SC&A Review of NIOSH White Paper:
NIOSH Response to SC&A's Review of the SEC-00109 LANL Addendum

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SEC-00109 Evaluation Report Addendum

- End date of December 31, 1995, for the 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."

SC&A Summary of Updated NIOSH Position re: LANL SEC-00109 Evaluation Addendum

- NIOSH concurs that 10 CFR Part 835 "presumptive" compliance not sufficient to demonstrate implementation of 100 mrem/year 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% 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"

NIOSH Conclusion

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.

NIOSH Position that 100 mrem/year CEDE Can Be Based on Program Adequacy

- 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 Position that Intakes Can Be Bounded by 100 mrem/yr CEDE

- NIOSH:
  - Looks to primary LANL radionuclides – tritium, plutonium, uranium – where bioassay data are "abundant," to demonstrate intake values for any given year are bounded by 100 mrem/year CEDE.
  - Finds "no reason to believe that intakes of exotic radionuclides by unmonitored workers would be substantially different."
- SC&A:
  - 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; long-established precedent at other EEOICPA sites for dose modeling based on source term or air sampling results.

SC&A Response: 10 CFR Part 835 as a Paradigm Shift

- Agree that 10 CFR part 835 implementation period in late 1990s increased accountability to safety and health; however, that accountability not necessarily accomplished by January 1, 1996.
- Bioassay program deficiencies so widespread across complex in 1997–1998 that DOE imposed 120-day moratorium beginning December 1, 1998, for all contractors to self-assess and correct common concerns, including:
  - Lack of formalized and approved procedures
  - Non-collection and participation in required bioassays
  - Improper use of MDA criteria
  - Failure to properly evaluate bioassay results
  - Failure to maintain accurate internal dose records
- For LANL, specifically:
  - 1997: Pu bioassay pgm deficiencies, 10 corrective actions
  - 1999: Internal dose/bioassay pgm deficiencies, 10 corrective actions

Specific Issue: Technological Limitations of *in vivo* Capability

- NIOSH states it does not share many of SC&A's concerns, but more agreement than not (based on points provided on page 12 of NIOSH response):
  - Use of germanium detectors: SC&A and NIOSH agree on their use (albeit, twin three-detector array of HPGe detectors introduced in 1998, replacing phoswich detectors).
  - Lack of bioassays, internal dose assessments for exotics: SC&A and NIOSH agree that data are scarce and were primary driver to extend LANL SEC to 1995.
  - SC&A disagrees that DR approach for exotics cited in ER Addendum is valid given its basis in 10 CFR Part 835 compliance.
  - SC&A and NIOSH agree that use of exotic radionuclides was rare compared with primary radionuclides, but SC&A views their occupational exposure potential to be historically significant, albeit sporadic in later years.

  [remaining points addressed elsewhere in SC&A's report]

Specific Issue: DOE Oversight Finding in 2001

- NIOSH does not share SC&A's concern over lack of Th-232 monitoring capability and absence of LANSCE-related MAPs in LANL's *in vivo* monitoring library, and cites LANL's monitoring capability for Th-232.
- DOE found that LANL not providing capability to monitor for Th-232, which would entail action to "maintain the phoswich system consistent with this need or update their procedure and/or calibrations to permit thorium monitoring on the germanium system."
- DOE also found that LANL *in vivo* program had "not received the library of radionuclides of concern from LANSCE."
- SC&A agrees with DOE finding that LANL capabilities to monitor for Th-232 and MAPs were hampered.

Specific Issue: Exposures from Unevaluated Np-237

- NIOSH: LANL would have limited any unmonitored doses to Np-237 sources to 100 mrem CEDE/year and any unmonitored exposures can be bounded accordingly.
- SC&A: Potential Np-237 exposure sources identified that need to be evaluated; presumption regarding 100 mrem/year CEDE based on "well-established and formalized" bioassay programs not supportable for reasons stated earlier.

