Method for Spent Fuel Oxidation Testing - Activity Plan.	08/17/2017	25
Oak Ridge Institute for Science and Education (ORISE)	Chelation DTPA data.	07/11/2023	5
ORNL	Electronuclear Research division annual progress report, Isotope Program progress report, Isotope Separations progress report, Isotopes Development center newsletter, ORNL status and progress report, request for special work forms plutonium returns and transfers, source and special nuclear material accountability report, transuranium processing plant semiannual report for production, status, and plans, Workshop on personnel neutron dosimetry repot.	11/01/2021	46
Oak Ridge Associated Universities (ORAU)	DOE 2012 Occupational Radiation Exposure, ICRU 69 - Direct Determination of the Body Content of Radionuclides 2003	06/15/2022	2
ORAU COC	ICRP 130 - Occupational Intakes of Radionuclides: Part 1, Summary Review Report for Gaseous Diffusion Plants Safety Evaluation Reports, ICRP 59 - The Biological Basis for Dose Limitation in the Skin.	04/30/2024	3
ORAU Team	Evaluation of NTA film in an accelerator environment and comparisons with CR-39, development of the 1996 proposed amendment to 10CFR835 occupational radiation protection, documented communication for SEC-00068, documented communication doe SEC-00192, documented communication for SEC-00195, DOE adoption of 1990 ICRP recommendations on neutron weighting factors, annual report radiation exposures for DOE and DOE contractor employees, exotic radionuclides at the Savannah River Site, Hanford site - occupational external dose, implementation of the combination neutron dosimeter and the field neutron spectrometer, internal dosimetry coworker data for LLNL, LLNL Heavy Element Facility, Building 251: a short history of the risk reduction program, standard methodology for overestimating external doses measured with thermoluminescent dosimeters, technical basis document for the LLNL - occupational external dose/occupational internal dose/occupational environmental dose.	01/08/2024	94
Personal Files	Annual Reports for Radiation Exposures for DOE and DOE Contractor Employees, Report on Health and Mortality Among Contractor Employees at U.S. Department of Energy Facilities, Office of Oversight Radiological Protection Task Team Reports, Development of the Internal Dosimetry Software Called IMBA Expert US DOE-Edition, Proposed Limits: Laundry Monitoring, Proposed Technical Requirements for IMBA Expert US DOE-Edition, Alpha Air Monitor Alarm Sensitivity: Operational Experience, Comparison of the 1st, 2nd and 3rd Generation LLNL Torso Phantoms, The LLNL CR-39 Personnel Neutron Dosemeter, Perspectives of Personnel External Dosimetry at Stanford Linear Accelerator Center.	09/01/2022	17

Data Capture Information	Data Capture Description	Date Completed	Number Uploaded into SRDB
Savannah River Site (SRS)	Dosimetry visitors cards, Health Protection monthly summary 1969, in vivo comparison report, Savannah River irradiated thorium, Savannah River laboratory monthly report, specifications for neptunium slugs interim irradiation program, trip report for neptunium information meeting, Compliance Assessment of the Savannah River Site Appendices March 1990, Works Technical Department Progress Report for December 1966, Works Technical Reports, Radiological Sciences Monthly Report, Trip Report, Neptunium Information Meeting, Savannah River Irradiated Thorium, Monthly Status and Progress Reports, In Vivo Comparison Report..	08/30/2022	33
SNL / New Mexico (NM)	Description of the external QC program for in-vivo and in-vitro bioassay located at Oak Ridge National Laboratory 1991-1993, environmental analysis of metal particle dispersion from an explosive test at Tonopah test range, bioassay results, description of facility at Sandia Livermore and Tonopah, incident that includes plutonium and Oak Ridge National Laboratory 1957, radiation incident reports 1960 through 1978 with index, Ross aviation lab surveys, shipment surveys and shipping documents 1982, environmental monitoring report for Sandia laboratories from 1964 through 1972, tritium bioassay records, webdose database external doses, Tritium Bioassay Records, Urinalysis and Bioassay Records 1955-1976, Radiation working permits, Radiation exposure records.	07/29/2020	34
SC&A	Neutron dose and energy spectra measurements at Savannah River Plant 1987, Operation Grommet, Operation Toggle - onsite radiological safety report, environmental sampling at Lawrence Radiation Laboratory, Berkeley, personnel dosimetry associated with the handling of large numbers of 3-kg Pu-239 billets, proposal for expanded operations at Site 300, thorium hydrodynamic shots at Site 300, site environmental report, documented communication, annual radiation safety review - LRL Berkeley, Chemistry Division annual report, Medical And Health Physics quarterly report, operational safety procedures, neutron depth dose from alpha-neutron (a, n) and gamma-neutron (y, n) sources in a tissue-equivalent phantom, Am-241 hand incident and other incidents, radiation levels around UCRL accelerators, measurement of average neutron energies for (a, n) neutron sources, history of Donner laboratory, experimental shielding studies at high energy proton accelerators, LBL pursuit of DOELAP accreditation: a chronology, radiation studies at a medium energy accelerator, some energy spectra of stray neutrons from the Bevatron, survey of program Donner laboratory and Donner pavilion, environmental reports, Gilman hall decontamination project, stack releases, Nuclear Science division 1annual report, accuracy of very-high-energy radiation monitoring, accelerator neutron spectra and spectra to dose conversion, report of the bioassay program, SNM licensing, shipping reports, air sample data and urinalysis information 1956-1971, SLAC today newsletter.	02/25/2021	111
SC&A / Internet - DOE OpenNet	Plutonium - the first 50 years, Linking Legacies Connecting the Cold War Nuclear Weapons Production Processes to Their Environmental Consequences 1997.	05/24/2017	2
SC&A / Internet-Google	Neutron Dosimetry In and Around Human Phantoms by Use of Nuclear Track Emulsion.	02/22/2023	1
SC&A / NIOSH	Environment, safety and health progress assessment of the Pantex Plant, Review of Generation and Flow of Recycled Uranium at Hanford, Plutonium Working Group Report on ES&H Vulnerabilities Associated With the Department's Plutonium Storage Volume II Part 7 Mound Working Group Assessment Team Report September 1994.	06/09/2016	4
SLAC	Calibration of PuLi 238 source, SLAC External Dosimetry Quality Assurance Manual, Calibration of Our PuLi-238 Source June 28, 1985, LLNL Bioassay reports, Dosimetry system calibration procedures and manuals, Technical Basis Regarding Routine Bioassay Measurements, Shipping and Receiving of Radioactive Materials Work Controls Manual, Neutron Measurements in the SLC, Cryogenics Accelerator, High Voltages in a Vacuum, Radiation Physics Logbooks, TLD Neutron/Photon Angular Dependence Study, Sealed Source Information, Source Certification Certificates and Shipment of Transfers, Radiation Area Monitoring, ALARA Committee Meeting Minutes With Incident Reports and Exposure Data 1999-2000, Radiation Safety Documents, SLAC Radiological Environmental Protection Internal Independent Assessment (IIA) July 2 and 3, 2007, SLAC Radiation Detection Instrumentation Program Technical Basis Documents, Visitor TLD Badge Systems, Environmental monitoring and controls.	09/25/2018	55

