MEMORANDUM

TO: Los Alamos National Laboratory Work Group
FROM: SC&A, Inc.
DATE: January 4, 2019
SUBJECT: Clarification Comments about NIOSH White Paper Response (September 12, 2018), Appendix A, "SEC-00109 LANL Petitioner Issues and Resolutions"

Beyond SC&A's general comments in its draft report (SC&A 2018) about the assumption of 100 millirem (mrem) committed effective dose equivalent (CEDE)/year for any unmonitored exposures after 1995 (an assumption that figures in many of the responses in Appendix A), SC&A has one specific comment on Appendix A. As a function of NIOSH's intended reassessment of such exotic internal exposures (ABRWH 2018), this concern may also be resolved in the course of that planned review.

Issue 55. Petitioner concern about spallation products from the accelerator

The National Institute for Occupational Safety and Health's (NIOSH's) response to the petitioner (NIOSH 2018, p. 54) notes that: "For dose reconstruction purposes, NIOSH has numerous bioassay results for LANSCE that include assay for Be-7, C-11/N-13, and several other activation products (as shown in Table 4-1 in this white paper)" and that these products "were unlikely to have been significant contributors to worker doses."

SC&A Clarification Question

The Special Exposure Cohort (SEC)-00109 Addendum white paper (NIOSH 2018, p. 22) acknowledges that "a class of LANL workers has been added to the Special Exposure Cohort due to a lack of available bioassay data for 'exotic' radionuclides" (including mixed activation products [MAPs], such as those emitted by Los Alamos Neutron Science Center [LANSCE] over the years), and that lack of such data persists to the present time. In the SEC petition evaluation report addendum (NIOSH 2017), NIOSH indicates that in the absence of bioassay data for exotics, it intends to assign 100 mrem CEDE to annual intakes for exotics, including MAPs.

In its Appendix A response for Issue 55, NIOSH states that, given the "short-half lives" of the "numerous" bioassay results "for Be-7, C-11/N-13, and several other activation products," these spallation products were "unlikely to have been significant contributors to worker doses" (NIOSH 2018, p. 54). However, the unlisted "other activation products" include argon-41 (Ar-41) and oxygen-15 (O-15), which are referenced in Table 4-29 of ORAUT-TKBS-0010-4 (but not in Table 4-1 of the white paper), as the basis for estimated whole-body and skin doses for LANSCE airborne emissions, respectively (NIOSH 2010). For the years 1990–1997, using a

whole-body dose factor based on Ar-41 and a skin dose factor based on O-15, **average** occupational whole body doses from LANSCE emissions were estimated to range from 11 mrem to 120 mrem, and **average** skin doses from 17 mrem to 190 mrem. While SC&A agrees that the other LANSCE activation products are relatively short-lived, the half-life of Ar-41 is almost 2 hours.

In terms of applicable dose coefficients, NIOSH 2010 explains:

> *Submersion dose coefficients for the four radionuclides (^{11}C, ^{13}N, ^{15}O, and ^{41}Ar) are less than or equal to the skin dose factor for ^{15}O (1.04×10^{-13} Sv/Bq or 3.85×10^{-6} mrem/µCi) or the whole-body dose factor for ^{41}Ar (6.50×10^{-14} Sv/Bq or 2.41×10^{-6} mrem/µCi) according to Federal Guidance Report No. 11…. Therefore, this analysis simplified the calculations by assuming that the composite emissions activity for all four radionuclides was equal to that for ^{15}O alone for skin dose, and to that for ^{41}Ar alone for whole-body dose.* [NIOSH 2010, p. 23]

Based on Table 4-1 of the white paper, it remains unclear whether NIOSH has any bioassay or air monitoring data that includes either O-15 or Ar-41 such that MAP emissions from LANSCE can be dose reconstructed with sufficient accuracy after 1995.

References

ABRWH 2018. Meeting of the Advisory Board on Radiation and Worker Health, Redondo Beach, CA. December 12–13, 2018. [Transcripts pending]

NIOSH 2010. *Los Alamos National Laboratory – Occupational Environmental Dose*, ORAUT-TKBS-0010-4, Revision 01, National Institute for Occupational Safety and Health, Cincinnati, OH. March 26, 2010. [SRDB Ref. ID 80164]

NIOSH 2017. *SEC Petition Evaluation Report, Petition SEC-00109, Addendum*, National Institute for Occupational Safety and Health, Cincinnati, OH. April 24, 2017. [SRDB Ref. ID 173741]

NIOSH 2018. *NIOSH Response to SC&A's Review of the SEC-00109 LANL Addendum: Response Paper*, National Institute for Occupational Safety and Health, Cincinnati, OH. September 12, 2018. [SRDB Ref. ID 173861]

SC&A 2018. *SC&A Review of White Paper, "NIOSH Response to SC&A's Review of the SEC-00109 LANL Addendum,"* SCA-TR-2018-SEC005, Revision 1, SC&A, Inc., Arlington, VA. November 16, 2018.