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**ADVISORY BOARD ON
RADIATION AND WORKER HEALTH**

National Institute for Occupational Safety and Health

**INTEGRATED STATUS REPORT OF SITE PROFILE AND SEC
ISSUES RELATED TO INL AND ANL-W**

**Contract No. 211-2014-58081
SCA-TR-2016-SEC011, Revision 0**

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July 2016

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SC&A, INC.: *Technical Support for the Advisory Board on Radiation and Worker Health Review of NIOSH Dose Reconstruction Program*

DOCUMENT TITLE:	Integrated Status Report of Site Profile and SEC Issues Related to INL and ANL-W
DOCUMENT NUMBER/ DESCRIPTION:	SCA-TR-2016-SEC011
REVISION NO.:	0 (Draft)
SUPERSEDES:	N/A
EFFECTIVE DATE:	July 15, 2016
TASK MANAGER:	John Stiver, MS, CHP [signature on file]
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Record of Revisions

Revision Number	Effective Date	Description of Revision
0 (Draft)	07/15/2016	Initial issue

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ABBREVIATIONS AND ACRONYMS

ABRWH	Advisory Board on Radiation and Worker Health or Advisory Board
ANL-W	Argonne National Laboratory-West
ANP	Aircraft Nuclear Propulsion
CDC	Centers for Disease Control and Prevention
CFA	Central Facilities Area
cpm	counts per minute
CPP	Chemical Processing Plant
Cs	cesium
D&D	decontamination and decommissioning
DCAS	Division of Compensation and Analysis
DOE	U.S. Department of Energy
DR	dose reconstruction
ER	evaluation report
FAP	fission and activation product
FP	fission product
HDE	Historical Dose Evaluation
HP	Health Physics
IET	Initial Engine Test
INEL	Idaho National Engineering Laboratory
INL	Idaho National Laboratory
MDL	maximum detectable limit
MESODIF	Mesoscale Atmospheric Transport Model
MeV	mega-electron volts
MFP	mixed fission product
mrem	millirem
MTR	Materials Test Reactor
Np	neptunium
NIOSH	National Institute for Occupational Safety and Health
NTA	nuclear track emulsion, type A (film)
ORAUT	Oak Ridge Associated Universities Team

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ORIGEN	Oak Ridge Isotope Generator
OTIB	ORAUT Technical Information Document
POC	probability of causation
Pu	plutonium
SEC	Special Exposure Cohort
SL-1	Stationary Low-Power Reactor
Sr	strontium
SRDB	Site Research Database
TAN	Test Area North
TBD	technical basis document
Th	thorium
TLD	thermoluminescent dosimeter
U	uranium
UO ₂	uranium dioxide
WG	Work Group

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1.0 INTRODUCTION

The National Institute for Occupational Safety and Health (NIOSH) and SC&A have been assisting the Advisory Board on Radiation and Worker Health (ABRWH or “Advisory Board”) in identifying, reviewing and closing out issues related to Idaho National Laboratory (INL) site facilities, beginning with SC&A’s January 25, 2006, review of the 2004 version of NIOSH’s site profile for INL (SC&A 2006). In 2007, NIOSH issued a revision of the site profile, and on December 30, 2008, SC&A issued a supplement to its review of the site profile (SC&A 2008). This supplement contained 13 findings and 19 observations (collectively referred to as “issues” in this report). The latest INL issues resolution matrix currently available on the NIOSH Web site, dated March 20, 2014 (NIOSH 2014c), is a useful platform upon which to build a status report for all issues associated with both INL and the Argonne National Laboratory-West (ANL-W); this NIOSH/Division of Compensation Analysis and Support (DCAS) matrix follows closely SC&A’s *INL SEC-00219: Compilation of SC&A Review issues, Comments, and Recommendations*, dated February 23, 2016 (SC&A 2016a).

