SC&A Review of Los Alamos National Laboratory Internal Dose Topics (RPRT-0101 and RPRT-0102)

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SEC-00109 Evaluation Report (ER) Addendum

- End date of December 31, 1995, for the Special Exposure Cohort (SEC) petition SEC-00109 class is based on the presumption that Los Alamos National Laboratory (LANL) would have been in full compliance with Title 10 of the Code of Federal Regulations (10 CFR) Part 835, "Occupational Radiation Protection," by then.
- With full compliance, the National Institute for Occupational Safety and Health (NIOSH) assumes that all U.S. Department of Energy (DOE) work sites, including LANL, would have satisfied the monitoring requirements in the rule, thereby resolving any limitations that make dose reconstruction infeasible prior to that date.
- For LANL, these limitations included the "inability to bound unmonitored intakes of exotic alpha-emitters, fission products, and activation products."

SC&A summary of 2022 NIOSH position on LANL SEC-00109 ER Addendum

- NIOSH concurs that 10 CFR Part 835 “presumptive” compliance is not sufficient to demonstrate implementation of 100 millirem (mrem)/year committed effective dose equivalent (CEDE).
- NIOSH finds other bases upon which bounding assumption of 100 mrem/year CEDE can be assumed at LANL during 10 CFR Part 835 era:
  - **Programmatic:** field monitoring and contamination control programs “well-established and formalized” by January 1, 1996, and “intended to ensure that unmonitored individuals were unlikely to receive intakes of 100 mrem CEDE.”
  - **Bioassay data adequacy and completeness:** abundance of bioassay data for primary radionuclides that demonstrate ER Addendum intake rates are bounding at 2% stochastic annual limit on intake (SALI) (100 mrem CEDE); no reason to believe that intakes of exotic radionuclides by unmonitored workers would be substantially different.
- NIOSH believes the 10 CFR Part 835 era represents a paradigm shift in DOE operations.

NIOSH conclusion (2022)

Based on “weight of evidence,” NIOSH concludes that assignment of 2% SALI (or intakes that would have resulted in 100 mrem CEDE) is justified for unmonitored workers at LANL, 1996–2005, as proposed in ER Addendum.

Background: Radiation Work Permit completeness

- NIOSH acknowledged that SC&A disagrees with NIOSH's assessment that the amount of routine bioassay data available obviates the need to confirm its completeness in the face of NC ID 484 findings of potential data gaps for bioassay enrollment and radiological work permit (RWP) job-specific bioassay participation.
- NIOSH committed to follow up with LANL to ascertain whether the bioassay incompleteness identified in the limited sampling in 1999 reflects a broader incompleteness in LANL's bioassay database for 1996–2000.

Background: RWP sampling

- Based on LANL interviews:
  - There was nothing done at the time to determine the magnitude of individuals not leaving the required bioassay.
  - For other issues, e.g., inadequate RWP checklists, corrections were only made going forward in time.
- NIOSH agreed to develop a sampling plan and sample RWPs to determine compliance with bioassay requirements.
- While the Work Group (WG) agreed with the RWP sampling plan, NIOSH proceeded to encode the entire available RWP set.

Background: RPRT-0101 and RPRT-0102

- Presented at the March 23, 2022, LANL work group meeting:
  - ORAUT-RPRT-0102, rev. 00, "Assessment of Los Alamos National Laboratory Plutonium Bioassay Programs, 1996 to 2001," issued on December 2, 2021 ("RPRT-0102")
  - ORAUT-RPRT-0101, rev. 00, "Bounding Intakes of Exotic Radionuclides at Los Alamos National Laboratory," issued on March 1, 2022 ("RPRT-0101")

LANL work group tasking

- At its March 23, 2022, meeting, WG tasked SC&A to review RPRT-0101 and RPRT-0102 and, in parallel, to review available RWPs, captured by NIOSH, as a further means to assess job-specific bioassay data completeness, particularly for source terms other than plutonium and other primary radionuclides.
- With NIOSH's distribution of ORAUT-RPRT-0103, rev. 00, on August 15, 2022, SC&A included it in its review.

SC&A's two-fold review approach

1. SC&A examined to what extent available data and analysis in the three NIOSH reports (0101, 0102, 0103) are complete and representative of exposed worker population.
2. SC&A reviewed programmatic considerations for LANL implementation of bioassay programs for exotic radionuclides for the SEC time period in question.

