



Los Alamos National Laboratory (LANL) Special Exposure Cohort (SEC) Petition-109 Dose Reconstruction Feasibility after 1995

Briefing for Advisory Board on Radiation and Worker Health

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August 27, 2026

OUTLINE

- Site Background
- Special Exposure Cohort Petitions
 - 10 Code of Federal Regulation (CFR) 835; Modern Era
- Why Dose Reconstruction is Feasible (1996-2005)
 - Reports 101, 102, 103, 107 and Weight-of-Evidence Memoranda
- Compliance vs. Dose Reconstruction
- Past Divided Work Group Experience
- LANL Work Group Discussion
- NIOSH Conclusion



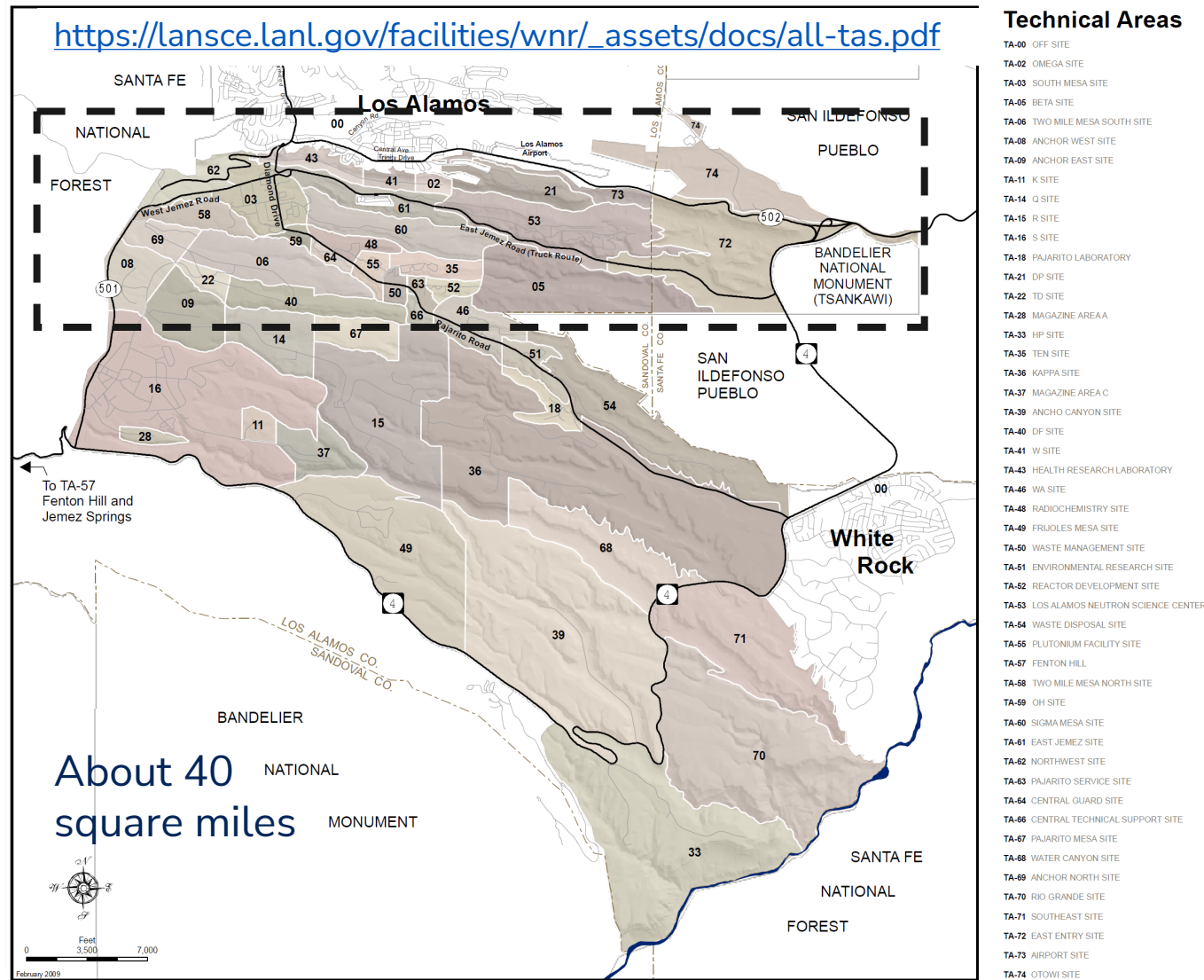
Credit: Los Alamos National Laboratory

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ACKNOWLEDGMENTS

- LaVon Rutherford, DCAS Deputy Director
- Brant Ulsh, DCAS Acting Associated Director for Science
- Oak Ridge Associated Universities Team
 - Timothy Adler
 - Nickolas Altic
 - Daniel Stempfley

