

NIOSH and SC&A Reviews of Issues with SEC-00109 LANL Addendum

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Chronology

- NIOSH issued Addendum to SEC-00109 petition evaluation addressing 1996-2011: April 24, 2017 (Class evaluated: all Service Support Workers for January 1, 1976 through December 31,2005)
- SC&A was tasked with reviewing the NIOSH addendum: May 4, 2017
- SC&A issued their review of the NIOSH Addendum: July 27, 2017
- LANL work group meeting on Aug 15, 2017, followed by presentations by NIOSH and SC&A at Board meeting in Santa Fe, NM, on Aug 24, 2017
- NIOSH issued its response to SC&A's review: Sept 12, 2018
- SC&A issued its response to NIOSH's response: Nov 16, 2018
- LANL work group meeting on Nov 29, 2018

SEC-00109 Evaluation Report Addendum

- End date of December 31, 1995, for SEC-00109 class is based on the presumption that LANL would have been in full compliance with 10 CFR Part 835, “Occupational Radiation Protection,” by then.
- With full compliance, NIOSH assumes that all DOE work sites, including LANL, would have satisfied the monitoring requirements contained 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.”

Summary of NIOSH and SC&A Review

- SC&A concluded program compliance with 10 CFR 835, while necessary under DOE's regulatory framework, is not sufficient for demonstrating that actual radiation program practice is adequate for 1996-2005 SEC evaluation years.
- NIOSH concurs that 10 CFR Part 835 "presumptive" compliance not sufficient to demonstrate implementation of 100 mrem/year CEDE, but additional analyses support weight-of-evidence conclusion that it is bounding of internal intakes.
- NIOSH finds other bases upon which bounding assumption of 100 mrem/year CEDE can be assumed:
 - 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 for primary radionuclides demonstrate ER Addendum intake rates are bounding at 2% SALI (100 mrem CEDE); "no reason to believe that intakes of exotic radionuclides by unmonitored workers would be substantially different."
- NIOSH believes 10 CFR Part 835 era represents "paradigm shift in DOE operations"

Technical capabilities to monitor for MFAP

- NIOSH and SC&A agree that germanium detectors in wide use at LANL since 1970s and over 7,000 MFAP in-vivo records exist for LANSCE workers; however, SC&A emphasizes LANL did not focus on exotic radionuclides and bioassay data remain inadequate for coworker modeling after 1995.
- SC&A agrees with NIOSH that work with (and potential exposure to) exotics at LANL had become increasingly sporadic in 1990s
- Using gaseous MAPs from LANSCE as illustrative marker, SC&A found average occupational doses to have declined to well under 100 mrem/year by mid-1990s; could NIOSH demonstrate maximum worker exposures to relevant exotics had likewise declined to below 100 mrem CEDE/year after 1995?

NIOSH additional “weight-of-evidence”: LANL field monitoring program

Health Physics field monitoring and contamination control program:

- Over 60 procedures addressing radiological protection – Covering program administration, exposure and contamination control, monitoring, instrumentation, protective equipment, emergency response, and the As Low As Reasonably Achievable (ALARA) program.
- Additionally area-specific procedures and instructions existed

LANL field monitoring program (cont'd)

- NIOSH has captured a number of field monitoring data at LANL for the period under evaluation including:
 - Radiological Work Permits (RWP)
 - Monthly/Quarterly Contamination Surveys
 - Area-specific contamination surveys
 - Area-specific monitoring data quarterly reviews
 - Air sample analysis data
 - Air sampling/monitoring technical evaluations
 - Airborne radioactivity investigation reports

LANL field monitoring program (cont'd)

- NIOSH attempted to review work controls established by reviewing RWP
- During NIOSH's multiple data captures, NIOSH found many boxes of LANL RWPs
 - NIOSH did not capture all but what we feel is a representative sample (several hundred)
 - NIOSH focused on finding RWPs that involved non-routine radionuclides
 - Many RWPs for common radionuclides were also collected

SC&A response to NIOSH position on LANL field monitoring program

- Whether field monitoring and contamination control programs “well-established and formalized” belies whether they were adequately carried out by LANL personnel in practice.
- LANL’s self-assessment of bioassay program in 1999 found significant deficiencies, including those impacting LANL’s ability to monitor workers likely to receive 100 mrem CEDE/year – only in-depth validation of LANL practice during late 1990s.
- Findings that workers not providing RWP-required bioassays, and CTWs not being enrolled in bioassay program, raise concern over data adequacy and completeness for 1996–2000.
- NIOSH’s reference to “hundreds of radiological documents” points to a functional bioassay program, not necessarily one being adequately carried out “on the ground.”

