NIOSH Response to SC&A's Review of Remaining LANL SEC-00109 Internal Dose Issues for 1996–2005

Presenter: Tim Adler
Oak Ridge Associated Universities

Site Lead: John Cardarelli II, PhD, Certified Health Physicist (CHP), Certified Industrial Hygienist (CIH), Professional Engineer (PE)
National Institute for Occupational Safety and Health (NIOSH)
Division of Compensation Analysis and Support

Los Alamos National Laboratory (LANL) Work Group Meeting
May 6, 2026

PURPOSE

This presentation summarizes the April 2025 NIOSH response to an independent SC&A review of internal radiation dose issues at LANL for 1996-2005:

NIOSH Response to SC&A's Review of Remaining LANL SEC-00109 Internal Dose Issues for 1996–2005 [NIOSH 2025]

- Responds to *SC&A Review of Remaining Internal Dose Issues for the LANL SEC-0109 Addendum Period (1996-2000)* [SC&A 2024]

CONTEXT

NIOSH [2025] addresses the **8 Findings** and **9 Observations** described in SC&A [2024] from their review of three Oak Ridge Associated Universities Team (ORAUT) reports:

- **ORAUT-RPRT-0101** Rev. 01: *Bounding Intakes of Exotic Radionuclides at Los Alamos National Laboratory* [ORAUT 2023]
- **ORAUT-RPRT-0102**: *Assessment of Los Alamos National Laboratory Plutonium Bioassay Programs 1996 to 2001*. [ORAUT 2021]
- **ORAUT-RPRT-0103**: *Review of Potential Exposure to Exotic Radionuclides Using Radiological Work Permit Data at Los Alamos National Laboratory*. [ORAUT 2022]

SUMMARY: ORAUT-RPRT-0101, REV. 01

- Assessed the ability to bound 1996–2005 doses from exotics at a committed effective dose (CED) of 100 millirem per year (mrem/yr)
- Assessed and discussed LANL's radiological controls, including:
  - workplace controls
  - workplace monitoring
  - worker self-monitoring
- Derived conservative removable surface activity and air concentrations corresponding to CED monitoring threshold
- Compared routine radiological protection data from Technical Areas (TAs) 3, 48, and 53 (areas involving exotic radionuclides) to derived limits

RPRT-0101 Conclusion: LANL's radiological control program was structured and implemented such that the weight of evidence indicates doses to unmonitored workers can be bounded at 100 mrem/year CED

SUMMARY: ORAUT-RPRT-0102, REV. 00

- Analyzed available 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, which included:
  - Health Physics Checklists
  - Bioassay Enrollment, Scheduling, and Tracking (BEST)
  - Plutonium *in vitro* bioassay
  - Plutonium *in vivo* bioassay
  - External dose
  - Radiological Work Permits (RWPs) that required monitoring for plutonium and the associated acknowledgement forms
- Determined that plutonium bioassay data were collected from a significant portion of the most highly exposed workers

RPRT-0102 Conclusion: Plutonium bioassay data were adequate to construct a co-exposure model for plutonium

SUMMARY: ORAUT-RPRT-0103, REV. 00

- Supplemented RPRT-0101, *Bounding Intakes of Exotic Radionuclides at Los Alamos National Laboratory* [ORAUT 2023]
- Used Radiation Work Permit (RWP) documentation to show how work was monitored

RPRT-0103 Conclusion: RWP review supports the RPRT-0101 conclusion that LANL appropriately monitored workers (Note: conclusions are qualitative)

ORAUT-RPRT-0101 Rev 01

SC&A Observations and Findings and NIOSH Responses

ORAUT-RPRT-0101 REV 01

SC&A Finding 1: Survey and air sampling data may not be representative

SC&A Finding 1: [SC&A 2024, PDF p. 11]

> *As NIOSH indicated, the evaluation of survey smear sampling and air sampling does not represent all facilities that potentially handled exotic radionuclides, nor are the data necessarily considered a random or representative sample within the three facilities evaluated. Likewise unknown are the radiological classifications of the areas the data represent.*