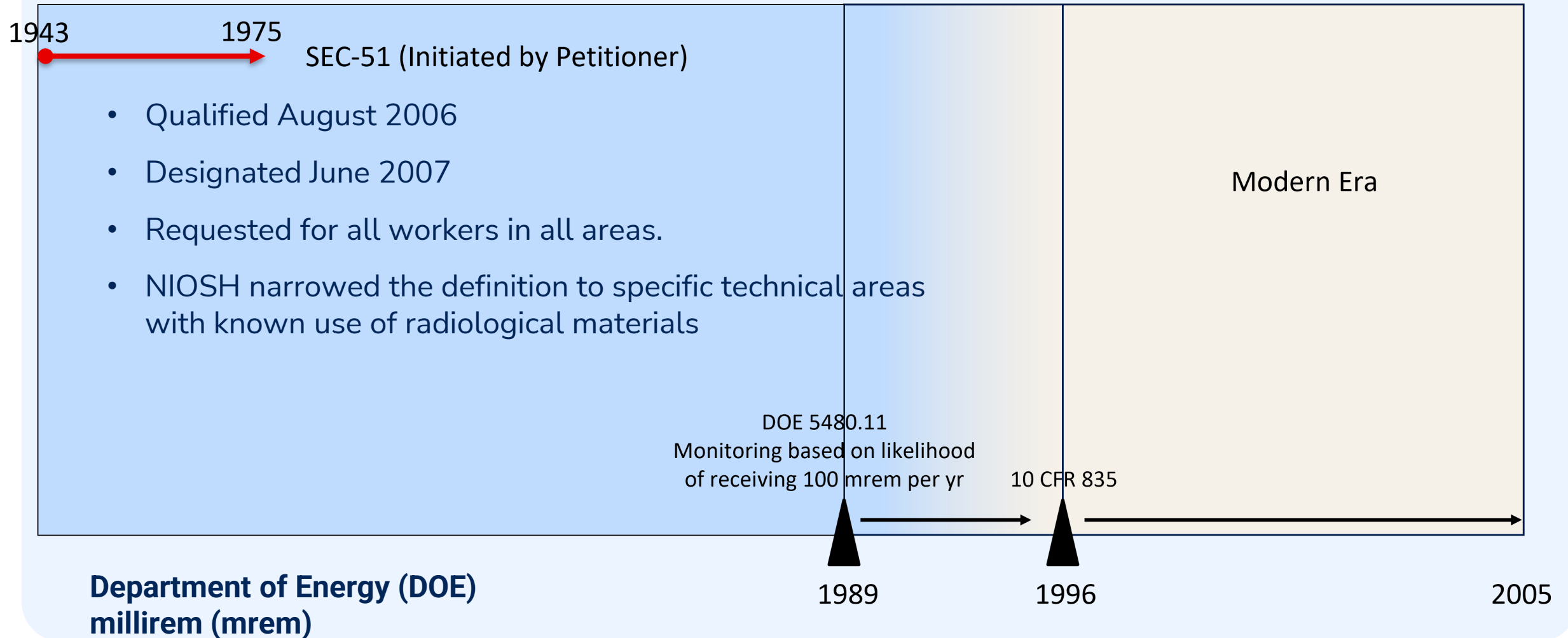
LANL BACKGROUND 1943 - PRESENT



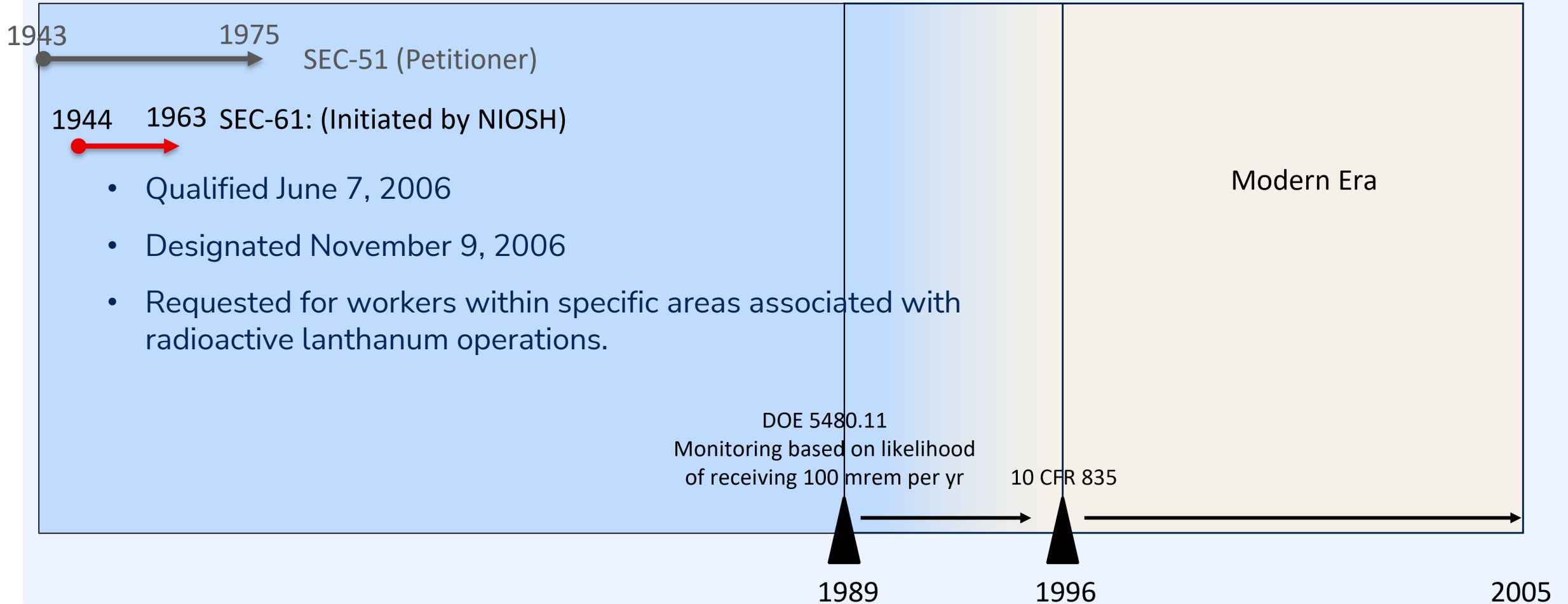
- Worker populations
 - 1943 – 100 workers
 - 1945 - >4,000 workers
 - 2008 – 13,500 workers
 - 2020s - >16,000 workers
- Manhattan Project / nuclear weapons
- Weapons design, high explosives and ordnance development/testing, nuclear reactor research, waste disposal, chemistry, criticality experimentation, tritium handling and radiobiology
- About 50 Technical Areas
- Common radionuclides: Plutonium, Uranium, Americium, Tritium, Cesium, Activation Products, and Fission Products