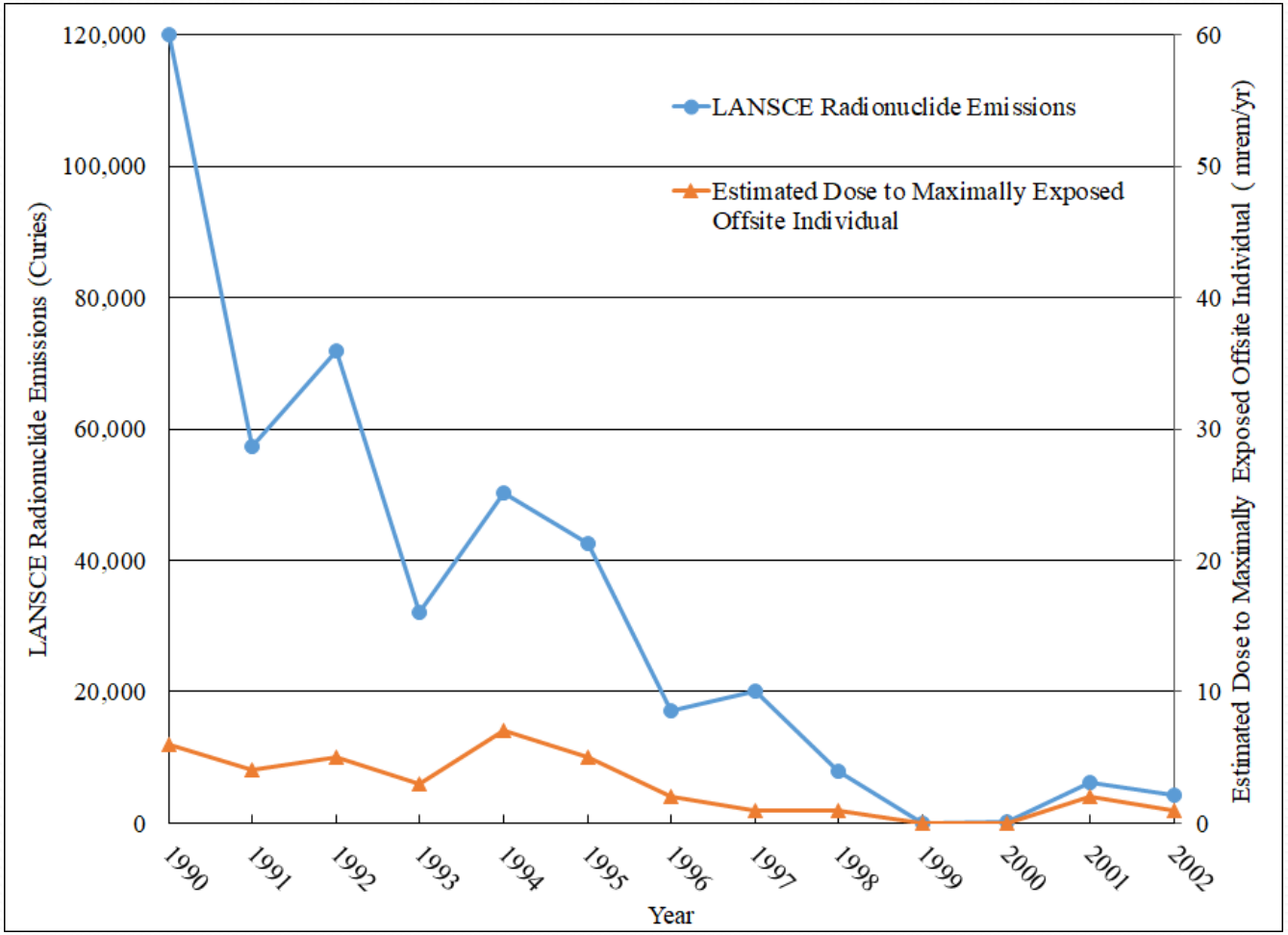
Specific Issue: Relevancy of DOELAP Accreditation

- NIOSH: Does not agree that DOELAP accreditation is relevant to full compliance with 10 CFR Part 835.
- SC&A:
  - At some DOE sites, compliance with 10 CFR Part 835 internal dose requirements not fully satisfied until DOELAP accreditation process well underway.
  - LANL 1997 response to bioassay program deficiencies entailed commitment to DOE for expedited action to "meet the requirements of [DOELAP]" and to perform an assessment to "identify and eliminate weakness found in the [bioassay] program."
- Clear that both LANL and DOE found DOELAP relevant to advancing 10 CFR Part 835 compliance.

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

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