Though administratively separate until 2005, with separate research programs, ANL-W is physically located on the INL site and shares many of the radiation protection issues with INL and also employs common radiation protection programs. Given the protracted review of issues related to INL site facilities, including a relatively recent Special Exposure Cohort (SEC) for the INL Chemical Processing Plant (CPP) (SEC-00219), and also the recent attention to ANL-W by NIOSH and the Advisory Board, including an ANL-W SEC (SEC-00224), the Advisory Board requested that SC&A compile a report on the status of all issues that have been identified and have been or are being addressed by the Board. This status report is provided in response to this request and is intended to help ensure that (1) no issues are left unaddressed, given the protracted nature of the INL facilities review, and (2) issues that are common the both INL and ANL-W are identified, which should help to streamline the review process for both facilities.

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2.0 STATUS OF INL SITE PROFILE ISSUES

We elected to begin this process with a review of the March 20, 2014, NIOSH/DCAS issues resolution matrix (NIOSH 2014c), which addresses all facilities at INL except ANL-W and the Naval Research Facility. The matrix shows that Issues 3, 7, 10, 11, 12, 13, 22, 25, 37, and 38 have been closed by the INL Work Group (WG); SC&A recommends in the matrix that the WG close Issues 4, 8, 14, 17, 18, 20, 21, 26, 29, 30, 32, 33, 35, and 36. At the time of the preparation of the matrix, the remaining 14 issues were in various stages of review. SC&A recommended that these issues remain open for a variety of reasons, such as waiting on commitments by NIOSH to prepare white papers and coworker models.

The following briefly identifies and describes the issues that remained open as of March 2014. Those issues that are generic (i.e., apply to more than a single site) and, in SC&A's opinion, have been resolved under other venues, are so indicated. As such, these are new SC&A recommendations:

- **Issue 1:** Onsite outdoor exposures to workers from routine atmospheric emissions. NIOSH issued a separate white paper on this issue, which is discussed in Section 2.1.
- **Issue 2:** Onsite outdoor exposures to workers from episodic atmospheric emissions. In the matrix, NIOSH states that a response to this issue is in a separate white paper. That white paper is discussed in Section 2.1.
- **Issue 5:** Internal doses from high-risk jobs. In the matrix, NIOSH argues that this issue is adequately addressed in the site profile. This matter is similar to Issue 34, in which neutron exposures to high-risk job categories is discussed (see Section 2.5).
- **Issue 6:** Calibration of equipment used to collect the data used to reconstruct internal exposures. In the matrix, NIOSH argues that this issue is related to a Tiger Team finding and is not a site profile issue because the methods used in the site profile to reconstruct doses account for uncertainties associated with instrument calibration. NIOSH provides the basis for its position in Section 4.4 of the March 5, 2014, NIOSH white paper, *NIOSH Investigation into the Issues Raised in Comment 1 from SCA-TR-TASK1-005*, prepared by Brian Gleckler (NIOSH 2014e). The white paper explains that, because of deficiencies in the outdoor air monitoring program, including deficiencies in calibration, NIOSH elected not to use these data but instead relied on atmospheric models for reconstructing outdoor internal exposures at INL. We agree and recommend closing this issue).
- **Issue 9:** Exposures from direct contamination of skin. This is a generic issue that was resolved during issues resolution related to ORAUT-OTIB-0017, *Interpretation of Dosimetry Data for Assignment of Shallow Dose* (ORAUT 2005), and other site profile reviews. SC&A recommends closing this issue with respect to methods for reconstructing such doses. However, there is a need for additional guidance in the site profile for when such doses need to be explicitly considered. This matter is discussed in considerable detail in Section 2.3.