LANL SEC PETITION 51

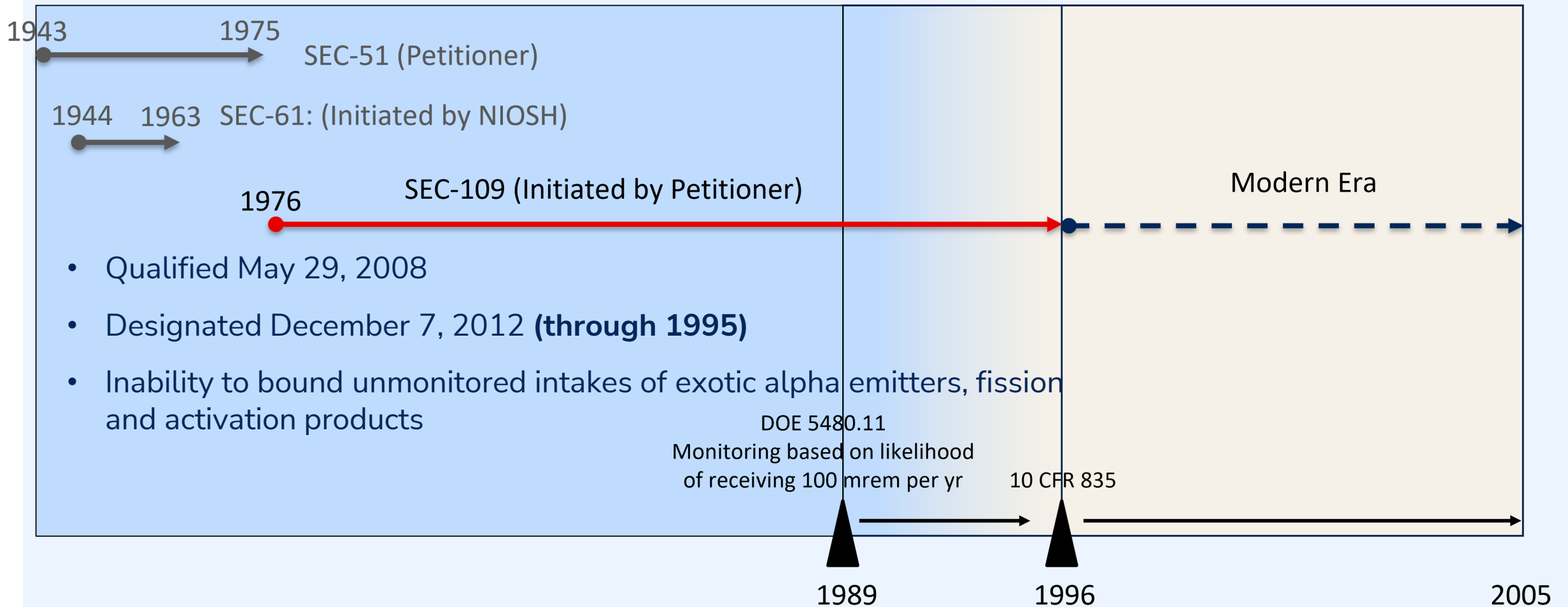
Special Exposure Cohort (SEC)