Data Capture Information	Data Capture Description	Date Completed	Number Uploaded into SRDB
SRS Electronic Document Workflow System (EDWS)	Minimum Detectable Activities of the In Vivo Counting Instrumentation.	09/09/2019	1
Wah Chang	Annual Site Environmental Reports.	11/08/2022	2
TOTAL	**N/A**	**N/A**	**6,982**

Table A1-2: Database Searches for LLNL (after February 2016)

Database/Source	Keywords	Hits	Number Uploaded into SRDB
Internet - UNT COMPLETED 02/23/2024	Database search terms are available in the Excel file called "Lawrence Livermore National Laboratory Rev 01, (83.13) 04-30-24."	13,369	377
Internet - DOE OSTI COMPLETED 05/01/2023	Database search terms are available in the Excel file called "Lawrence Livermore National Laboratory Rev 01, (83.13) 04-30-24."	13,981	17
Internet - Google COMPLETED 05/05/2023	Database search terms are available in the Excel file called "Lawrence Livermore National Laboratory Rev 01, (83.13) 04-30-24."	6,210,000	17
Internet - Google COMPLETED 05/05/2023	Database search terms are available in the Excel file called "Lawrence Livermore National Laboratory Rev 01, (83.13) 04-30-24."	222,000	13
Internet - Google COMPLETED 05/05/2023	Database search terms are available in the Excel file called "Lawrence Livermore National Laboratory Rev 01, (83.13) 04-30-24."	1,200	1
Internet - DOE OSTI COMPLETED 05/22/2023	Database search terms are available in the Excel file called "Lawrence Livermore National Laboratory Rev 01, (83.13) 04-30-24."	18,580	19
Internet - UNT COMPLETED 03/05/2024	Database search terms are available in the Excel file called "Lawrence Livermore National Laboratory Rev 01, (83.13) 04-30-24."	27,658	92
Internet - UNT COMPLETED 12/28/2023	Database search terms are available in the Excel file called "Lawrence Livermore National Laboratory Rev 01, (83.13) 04-30-24."	2,243	26
Internet - OSTI COMPLETED 01/25/2024	Database search terms are available in the Excel file called "Lawrence Livermore National Laboratory Rev 01, (83.13) 04-30-24."	1,890	25
Internet - UNT COMPLETED 03/06/2024	Database search terms are available in the Excel file called "Lawrence Livermore National Laboratory Rev 01, (83.13) 04-30-24."	13,369	32
Internet - NRC ADAMS COMPLETED 05/03/2023	Database search terms are available in the Excel file called "Lawrence Livermore National Laboratory Rev 01, (83.13) 04-30-24."	1,000	1
Internet - NRC ADAMS COMPLETED 05/03/2023	Database search terms are available in the Excel file called "Lawrence Livermore National Laboratory Rev 01, (83.13) 04-30-24."	400	0
Internet - NRC ADAMS COMPLETED 05/03/2023	Database search terms are available in the Excel file called "Lawrence Livermore National Laboratory Rev 01, (83.13) 04-30-24."	472	0
Internet - NRC ADAMS COMPLETED 05/03/2023	Database search terms are available in the Excel file called "Lawrence Livermore National Laboratory Rev 01, (83.13) 04-30-24."	1,000	0