NIOSH additional “weight-of-evidence:” Comparison of Monitored Worker Dose to 100 mrem CEDE

- LANL noted that its internal dosimetry monitoring programs are established on an as-needed basis and monitoring is only required for radiological workers likely to receive 100 mrem annually from internal exposure
- LANL further notes:
 - LANL has an in-vivo monitoring program established for fission and activation products, and has historically used in vivo monitoring for these radionuclides. A spectral analysis of each count was performed by the in vivo staff. During this review, all peaks were identified and quantified

Comparison of Monitored Worker Dose to 100 mrem CEDE (cont'd)

- NIOSH reviewed the LANL Bioassay Repository Database (ORAUT-OTIB-0063). The database includes 106,950 in-vivo records
 - Pu-239 and Am-241 make up 82% of the records
 - U-234 and Th-234 make up 10% of the records
 - Bulk of the remaining 7000+ records is primarily comprised of fission and activation product radionuclides for LANSCE employees that were acquired via germanium detectors

Comparison of Monitored Worker Dose to 100 mrem CEDE (cont'd)

Primary Radionuclides (Tritium, Plutonium, and Uranium)

- There are over 450,000 LANL urinalysis records for 1945 through 2008
- As previously mentioned there are over 100,000 in-vivo records
- The data are presented and evaluated in the Internal Dosimetry Coworker Data for LANL(ORAUT-OTIB-0062)
- Tables 5-1 through 5-7 of the white paper are tables taken from OTIB-0062. They show for the primary radionuclides:
 - Dose for monitored workers generally goes down over time
 - Dose for monitored workers are less than 100 mrem CEDE with one exception

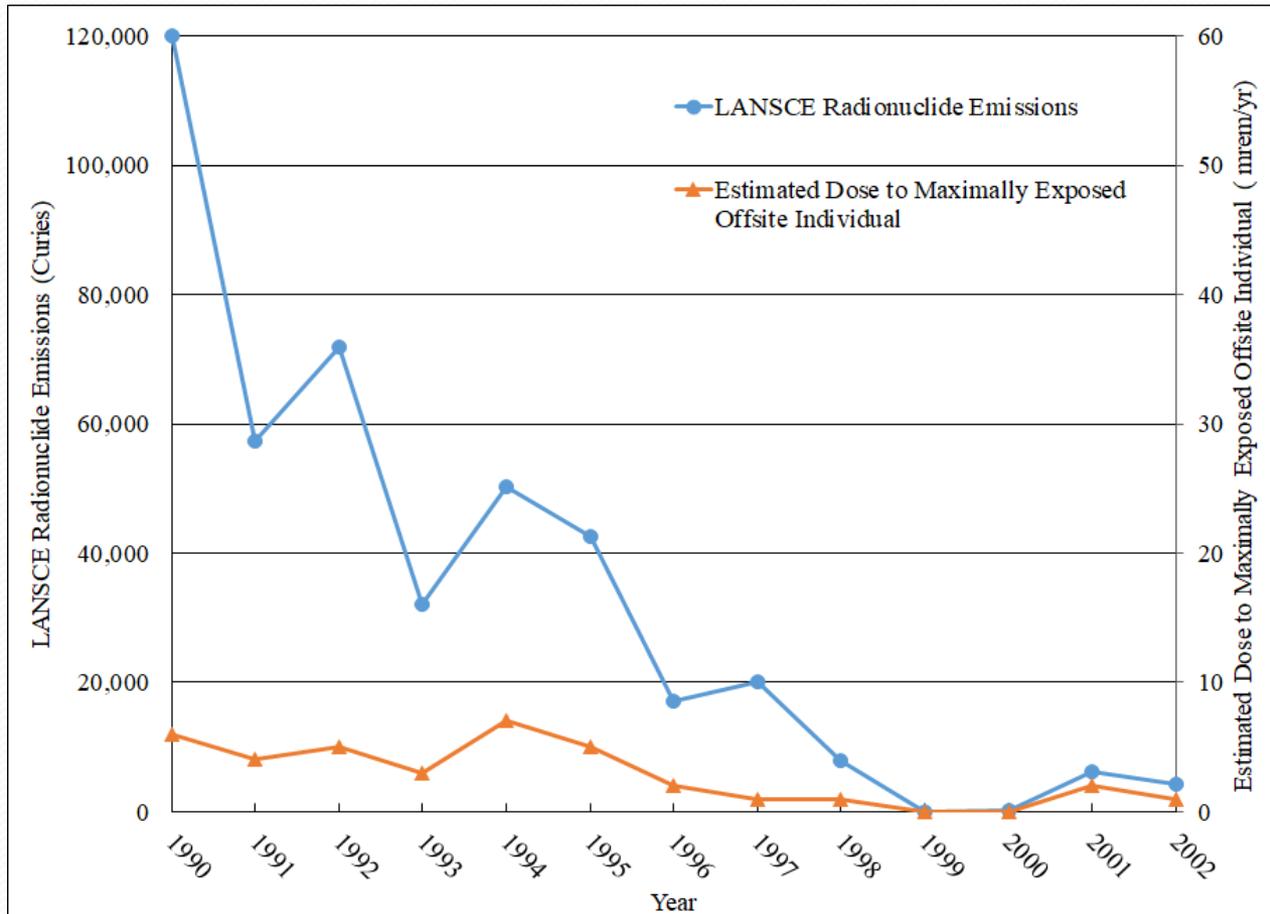
SC&A response to NIOSH Position that Intakes Can Be Bounded by 100 mrem/yr CEDE