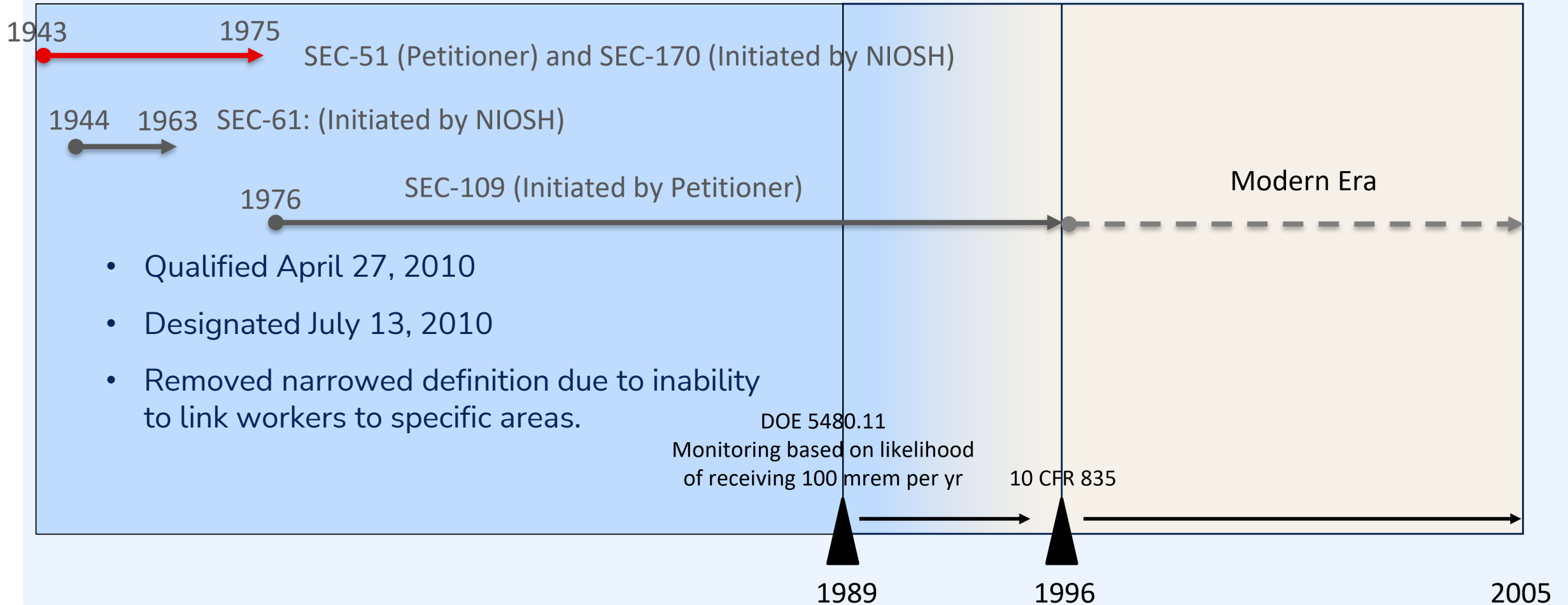
LANL SEC PETITION 61



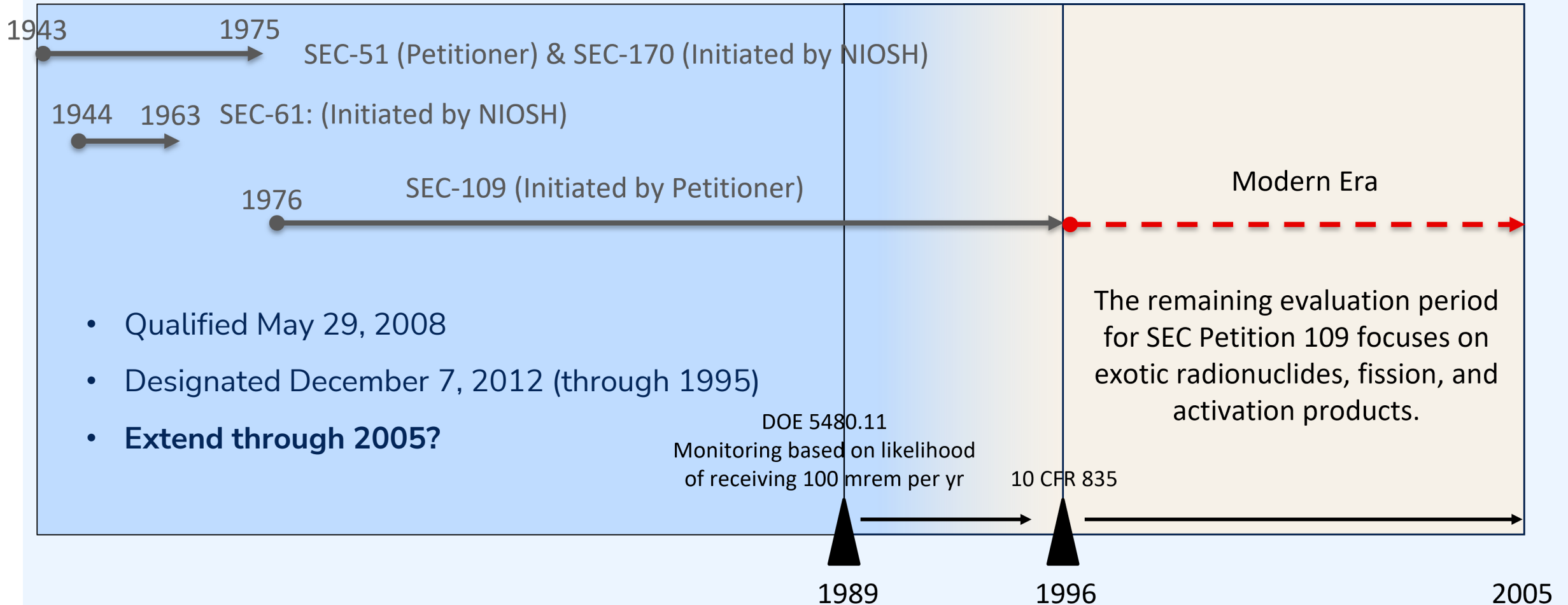
LANL SEC PETITION 109



LANL SEC PETITION 170



LANL SEC PETITION 109 MODERN ERA

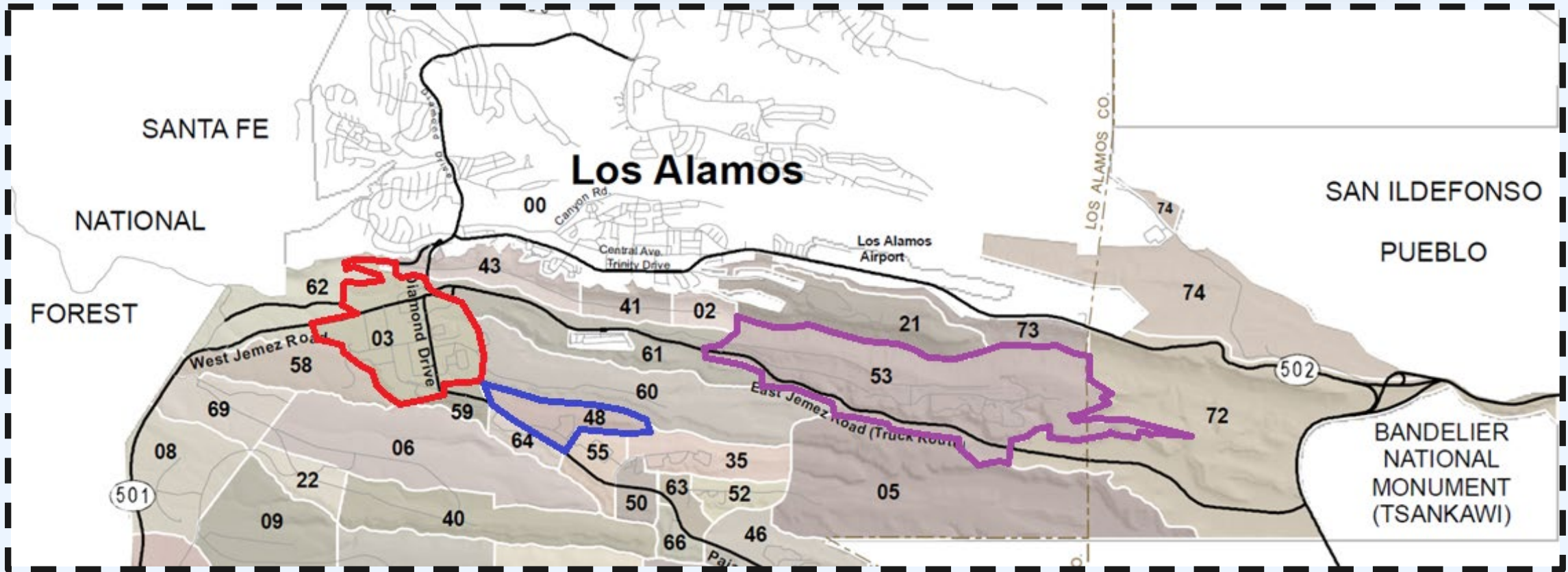


LANL SEC-109: HOW THE POST-1995 ISSUE EVOLVED

From presumed 10 CFR 835 compliance to the unresolved question of whether exotic-radionuclide doses can be reconstructed.

Date	Summary of LANL Work Group Meetings
August 2017	Post-1995 SEC-109 reopened: Can 10 CFR 835 implementation support dose reconstruction for exotics?
November 2018	Issue reframed: actual implementation, bioassay completeness, and non-compliant report ID 484 (NCID 484) became central.
July 2019	Path forward set: review Radiation Work Permits (RWPs), evaluate bioassay gaps, and mixed fission / activation products.
March 2022	Reports 101 and 102 reviewed: RWP / bioassay completeness concerns remained unresolved.
December 2025	Status reset: remaining issues narrowed to Reports 103, 107 and NIOSH Weight-of-Evidence.
May 2026	Evidence debated: Work Group voted 3-2 to take 1996-2000 SEC extension findings to the Board.