NIOSH Response to SC&A Finding 1

- NIOSH agrees that the RPRT-0101 analysis is not suitable for making inferences about overall contamination levels at LANL
- RPRT-0101 is not intended to be a stand-alone defense of the proposed bounding dose; RPRT-0101 **adds** to the Weight of Evidence
- TAs in RPRT-0101 were selected based on known work with exotics as established in facility documentation and an interview with LANL staff
- Primary drivers for data selection were:
  - known use of exotics
  - surveys representative of typical (routine) contamination levels
  - Radiological classification of the facility areas **was not** a primary driver

ORAUT-RPRT-0101 REV 01

SC&A Finding 2: Contamination survey and air sampling datasets are incomplete

SC&A Finding 2: [SC&A 2024, PDF p. 11]

> *As NIOSH has affirmed in RPRT-0101, the dataset is not complete. Without some form of secondary source to know how many survey swipes and air sampling results were measured in the areas of interest, it is not possible to establish the level of incompleteness with the data forming the weight-of-evidence argument for 100 mrem.*

NIOSH Response to SC&A Finding 2

- NIOSH agrees with the finding as stated explicitly in RPRT-010
  - “NIOSH makes no claim that these data are complete. The goal of this report was to produce a qualitative analysis of these data.” [PDF p. 11]
- Contamination survey and air sampling results (approximately 106,000) are further evidence that LANL actively managed exposure potentials during the evaluated period
- While the RPRT-0101 analysis cannot make inferences about site conditions, it cannot be said that the assessment is biased towards areas that are “cleaner” than others

ORAUT-RPRT-0101 REV 01

SC&A Finding 3: Routine monitoring instructions do not encompass the entire evaluation period

SC&A Finding 3: [SC&A 2024, PDF p. 11]

> *Examples of routine monitoring instructions intended to demonstrate contamination surveying and air monitoring responsibilities were dated as taking effect in the year 2000 or later (except the one for TA-48, which was effective July 1997). Additionally, examples of incidents in 1996 with fixed monitoring stations used to control contamination at location entrances were for TA-55, which is the plutonium facility and may not be representative of the facilities where exotics were handled.*

NIOSH Response to SC&A Finding 3

- NIOSH agrees with SC&A's temporal and spatial assessment of the available routine monitoring instructions
- NIOSH agrees that RPRT-0101 references an incident report for TA-55; however, incident reports for the three primary focus areas (TAs 3, 48, and 53) are also provided in RPRT-0101
- As stated in responses to Findings 1 and 2, available data were evaluated to support a weight-of-evidence-based assessment of LANL's radiation protection program sufficiency

ORAUT-RPRT-0101 REV 01

SC&A Observation 1: Worker types and covered radionuclides are not clearly specified

SC&A Observation 1: [SC&A 2024, PDF p. 11-12]

> *SC&A believes a clear specification of the worker job types and radionuclides covered by the 100 mrem approach is warranted for work group discussion to clearly distinguish between the RPRT-0101 approach and any future development of co-exposure models for unmonitored workers who should have been monitored or whose records are unavailable.*

NIOSH Response to SC&A Observation 1

- RPRT-0101 was not intended to re-define what is considered an "exotic" radionuclide
- The Evaluation Report definition [NIOSH 2012, PDF p. 41] is what NIOSH considers an exotic radionuclide as presented in RPRT-0101:
  - *"everything other than* $^{234/235/238}U$ [uranium], $^{238/239}Pu$ [plutonium], ^{3}H [tritium], ^{241}Am [americium], *and* ^{137}Cs [cesium]" [ORAUT 2023, PDF p. 9]
- This observation is a Technical Basis Document (TBD) issue (and supporting documents), not a Special Exposure Cohort (SEC) issue
  - Dose reconstructors use guidance from TBDs, claimant interviews, and available claimant records on a case-by-case basis
  - Information related to application of the bounding dose will be added to the applicable section of the LANL TBD