- Threshold question is whether conditions and basis for prior SEC class designation had been satisfied after 1995 such that individual dose reconstructions with sufficient accuracy are feasible for internal radiological exposures to fission and activation products and various other radionuclides (i.e., "exotic" radionuclides) to which these workers may have been subjected during the time period in question.

SC&A's Findings and Observations Regarding Review of RPRT-0101: Bounding Intakes of Exotic Radionuclides at Los Alamos National Laboratory

RPRT-0101 Finding 1: Completeness of area monitoring

Finding 1

- 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 sample within the three facilities evaluated. Likewise unknown are the radiological classifications of the areas the data represent.

Basis

- NIOSH acknowledged that the data captured was meant to be illustrative rather than quantitative (i.e., not a random sample nor known to be a representative sample rather a scoping analysis).

RPRT-101 Finding 2: Secondary confirmation of selected data

Finding 2

- 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.

Basis

- No regular Health Physics reports have been captured that would provide an indication of the number of area monitoring data measurements (e.g., the number of swipes taken in March 1998); it is not clear whether such data exists.

RPRT-101 Finding 3: Dates of example monitoring

Finding 3

- 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 for the one for Technical Area (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.

Basis

- SC&A believes the majority of captured documentation is illustrative and helpful but is also limited and procedural in nature.

RPRT-101 observations: Data analysis and interpretation in dose reconstruction

- **Observation 1.** 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
- **Observation 2.** 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.
- **Observation 3.** 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 (around 33% and 22%, respectively). This was significantly higher than all other technical areas and years.

RPRT-0101: NIOSH and SC&A conclusions

NIOSH:

- Weight of evidence clearly indicates that worker doses due to unmonitored exotic radionuclides would not likely have exceeded 100 mrem/year. Doses for workers monitored by bioassay can be bounded using bioassay results.

SC&A:

- Report not based on a complete dataset either by location or by year; overall completeness is unknown.
- 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 for the one for TA-48, which was effective July 1997).
- Assertion that the strength of LANL radiological controls can be founded on LANL "operat[ing]] a radiation protection and control program that included the use of portal monitors to identify and remediate workplace radiological contamination" is necessary but not sufficient as a measure for bioassay monitoring adequacy.

SC&A's Findings and Observations Regarding SC&A Review of RPRT-0102: Assessment of Los Alamos National Laboratory Plutonium Bioassay Programs 1996 to 2001

RPRT-0102 Finding 4: Association of observed monitoring and RWP requirements

Finding 4

- 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.

Basis

- This basis does not directly reflect a compliant RWP-directed bioassay program and would not reflect any worker exposures who then left the site during the intervening period between the end of work and any subsequent opportunity to be sampled.

RPRT-0102 Finding 5: Time-based monitoring window

Finding 5

- 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 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.

Basis

- This basis does not directly reflect a compliant RWP-directed bioassay program and would not reflect any worker who left the site during the intervening period between the end of work and any subsequent opportunity to be sampled.

RPRT-0102 Finding 6: Exposure potential based on specific tasks

Finding 6

- 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.

Basis

- The concept of “effective monitoring” (i.e., the workers were side by side) has been discussed and rejected by the Board for other sites, especially in RWP-based monitoring protocols.

RPRT-102 Observations 4 and 5

- **Observation 4.** 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 approximately 45% compliance for 29 requests in 2001 (approximately 72% 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 (approximately 89%) and was never lower than approximately 83%.
- **Observation 5.** 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% 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 energy employee was not exposed to plutonium for the entirety of the intended monitoring period.

RPRT-102 Observation 6

- **Observation 6.** 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).

RPRT-0102: NIOSH and SC&A conclusions

NIOSH:

- A 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, therefore, are adequate to construct a co-exposure model for plutonium.

SC&A:

- SC&A conditionally accepts that a co-exposure model for plutonium may be constructed for LANL for 1996–2005 based on the amount and availability of routine bioassay data for those years and its representativeness for exposure potential.
- However, NC ID 484 raises questions of bioassay data completeness and representativeness for both routine and nonroutine (e.g., RWP job-specific bioassays) internal exposures.

Questions?