LANL TECHNICAL AREAS (TA) 3, 48, AND 53



Technical Areas (TA)

- TA-03 Chemistry and Metallurgy Research (CMR)
- TA-48 Radiochemistry Site
- TA-53 Los Alamos Neutron Science Center (LANSCE)

- These areas contain the highest potential for exposure to exotic radionuclides

SUMMARY: ORAUT-RPRT-101, REV. 01

Purpose: Assess the ability to bound 1996–2005 doses from exotics at a committed effective dose (CED) of 100 millirem per year (mrem/yr)

- Compared routine radiological protection data from TA-3, TA-48, and TA-53 (areas involving exotic radionuclides) to derived limits
- Assessed LANL's radiological data, including:
 - >106,000 contamination surveys and air sampling results
 - 386 Occurrence Reporting and Processing System reports (sitewide)
- Derived conservative removable surface activity and air concentrations corresponding to CED monitoring threshold (actinium-227 for alpha and strontium-90 for beta)

RPRT-101 Conclusion: We found no evidence that unmonitored workers received doses above the 10 CFR 835 monitoring requirements and concluded:

- (1) that the weight of evidence indicates unmonitored exotic-radionuclide doses would not have exceeded 100 mrem per year CED during normal operations and
- (2) monitored workers' doses could be bounded using bioassay results.

1999 LANL SELF-ASSESSMENT

November 1998: DOE Office of Enforcement and Investigation issued 120-day moratorium on enforcement actions while DOE contractors reviewed their Internal Dose Evaluation Program – specifically the **routine bioassay program**.

- There was no routine bioassay program for exotics because the exposure potentials did not meet the monitoring threshold per 10 CFR 835.
- Four findings and ten observations
 - Three findings related to identifying workers required to submit bioassay samples.
 - One finding and remaining observations were related to the general lack of approved procedures.
- The report noted that the LANL staff was extremely technically competent and that none of the findings or observations were issues of adequately protecting workers, but were associated with compliance.
- This led to Noncompliance Report #484 (NCID 484).
- 18 corrective actions were completed by late 2000 and as a result, SEC-109 proposed class was extended from 1996 through 2000 instead of the petitioner's request for it to go through 2005.

ORAUT-RPRT-102: Assessment of LANL Plutonium Bioassay Program 1996-2001.

Purpose: To address if NCID 484 impaired NIOSH's ability to perform dose reconstruction for compensation purposes using co-exposure models.

- Analyzed data and searched for evidence that the most highly exposed workers were **not** monitored
- Analyzed six health-physics-related datasets to assess bioassay data completeness (1996-2001), which included:
 - 1,856 Health Physics Checklists
 - 11,914 Bioassay Enrollment, Scheduling, and Tracking (BEST) results
 - 12,666 Plutonium *in vitro* bioassay
 - 6,817 Plutonium *in vivo* bioassay
 - 3,400,000 External dose records
 - 5,496 RWPs that required monitoring for plutonium and the associated acknowledgement forms

SUMMARY: ORAUT-RPRT-102, REV. 00 (2 OF 2)

- Determined that plutonium bioassay data were collected from a significant portion of the most highly exposed workers

RPRT-102 Conclusion: Plutonium bioassay data were adequate to construct a co-exposure model for plutonium

ORAUT-RPRT-103: Review of Potential Exposure to Exotic Radionuclides Using Radiological Work Permit Data at LANL, August 2022

Purpose: Supplemented RPRT-101, *Bounding Intakes of Exotic Radionuclides at Los Alamos National Laboratory*.

- Period covered 1996-2005
- Reviewed 24 RWPs to show how work was monitored in areas where the highest potential for exposure existed for exotic radionuclides
 - Exotics were defined as everything other than uranium-234, uranium-235, uranium-238, plutonium-238, plutonium-239, tritium, americium-241, and cesium-137
 - Technical Areas 3, 48, and 53
- No bioassay program for actinium-227, curium-244, neptunium-237, protactinium-231, strontium-90, because these isotopes were not likely to result in doses of 100 mrem CED.

RPRT-103 Conclusion: RWP review supports the RPRT-101 conclusion that LANL appropriately monitored workers and had the capacity to perform bioassay for exotics if needed.

ORAUT-RPRT-107: Dose Estimation from Intakes of Exotic Radionuclides at the Los Alamos Neutron Science Center (LANSCE), 1996 to 2005, September 2023.

Purpose: How to bound the potential dose to workers at LANSCE from exotic radionuclides that were not adequately measured by whole body counting.

The RPRT-107 approach is similar to the approach provided in ORAUT-OTIB-0054 Rev 04, *Fission Activation Product Assignment for Internal Dose-Related Gross Beta and Gross Gamma Analyses*.

RPRT-107 methodology:

1. Identify a reference radionuclide mixture containing exotics;
2. Cobalt-60 served as the indicator radionuclide in the mixture;
3. Calculate intakes of the indicator radionuclide using standard dose reconstruction methods;
4. Scale the intakes of each exotic to the intake of the cobalt-60.