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- Issue 15:** Exposures to emergency response personnel who responded to the Stationary Low-Power Reactor (SL-1) accident. A vast body of records pertaining to the exposure of these emergency response personnel has been compiled. In addition, the matrix indicates that an SL-1 specific coworker model is provided in the site profile. SC&A would like to revisit the site profile with respect to this issue before recommending closure.
- Issue 16:** Missed external dosimetry data and the need for a coworker model. NIOSH's response to this issue in the matrix is that there is no need for an external dose coworker model. Coworker model issues remain of concern to both INL and ANL-W. We recommend that this issue remain in progress.
- Issue 19:** Angular dependence issues for external dosimetry. In the matrix, NIOSH explains that such angular adjustments are for workers at a glove box where the badge is worn on the collar, but the organ of concern is the lower body. Reference is made to ORAUT-OTIB-0010, Revision 01, *A Standard Complex-Wide Methodology for Overestimating External Doses Measured with Film Badge Dosimeters* (ORAUT 2006), and OCAS-IG-001, *External Dose Reconstruction Implementation Guideline* (NIOSH 2007). NIOSH issued a white paper on this subject, which is discussed in Section 2.2. As indicated, it appears that this issue requires additional discussion by the WG before it can be closed because the documents cited by NIOSH do not appear to explicitly address the interactions of photons with the shielding that covers the film. This shielding could substantively affect the readout of the film when photons strike the badge at a sharp angle.
- Issue 23:** External doses to high risk jobs (similar to issue 5).
- Issue 24:** Missed extremity doses. NIOSH issued a white paper on this subject, which is discussed below.
- Issue 27:** Questions pertaining to the use of ½ the maximum detectable limit (MDL) to account for missed dose, when the reconstructed doses are close to a probability of causation (POC) of 50%. SC&A recommends closing this issue because the use of ½ the MDL for missed dose is a well-established practice on the program.
- Issue 28:** Questions pertaining to the assignment of ½ the MDL for missed neutron doses, especially when using nuclear track emulsion, Type A (NTA) film, which could miss doses from neutrons below about 0.8 mega-electron volts (MeV). (This issue is similar to Issue 27 with respect to using ½ the MDL for missed dose. SC&A recommends closing this aspect of Issue 28. With respect to adjustment factors for reconstructing neutron doses, this issue has been resolved in other venues. In addition, we recently revisited the 2004 and 2011 INL technical basis documents (TBDs) and would like to withdraw this issue, because it appears that both TBDs thoroughly address this issue and have suggested adjustment factors for workers who were monitored with NTA film for the Zero Power Physics Reactor and Transient Reactor Test Facility at ANL-W.)

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- **Issue 31:** Missed neutron doses and the need for a coworker model. At the time of the preparation of this report, NIOSH is in the process of a data capture to fill in data gaps related to external dosimetry at INL and ANL-W.
- **Issue 34:** High-risk jobs and neutron exposures. In its response in the matrix, NIOSH indicates that it has responded to this issue in a separate document that is associated with documentation of worker interviews. NIOSH has issued a white paper on this subject, which is discussed in Section 2.5.

Given this historic background information, the approach used in this report is to first track the degree to which the remaining issues were subsequently addressed by NIOSH, SC&A, and the INL WG in order to determine if, as of the date of this report, we can recommend closing any of the remaining issues. This is followed by determining if any “new issues” have emerged subsequent to March 20, 2014, including those related to site profiles and INL and ANL-W SEC petition evaluation reports (ERs). During this process, we can assess the degree to which any “new issues” have already been adequately addressed as part of the issues resolution process. We also make certain judgments regarding whether a given new issue is unique to INL facilities, or if it might also have applicability to ANL-W as well. Our objective is to try to capture a broad view of issues that we believe need to be addressed by the Board that apply to INL as a whole, to ANL-W, and to specific facilities at INL and ANL-W. In addition, by revisiting the previously unaddressed INL issues, we may find that some might apply to ANL-W and might even be considered potential SEC issues. This report does not raise new issues. It is limited to providing the status of existing issues; this is a “book keeping” report.

2.1 ISSUES 1 AND 2 (OUTDOOR EXPOSURES FROM CHRONIC AND EPISODIC ATMOSPHERIC RELEASES)

On March 5, 2014, NIOSH issued a white paper, *NIOSH Investigation into the Issues Raised in Comment 1 from SCA-TR-TASK1-005*, prepared by Brian Gleckler (NIOSH 2014e). This report was prepared by NIOSH in response to Issue 1 in the March 20, 2014, issues matrix (NIOSH 2014c) dealing with outdoor exposure to workers associated with routine atmospheric releases from INL facilities and resuspension of particulates associated with ground contamination. A second NIOSH white paper that is closely related to Issue 1 and explicitly addresses Issue 2 is *NIOSH Investigation into the Issues Raised in Comment 2 from SCA-TR-TASK1-005* Revision 0, by Brian Gleckler, September 3, 2013 (NIOSH 2013). The former addresses chronic emissions, while the latter has applicability to episodic releases. It is noteworthy that, to the degree to which the Advisory Board determines that these issues should remain open, they could also have applicability to ANL-W.