- Finds no substantiation for NIOSH's belief regarding exotic radionuclides; 100 mrem/year CEDE bounding for primary radionuclides.
- Notes that Work Group and NIOSH agree that bioassay results for primary radionuclides should not be used to compare or bound intakes of exotics.
- Does not agree with NIOSH apparent support of LANL's contention that bioassay data for exotics scarce because workers not required to be monitored for them; exotics monitoring was not focus.
- Bounding dose assessment lacking for exotics (LANL or NIOSH); long-established precedent at other EEOICPA sites for dose modeling based on source term or air sampling results.

A Perspective: Gaseous Mixed Activation Products (G/MAPs) from LANSCE and Dose Assessment

- SC&A agrees with NIOSH statement that work with (and potential exposures to) exotics at LANL had become increasingly sporadic, particularly after 1995.
- LANSCE/LAMPF was dominant source of airborne radionuclides at LANL from late 1970s to 1990s (site description TBD, 2004). Represents one key source of potential unmonitored G/MAPs exposure.
- However, LANSCE airborne emissions and related estimated site boundary doses have steadily declined since mid-1980s to almost negligible by 1999.
- Gaussian-based dispersion modeling of occupational exposure from G/MAPs from LANSCE show average whole-body dose range of 0.3 to 20 mrem/year during 1996–2000 period (occupational environmental dose TBD, 2010).
- Decline of LANSCE emissions and corresponding estimated average worker whole-body dose by 1996 is significant – can maximum worker exposures be similarly characterized for exotics based on available source term and monitoring data?

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

Appendix A –LANL Petitioner Issues and Resolutions

- A number of issues have been identified by the petitioner over the course of several years
- The petitioner has provided a vast amount of supporting documents in support including: – Petition with 102 page written narrative – CD with a number of documents
- The petitioner has also been very active in Advisory Board meetings and work group meeting
- Appendix A identifies the petitioner issues and provides NIOSH's response to those issues
- Beyond outstanding 10 CFR 835 implementation issues referenced as SC&A issues, SC&A had one clarifying comment re Issue #55 (status of MAPs dose estimation from LANSCE)

NIOSH Conclusion

- The field monitoring and contamination control programs at LANL were well-established and formalized by January 1, 1996 to ensure areas where workers were likely to exceed 100 mrem CEDE were well identified and controlled
- Based on review of existing bioassay results, workers monitored for the primary radionuclides were unlikely to have received intakes exceeding 100 mrem CEDE
- Based on the routine monitoring and contamination control established, NIOSH has no reason to believe intakes of exotic radionuclides for unmonitored workers would be different

SC&A Conclusions

- Lack of substantiation that 100 mrem/year CEDE bounds unmonitored intakes of exotics after 1995; available evidence supports only primary radionuclides
- Lack of follow-up to establish whether 1999 LANL findings regarding bioassay program deficiencies demonstrate data inadequacy and incompleteness significant enough to impair dose reconstruction
- DOE enforcement moratorium in 1998 underscores “commonality” of serious bioassay program deficiencies across DOE sites despite implementation of 10 CFR Part 835 almost 3 years before; uniform site implementation of 100 mrem/year CEDE as basis for compliant bioassay monitoring should not be assumed

NIOSH Actions

- NIOSH will respond to the 1999 LANL program self-assessment
NIOSH plans to issue a white paper that will:
 - Identify the findings of the assessment
 - Provide the background information driving the finding
 - Corrective actions taken by the site
 - How the findings affect NIOSH's ability to reconstruct dose
 - Expected Completion: March 2019
- NIOSH will draft a plan and schedule for addressing how they will reconstruct dose for mixed fission and activation products and other exotics at LANL
 - Expected Completion: March 2019