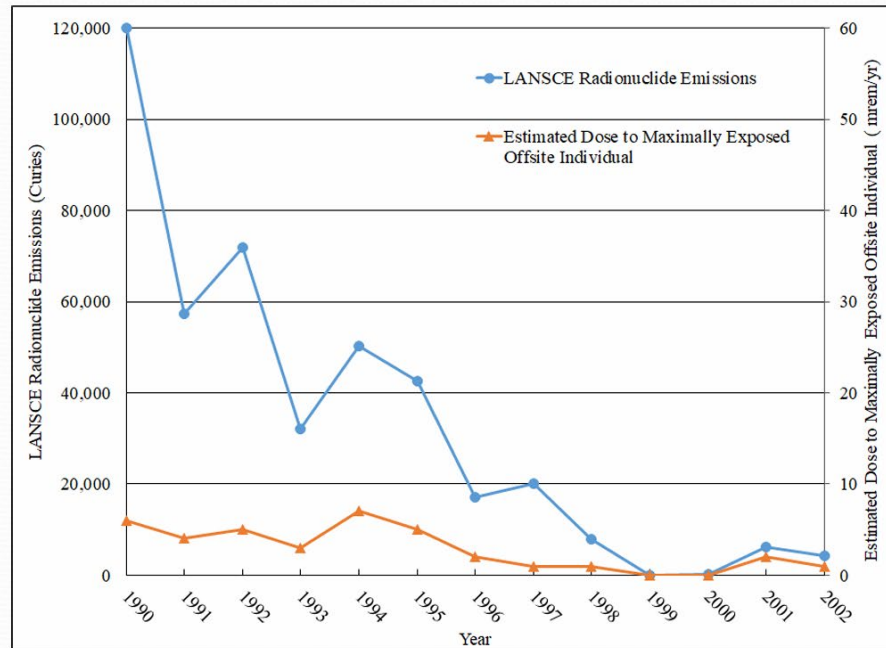
WEIGHT OF EVIDENCE 2023 SUMMARY (1 OF 2)

- **Issue addressed:** The August 2023 NIOSH memorandum responds to the LANL Work Group's concern about whether doses from exotic radionuclides at LANSCE can be bounded for the modern era.
- **Two categories of work:** NIOSH distinguishes between routine work and non-routine work performed under a Radiological Work Permit.
 - **Routine work:** This includes activities performed without a specific RWP, such as work by guards and custodians.
- **Evidence supports bounding approach for routine-work:** NIOSH relies on the conclusions of Reports 101 and 103, implementation of 10 CFR Part 835, controlled access to beam areas, routine radiological surveys, personnel contamination monitoring, gate monitoring, reviews of Dept. of Energy Radiation Exposure Monitoring System (REMS) data, and reviews of occurrences and incidents.
- **Conclusion for routine workers:** Taken together, this evidence supports the conclusion that unmonitored LANSCE workers performing routine work were unlikely to receive internal doses exceeding **100 mrem per year CED**.

LANSC E DOSES

2018 LANL Work Group Meeting: SC&A Presentation Maximum Exposed Individual (MEI) Gaseous Mixed Fission Products (G/MAPs)

Annual LANSCE Radionuclide (G/MAPs) Emissions and
Offsite MEI, 1990–2002 (adapted from LANL 2003, 2018)



Average Occupational External Doses from G/MAPs released from LANSCE (mrem/yr)

(excerpt from occupational env. TBD, 2010, Table 4-29)

Year	Skin (mrem)	Whole Body (mrem)
1990	190	120
1991	90	57
1992	110	71
1993	51	32
1994	79	49
1995	69	43
1996	17	11
1997	32	20
1998	12	7.7
1999	0.047	0.3
2000	1.1	0.68

WEIGHT OF EVIDENCE 2023 SUMMARY (2 OF 2)

- **Non-routine, RWP-controlled work:** Workers with the potential for intakes were subject to radiological controls and follow-up monitoring.
- **Follow-up monitoring:** Depending on the circumstances, this monitoring could include nasal smears and whole-body counts.
- **Additional bounding method:** The memorandum also identifies the Report 107 approach as a method for bounding doses from exotic radionuclides.
- **Radiation Exposure Monitoring System database:** No worker in Technical Area-53 received over 100 mrem CED in any year from 1996 through 2005.
- **Overall conclusion:** The weight of evidence supports NIOSH's ability to bound doses with sufficient accuracy to unmonitored LANSCE workers at **100 mrem per year during the modern era.**

WEIGHT OF EVIDENCE 2024 SUMMARY

- **Purpose of the memorandum:** Evaluate whether RWP controls support NIOSH's ability to bound doses at LANSCE for 1996–2005.
- **1,349 LANSCE/TA-53 RWPs** evaluated to supplement the 2023 weight-of-evidence memorandum and the findings in RPRT-103.
- **External monitoring:** More than **99 percent of the reviewed RWPs** specified external radiation monitoring. The review showed that RWPs were used throughout LANSCE facilities and work areas to establish radiological controls and manage worker exposure.
- **Airborne radioactivity:** Conditions involving elevated airborne radioactivity were not common.
- **Follow-up bioassay:** Workers received follow-up bioassay when warranted by the potential for an intake.
- **Overall conclusion:** The expanded RWP review supports NIOSH's position that LANL implemented a radiation protection program capable of monitoring workers commensurate with their known exposure potential. NIOSH also concluded that the RWP controls and supporting radiation protection practices support bounding LANSCE worker doses at **less than 100 mrem per year** during 1996–2005.