SC&A Observation 2: Duplicate entries are in the dataset

SC&A Observation 2: [SC&A 2024, PDF p. 12]

> *SC&A observed entries in the original dataset that were marked as duplicates but do not appear to have been deleted. However, given the small relative percentage and their observed relative magnitude, deleting these samples would likely have a minimal effect on the results.*

NIOSH Response to SC&A Observation 2

- ORAUT-RPRT-0101, Rev. 01 addressed these duplicates and other discrepancies
- As noted in Section 1.1 [ORAUT 2023, PDF p. 10]:
  - *"The ORAU Team produced a QA outline and data entry instructions to facilitate the use of these data . . .The ORAU Team compared the data from the first and second data entries and resolved differences"*

ORAUT-RPRT-0101 REV 01

SC&A Observation 3: Air sample results exceeded the 100 mrem limit in 1996 and 1997

SC&A Observation 3: [SC&A 2024, PDF p. 12]

> *Air sampling data evaluated for Technical Area 53 during 1996 and 1997 showed the highest number of observed results that were above the 100 mrem limit (~33 percent and 22 percent, respectively). This was significantly higher than all other technical areas and years.*

NIOSH Response to SC&A Observation 3 (Part 1)

- NIOSH agrees with this Observation
- The analysis of survey data presented in RPRT-0101 was not intended to assess temporal or spatial trends but was performed to support NIOSH's weight of evidence position

NIOSH Response to SC&A Observation 3 (Part 2)

Regarding elevated air sample results in TA-53:

- Elevated alpha radioactivity readings on air filters were caused by naturally occurring radioactive material (NORM) – specifically radon, thoron, and associated decay products, as confirmed by LANL staff [ORAUT 2023c]
- Plutonium-242 was never identified in air samples
- The dose-based air concentration limit is based on the most conservative radionuclide (Ac-227 [actinium], Type F), which was not identified on any RWP or incident report used for this analysis
- As a result, exceedances of the dose-based limits due to NORM were expected

ORAUT-RPRT-0102 Rev 00

SC&A Observations and Findings and NIOSH Responses

SC&A Finding 4: Single bioassay submission does not satisfy bioassay requirement for multiple RWPs

SC&A Finding 4: [SC&A 2024, PDF p. 12]

> *SC&A does not agree that an individual worker should be considered compliant with RWP bioassay requirements if ANY of the RWPs associated with that individual during the year have appropriate associated plutonium bioassays.*

SC&A Finding 5: Selected time window for bioassay submission is not appropriate

SC&A Finding 5: [SC&A 2024, PDF p. 12]

> *SC&A does not believe the NIOSH assumption that an appropriate time window for bioassay submission of during the RWP work or by "the end of the year after the year in which the RWP expired" is an appropriate metric for assessing monitoring compliance with RWP-related work. In addition, SC&A does not believe instances where the EE* [Energy Employee] *submitted a plutonium bioassay during the RWP work necessarily satisfy the RWP-mandated monitoring criteria. SC&A believes the only appropriate time window for submission should be 1 year after the expiration of the RWP.*

NIOSH Response to SC&A Findings 4 and 5 (Part 1)

There is no direct relationship between the timing of the bioassay sample request/submission and the start/stop dates of the RWPs as the RWPs do not drive the plutonium bioassay program nor trigger collection of a routine plutonium bioassay sample

- A requirement for work that involved plutonium, as indicated on an RWP, was that the worker be on the Plutonium Access List (PAL), which verified routine plutonium bioassay program participation
- An equivalent requirement would be that the worker wears the appropriate external dosimeter before performing work—the dosimeter is a prerequisite
- Unexpected field conditions may prompt special bioassay collection

NIOSH Response to SC&A Findings 4 and 5 (Part 2)

Regarding SC&A Finding 4:

- Workers were required to sign an RWP acknowledgment log to indicate they understood the monitoring and personal protective equipment requirements
- RPRT-0102 considers a worker to be compliant if any of the RWPs "acknowledged" by that worker during the year have associated plutonium bioassays
- Because these workers were on the PAL and on a routine program, requiring all RWPs for a worker in a year to have associated plutonium bioassay would not have changed the RPRT-0102 conclusion

NIOSH Response to SC&A Findings 4 and 5 (Part 3)

Regarding Finding 5:

- Various time “windows” for compliance with the RWP were used in RPRT-0102 [ORAUT 2021], and other windows might be reasonably considered
- All such windows are arbitrary and would not change the conclusion in RPRT-0102
- The only unambiguous metric is the number of plutonium samples requested and received in any given year [ORAUT 2021, PDF p. 23], which is independent of the RWPs

SC&A Finding 6:
Assumption of similar exposure potential between workers acknowledging the same RWP is questionable

SC&A Finding 6: [SC&A 2024, PDF p. 12]

> *The assumed connection between exposure potentials for workers based solely on signing the same RWP acknowledgement form is questionable. This would be particularly true for RWPs that span a significant length of time and require individual workers to perform several different tasks with variable exposure potentials.*

NIOSH Response to SC&A Finding 6

- Examining acknowledgment logs within individual RWPs, RPRT-0102 documents how infrequently listed workers were unmonitored
- As a result, the report concludes that "…it is highly likely that workers who were exposed to plutonium and not monitored had potentially exposed coworkers who were monitored"
- This portion of the RPRT-0102 analysis further concludes that "The preponderance of evidence supports the conclusion that the plutonium bioassay data reported by LANL in the 1996 to 2001 study period include a significant portion of the most highly exposed workers and are therefore adequate to construct a co-exposure model for plutonium" [ORAUT 2021, PDF p. 33]

ORAUT-RPRT-0102 REV 00

SC&A Observation 4: Bioassay compliance rates differed between maintenance contractors

SC&A Observation 4: [SC&A 2024, PDF p. 12]

> *The lowest observed compliance with bioassay requests via the Bioassay Enrollment, Scheduling, and Tracking (BEST) system was for Johnson Controls, one of LANL's maintenance contractors, which had a low of ~45 percent compliance for 29 requests in 2001 (~72 percent compliance for all years). However, KSL Services, which appears to have been another maintenance contractor for LANL, had the highest rate of compliance observed overall (~89 percent) and was never lower than ~83 percent.*

NIOSH Response to SC&A Observation 4

- NIOSH agrees with this observation:
  - Additionally, the KSL compliance percentage is higher than the Johnson Controls compliance percentage for every individual year and all combined years
- The observation does not highlight a specific problem for co-exposure modeling

ORAUT-RPRT-0102 REV 00

SC&A Observation 5: Reasons for not submitting a bioassay may not be legitimate

SC&A Observation 5: [SC&A 2024, PDF p. 12]

> *SC&A does not agree with NIOSH's contention that the large majority of unfulfilled bioassay requests (1,613 of 1,981) were for legitimate reasons (i.e., over 97 percent of bioassay requests were either correctly fulfilled or have legitimate reasons for going unfulfilled). It is SC&A's opinion that the only legitimate reason for an unfulfilled bioassay request is that the EE was not exposed to plutonium for the entirety of the intended monitoring period.*

NIOSH Response to SC&A Observation 5

The acceptability of an unfulfilled bioassay request is a regulatory issue, not a co-exposure issue

- A regulator will want to know the reason for an unfilled request, which is why LANL kept track of the reasons sample requests were not fulfilled
- For co-exposure modeling, the interest is in whether a requested sample was received (~86% were received) and whether the site monitored the workers with the highest exposure potential
- There is no evidence that unfulfilled requests were concentrated among the most highly exposed workers, therefore unfulfilled requests do not impact NIOSH's ability to construct a co-exposure model

ORAUT-RPRT-0102 REV 00

SC&A Observation 6: Open window approach does not guarantee that a subsequent co-exposure distribution would reflect the intake period

SC&A Observation 6: [SC&A 2024, PDF pp. 12-13]

SC&A's objections regarding the acceptable time window for bioassay submission do not affect the RPRT-0102 estimates when considering an open window timeframe. However, SC&A notes that the later monitoring result, as used in a potential co-exposure distribution, is not guaranteed to be reflected in the intake period for which it is intended (i.e., it would be reflected in the year the sample was taken, not the year in which the exposure was incurred).