COMPLIANCE VS. DOSE RECONSTRUCTION (1 OF 2)

- Compliance audits ask whether LANL followed every applicable procedure and 10 CFR Part 835 requirements; even one missed checklist, bioassay, or RWP action matters.
- The Energy Employees Occupational Illness Compensation Program Act asks whether NIOSH has reliable evidence to make a reasonable, claimant-favorable estimate or bounding dose – not whether LANL achieved perfect compliance.
- The reports presented here, especially ORAUT-RPRT-102, convey that compliance is “neither necessary nor sufficient” for a co-exposure model and is not required to reconstruct dose.
- The decisive question is whether monitoring, surveys, RWPs, bioassays, source-term, and radiological-control evidence captures the **highest exposed workers**.

COMPLIANCE VS. DOSE RECONSTRUCTION (2 OF 2)

- RPRT-102 addressed the representativeness of the plutonium bioassay record by evaluating whether the available data include a significant portion of the most highly exposed workers.
- RPRT-101 and RPRT-103 address potential unmonitored exotic-radionuclide exposures by evaluating whether contamination surveys, air-monitoring results, radiation work permits, and Health Physics implementation evidence support a 100-mrem-per-year CED bound.
- The LANSCE weight-of-evidence memoranda add specific evidence, including access controls, RWP implementation, REMS records, gate monitoring, and reviews of radiological incidents.
- Taken together, these reports apply a consistent dose-reconstruction standard: determine whether the monitoring record adequately represents the workers with the greatest exposure potential and whether the remaining unmonitored exposure can be conservatively bounded.

LANL WORK GROUP DISCUSSION

DOSE RECONSTRUCTION IS FEASIBLE

Member 1

Weight of evidence burden was met; no contrary evidence that data could not be relied upon.

Member 2

NIOSH approach to bounding dose was characterized as persuasive: "they can do it."

Member 3

Database described as rigorous and complete enough; NIOSH could reconstruct exposure.

PROCEDURAL VOTE TO GO TO THE BOARD

Motion clarified by Designated Federal Officer

Not a formal Work Group recommendation to add the class - rather, taking the Chair's findings to the full Board.

Vote result

YES
Member 1

YES
Member 4

YES
Member 5

NO
Member 2

NO
Member 3

DIVIDED WORK GROUPS

Example	Work Group Votes	Full Board	Final Result
Blockson Chemical SEC-	Divided on whether dose could be bounded	Board debated the disputed model; tie vote failed; later Board voted for SEC	SEC added
General Steel Industries SEC-105	Split Work Group vote for early period	Board treated periods as one motion on feasibility / no SEC	SEC not added
LANL (1996-2000) SEC-109	3-2 vote support dose reconstruction; 3-2 vote referral to full Board	Full board can accept, reject, divide, amend, table, or request more work	Pending

CREATING SECS IN THE MODERN ERA

- **10 CFR 835 marked a major transition** to a modern, enforceable radiation-protection framework—building over approximately seven years on earlier DOE requirements for monitoring, records, and dose assessment.
- **Noncompliance is relevant, but not determinative.** A regulatory or program deficiency does not, by itself, establish that dose reconstruction is infeasible.
- **Dose may still be reconstructed or bounded** using monitoring and bioassay data, co-exposure models, process and source-term knowledge, workplace controls, and claimant-favorable assumptions.
- **The SEC process is a narrow scientific process** for periods when dose cannot be estimated with sufficient accuracy—not an enforcement or compensation mechanism for every compliance failure.

CONCLUSION

- The LANL Work Group has devoted 14 years to this issue, supported by extensive data collection, technical analysis, and deliberation.
- Reports 101, 102, 103, and 107 and the weight-of-evidence memoranda provide multiple, complementary lines of evidence addressing monitoring completeness, worker representation, radiological controls, and conservative dose-bounding methods.
- Documented compliance deficiencies are relevant, but the statutory question is whether they **materially prevent NIOSH from reconstructing or conservatively bounding dose with sufficient accuracy.**
- On the merits, three Work Group members concluded that NIOSH could reconstruct post-1995 doses; two supported an SEC extension through 2000. The subsequent 3–2 vote was clarified as a procedural referral of the disputed issue—not a majority recommendation for an SEC extension.
- NIOSH concludes that dose reconstruction can be performed with sufficient accuracy at LANL for the modern era. We encourage the full Board to independently weigh the cumulative scientific record, the remaining uncertainties, and whether those uncertainties are sufficient to overcome the evidence supporting our conclusion.

Thank you.

For more information, contact CDC

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the U. S. Centers for Disease Control and Prevention or the National Institute for Occupational Safety and Health.



KEY REFERENCE DOCUMENTS (1 OF 2)

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Site Research Database (SRDB)
Reference ID (Ref ID)

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