NIOSH Response to SC&A Observation 6

- An external dosimetry co-exposure model models the doses received each year
- The equivalent analysis in an internal dosimetry co-exposure model would be to model the radionuclide intakes for each year
    - This type of analysis is infeasible for plutonium and most radionuclides, so the bioassay data in each year are modeled
- For long-lived nuclides, a urine sample contains activity from all previous intakes regardless of the year they occurred
- Thus, all internal dose co-exposure models constructed to date are based on the year the bioassay was performed, not the year of the intake

ORAUT-RPRT-0103 Rev 00

SC&A Observations and NIOSH Responses

ORAUT-RPRT-0103 REV 00

SC&A Observation 7: 22% of RWP-listed tritium workers were unmonitored

SC&A Observation 7: [SC&A 2024, PDF p. 13]

> *During the period of interest from 1996 to 2005, SC&A identified 34 RWPs covering 147 workers who had tritium bioassay specified. Of these 147 RWP-worker combinations, SC&A found that approximately 73 percent were appropriately monitored throughout the assumed job period, 5 percent were partially monitored, and 22 percent were unmonitored.*

NIOSH Response to SC&A Observation 7

As noted in RPRT-0102 [ORAUT 2021, PDF p. 20]:

> *Workers signed an acknowledgment sheet during the pre-job briefing, which was required before working under the RWP. The signature on the acknowledgment sheet indicated that the worker understood the monitoring requirements of the RWP [DOE 1998]. Note that a worker could have signed an acknowledgment sheet and never performed work under that RWP; it is not a sign-in sheet.*

- It's not be expected that the number of tritium bioassays completed would match the number of signatures on the RWP acknowledgment log
- The quotient of bioassays and RWP acknowledgment signatures is not the appropriate metric for assessing completeness

ORAUT-RPRT-0103 REV 00

SC&A Observation 8: Individuals working under one identified RWP were potentially under-monitored

SC&A Observation 8: [SC&A 2024, PDF p. 13]

> *SC&A identified a single RWP covering 10 workers that specified uranium monitoring in addition to plutonium urinalysis. [Redacted] of the 10 workers did not have [redacted] monitoring identified, [redacted] of 10 only had [redacted] monitoring, and [redacted] had unclear records due to an [redacted].*

NIOSH Response to SC&A Observation 8

- The RWP in question was not used in RPRT-103 because it did not involve exotics
- Worker signatures on acknowledgement logs indicated understanding of RWP monitoring requirements
- A signature on an RWP acknowledgement does not indicate the individual performed the work (see also Response to Findings 4 and 5)
- NIOSH reviewed the RWP in question and found different results than SC&A, but these results would not alter NIOSH's conclusion and are not presented here

SC&A Observation 9: Positive nasal smears did not always lead to follow-up bioassays

SC&A Observation 9: [SC&A 2024, PDF p. 13]

> *SC&A identified 24 individuals with positive nasal contaminations and evaluated their internal monitoring records. The number of individuals with follow-up monitoring varied from 14 to 17 (58 percent to 71 percent) depending on certain assumptions about undated records and potentially invalid positive nasal swipes.*

NIOSH Response to SC&A Observation 9

- Follow-up bioassays were only required when nasal swipe activity exceeded set thresholds (e.g., ≥35 disintegrations per minute (dpm) for plutonium or americium)
    - The number of positive nasal swipes and follow-up bioassay samples would not likely be equal
    - LANL internal procedures did not identify corresponding limits for beta activity on nasal smears; however, LANL generated Radiation Protection Observation Reports if the sum of the readings in both nostrils for nasal swipes exceeded 500 dpm for beta [e.g., LANL 1998, PDF p. 2]
- Although RWPs may list nasal smear requirements, the radiological control technicians (RCTs) and/or line management had discretion to relax the requirement if radiological conditions warranted
- NIOSH notes that at least two Energy Employees in SC&A's review were not involved with the work covered by the RWP in question.

Overall Programmatic Considerations for Internal Dosimetry at LANL

SC&A Findings and NIOSH Responses

OVERALL PROGRAMMATIC CONSIDERATIONS

SC&A Finding 7:

RPRT-101 and -103 don’t demonstrate an unmonitored worker would receive less than 100 mrem committed effective dose equivalent (CEDE)

SC&A Finding 7: [SC&A 2024, PDF p. 13]

> *SC&A finds that RPRT-0101 and RPRT-0103 do not demonstrate that nonroutine job-specific bioassays were adequately evaluated for potential operational exposures to exotics, and that LANL monitoring programs were being adequately implemented to ensure that unmonitored workers were unlikely to receive intakes resulting in 100 mrem CEDE.*

NIOSH Response to SC&A Finding 7 (Part 1)

NIOSH has previously requested information from LANL specifically aimed at learning how the 100 mrem/year monitoring requirement was implemented during the 1996-2005 period

- NIOSH summarized data capture efforts [NIOSH 2025, PDF pp. 35-57]
- Captured information included monitoring requirements and procedures, health physics checklists, area- and task-specific assessments and checklists, and interviews with LANL personnel
- This information consistently indicated that LANL assessed and controlled workplace hazards, and maintained robust field monitoring programs capable of identifying situations where bioassays would have been required

NIOSH Response to SC&A Finding 7 (Part 2)

Having little to no routine bioassay data for exotics is consistent with low exposure potential

- NIOSH adopted a weight of evidence approach as discussed at the work group meeting on September 11, 2012
- RPRTs-0101 and -0103 combine to support a weight of evidence conclusion that 100 mrem CED is bounding for unmonitored workers

NIOSH Response to SC&A Finding 7 (Part 3)

NIOSH previously assessed the non-compliance report (NC ID 484) in a 2019 Response Paper [NIOSH 2019]

- NC ID 484 involved a specific contractor for primary radionuclides (plutonium)
- No evidence was provided or identified that this very specific deficiency was generalizable to exotics; if the deficiency applied more broadly, it would have been written more broadly
- This specific deficiency does not contradict the conclusion that unmonitored worker exposure would be bounded at 100 mrem; no evidence of workers exceeding 100 mrem was provided

NIOSH Response to SC&A Finding 7 (Part 4)

The SEC class for the period 1976-1995 was not based on evidence indicating disparities in radiation program coverage between primary radionuclides of concern and exotics

- It was recommended because of concerns over a hypothesized, potential disparity between how the established radiation program was being applied to longer term, larger work efforts versus smaller, short-term and intermittent efforts. This question required further investigation
- The 1995 cut-off point was the most defensible choice based on 10 C.F.R. 835 implementation

OVERALL PROGRAMMATIC CONSIDERATIONS

SC&A Finding 8:

Results in RPRT-102 are nontransferable to nonroutine, job-specific sampling for exotics

SC&A Finding 8: [SC&A 2024, PDF p. 13]

> *The results in RPRT-0102 for routine plutonium monitoring are not transferable to nonroutine, job-specific sampling for exotics, which was much more discretionary and based on individual line management or RCT judgments about job-related exposure potential.*

NIOSH Response to SC&A Finding 8

- NIOSH agrees with SC&A's Finding 8
- NIOSH has previously stated (Work Group meeting September 11, 2012) that a chronic co-exposure model for plutonium is not appropriate to bound potential short-term exposure to exotics
- RPRT-0102's positive assessment of LANL's monitoring for plutonium is additional evidence of a health physics department and program focused on controlling and monitoring potential radiation exposures

Conclusion

NIOSH Conclusion

- There is no evidence that LANL's well-developed radiation protection program was applied differentially at varying site work areas or work activities as was originally questioned and used as the basis for the 1976–1995 SEC class addition
- Multiple independent evaluations of LANL records, monitoring data, and program documentation consistently show that radiation doses for all LANL workers during 1996-2005 can be estimated with sufficient accuracy
- No evidence to the contrary has been found or presented

KEY REFERENCE DOCUMENTS (PART 1)

LANL [1998]. Radiological incident reports TA-48 January, March, May - December 1998. Los Alamos National Laboratory, Los Alamos, NM: University of California. [SRDB Ref ID: 181219]

NIOSH [2012]. Special exposure cohort petition evaluation report Petition SEC-00109 Rev. 1 Los Alamos National Laboratory (LANL) May 29, 2008. August 13. [SRDB Ref ID: 165232]

NIOSH [2017]. Special exposure cohort petition evaluation report petition SEC-00109 addendum Los Alamos National Laboratory (LANL). Petition SEC-00109 Addendum, April 24. [SRDB Ref ID: 173741]

NIOSH [2019]. NIOSH response to NTS report NC ID 484 (LANL). March 26. [SRDB Ref ID: 175839]

NIOSH [2025]. NIOSH response to SC&A's review of remaining LANL SEC-00109 internal dose issues for 1996-2005. April 23. [SRDB Ref ID: 206063]

ORAUT [2021]. Assessment of Los Alamos National Laboratory plutonium bioassay programs 1996 to 2001. ORAUT-RPRT-0102 Rev. 00, December 2. [SRDB Ref ID: 187245]

KEY REFERENCE DOCUMENTS (PART 2)

ORAUT [2022]. Review of potential exposure to exotic radionuclides using radiological work permit data at Los Alamos National Laboratory. ORAUT-RPRT-0103 Rev. 00, August 15. [SRDB Ref ID: 193468]

ORAUT [2023]. Bounding intakes of exotic radionuclides at Los Alamos National Laboratory. ORAUT-RPRT-0101 Rev. 01, August 30. [SRDB Ref ID: 197263]

SC&A [2017]. Review of SEC petition evaluation report addendum (SEC-00109). July 27. [SRDB Ref ID: 173740]

SC&A [2024]. SC&A review of remaining internal dose issues for the LANL SEC-0109 addendum period (1996-2000). April 12. [SRDB Ref ID: 204632]

Thank you.

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 https://www.cdc.gov/ | https://www.cdc.gov/niosh
Follow us on social **@CDCgov**

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.

Thank you.

For more information, contact CDC
1-800-CDC-INFO (232-4636)
TTY: 1-888-232-6348 https://www.cdc.gov/ | https://www.cdc.gov/niosh
Follow us on social **@CDCgov**

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 TERMS AND ACRONYMS (PART 1)

Term	Definition
10 C.F.R. 835.402(c)(1)	Section of the Code of Federal Regulations that requires internal dosimetry monitoring for radiological workers who, under typical conditions, are likely to receive a committed effective dose of 0.1 rem (100 mrem) or more from all occupational radionuclide intakes in a year
BEST Bioassay Enrollment, Scheduling, and Tracking	Database used at Los Alamos National Laboratory to manage bioassay program enrollments
CED committed effective dose	Sum of the effective doses to various tissues or organs in the body each multiplied by the appropriate tissue weighting factor and committed for a 50-year period following an acute intake or the onset of chronic intake. It does not include contributions from external dose The internal dose measurement LANL used to decide if a worker needed routine bioassay monitoring
dosimetry thresholds	Describes the point at which radiological personnel monitoring will be performed

KEY TERMS AND ACRONYMS (PART 2)

Term	Definition
dpm disintegrations per minute	A unit of radioactivity
ER evaluation report	NIOSH-owned document with the purpose of evaluating Special Exposure Cohort petitions
exotic radionuclides referred to as **“Exotics”**	All radionuclides other than $^{234/235/238}$Uranium, $^{238/239}$Plutonium, tritium, ^{241}Americium, and ^{137}Cesium
hot job	LANL term for non-routine, higher-hazard radiological work activities
in process (survey)	Refers to work that is actively being performed An in-process survey would a radiological survey conducted during work activities
LANL Los Alamos National Laboratory	U.S. Department of Energy institution in New Mexico

KEY TERMS AND ACRONYMS (PART 3)

Term	Definition
LANSCE Los Alamos Neutron Science Center	This complex includes the linear proton accelerator
MAP mixed activation products	Radioactive isotopes formed by neutron irradiation [activation] of materials (structure, coolant, impurities) during nuclear operations
MFP mixed fission products	Radioactive isotopes formed after heavy atomic nuclei (like ^{235}U or ^{239}Pu) or undergo nuclear fission
mrem millirem	A unit measuring radiation dose
NIOSH National Institute for Occupational Safety and Health	A Federal agency responsible for conducting research and making recommendations for the prevention of work-related injuries and illnesses

KEY TERMS AND ACRONYMS (PART 4)

Term	Definition
NORM naturally occurring radioactive material	These are radionuclides like uranium and thorium that in their natural form are found everywhere on earth (i.e., soil, water) and are common hazards for miners and oilfield workers As related to Department of Energy worksites, they are processed from their natural form through techniques like enrichment or separation
NTS Noncompliance Tracking System	A DOE computer system used to track noncompliance reports The “NC” before an ID number is part of the official ID tracking number (i.e., NC ID 484)
ORAUT Oak Ridge Associated Universities Team	Contractor team assisting NIOSH with fulfilling its responsibilities under the Energy Employees Occupational Illness Compensation Program Act (EEOICPA) ORAUT includes teaming partners (ORAU, MJW, NV5-Dade Moeller)
PAL plutonium access list	Listing of workers who were compliant with the plutonium bioassay program

KEY TERMS AND ACRONYMS (PART 5)

Term	Definition
postjob surveys	Radiological survey conducted after the conclusion of work activities to assess the conditions of the work area
prejob surveys	Radiological survey conducted before the start of work activities to assess the conditions of the work area
prompt-action	Refers to a bioassay sample collected when an intake may approach administrative or regulatory limits
RCT radiological control technician	An individual that ensures safety by monitoring radiation levels, conducting contamination surveys, and enforcing radiation protection procedures
routine	Refers to bioassay samples collected on a periodic basis to monitor the typical exposure of workers in compliance with 10 C.F.R. 835.402(c)(1)
RPRT	An abbreviation for report It is used as part of the ORAU team's official report number (e.g., ORAUT-RPRT-0101)

KEY TERMS AND ACRONYMS (PART 6)

Term	Definition
RWP radiological work permit	The document that establishes worker protection and monitoring requirements and contains specific approvals for radiological work activities The RWP serves as an administrative process for planning and controlling radiological work and informing the worker of the radiological conditions
SC&A	Acts as the independent technical support contractor for the Advisory Board on Radiation and Worker Health, which advises NIOSH
SEC Special Exposure Cohort	Designation that applies to certain classes of employees that allows eligible claimants to be compensated without the completion of a NIOSH dose reconstruction
special	Refers to bioassay samples collected after a suspected intake from an accident or an off-normal situation
SRDB Site Research Database	A comprehensive record repository used by the NIOSH Dose Reconstruction Program Cited references include the associated SRDB number

KEY TERMS AND ACRONYMS (PART 7)

Term	Definition
TA technical areas	Subdivisions of work locations at the LANL site that generally reflect operational activities
TBD technical basis document	Documents that establish standard methods for calculating internal and external radiation exposures, forming part of a site profile.
worker self-monitoring	Workers are required to use radiation detecting instruments to frisk or check themselves for removable contamination
workplace controls	These are administrative controls conveyed to workers through procedures and training They include things like entry requirements necessary to enter a controlled area, such as training, personal protective equipment, dosimetry, and stay times