However, as will be discussed, SC&A believes that many aspects of these issues have been resolved. With respect to Issue 1, one of SC&A’s concerns was with the use of a mesoscale atmospheric transport model (i.e., MESODIF), which, at that time, SC&A argued is used for offsite dose reconstruction 20 miles or more from the release point, and that it is not appropriate for assessing doses to workers onsite. NIOSH’s white paper (2014e) provides a description of MESODIF, citing National Oceanic and Atmospheric Administration documentation that explains that the code can be used in the near field by selecting dispersion coefficients as input to the code that apply to shorter distances. The white paper (NIOSH 2014e) acknowledges that

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MESODIF may not be appropriate for use in predicting airborne concentrations that are less than 100 m from a release point. However, the white paper explains that all substantive airborne releases were from elevated stacks, and that there would not be substantial exposures to workers located within 100 m from the stack, unless there were fumigation conditions,¹ which NIOSH states occur less than 1% of the time at INL. NIOSH concludes that, because of this, worker exposures outdoors are likely to be dominated by atmospheric releases that are greater than 300 m from the worker locations, i.e., distances where MESODIF applies.

The second part of the March 5, 2014, NIOSH white paper (NIOSH 2014e) addresses issues raised by SC&A regarding exposures to resuspended particles in soil outdoors. In the white paper, NIOSH acknowledges that the resuspension pathway was not explicitly addressed in the site profile but argues that the resuspension pathway is not a significant contributor to outdoor internal dose.

A review this NIOSH white paper was prepared prior to the release of the SEC evaluation report in March 2015 but has not been finalized and distributed per WG direction.² As will be seen in our draft review of this issue, we accept NIOSH's arguments that MESODIF can be used at distances as little as 100 m from the release location. However, NIOSH should provide additional discussion on possible localized outdoor exposures due to downwash associated with the elevated releases and possible ground level releases. In addition, issues related to the deposition and resuspension of radionuclides onsite from the elevated releases, or from radionuclides in soil, should be explicitly addressed. Hence, we believe that this issue requires some additional discussion with the WG. Note that there is additional information on this subject in the NIOSH white paper dated September 3, 2013 (NIOSH 2013), which is discussed below.

The subject of resuspension and resuspension factors is addressed in greater detail in a recently completed, but yet to be delivered, SC&A's draft review of this subject. On that basis, we believe that NIOSH has adequately responded to some, but not all, of the concerns raised in Issue 1.

The NIOSH white paper dated September 3, 2013 addresses, in part, Issue 2. NIOSH acknowledges that concerns raised by SC&A regarding airborne emissions from Initial Engine Test (IET) 10, as provided in SC&A 2006, require further investigation. To our knowledge, NIOSH has not prepared any material that adequately addresses this aspect of Issue 2. However, in its white paper, NIOSH explains the following:

¹ Fumigation conditions refer to atmospheric temperature, wind speed, and stability class that cause a downdraft of emissions from a stack that results in elevated concentration of stack emissions close to the base of the stack. This occurs during temperature inversion, i.e., when the temperature increases with elevation above the effluent point of release.

² SC&A's response to NIOSH's white papers that addressed issues described in the March 20, 2014, white paper (NIOSH 2014c) was originally prepared by SC&A in May 2014 at the request of the WG. However, though SC&A's responses were completed in draft form, they were never finalized and delivered to NIOSH and the Board because of the emergence of the INL SEC, whose examination took precedence. At that time, it was determined that SC&A should delay delivering its responses to NIOSH's white papers until a determination could be made with regard to the SEC and its relevance to the various active INL site profile issues, as delineated above. These SC&A draft white papers are currently undergoing internal review and, upon completion, will require review by the U.S. Department of Energy (DOE). These white papers will then be delivered to NIOSH and the Advisory Board.

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Section 4.2.2.3 and Attribution 11 of the environmental TBD (ORAUT 2010) indicates that when the analysis of the INEL-HDE (DOE 1991) was completed the meteorological diffusion trajectories were reviewed to determine which INL facilities were affected. The result of those trajectory reviews was that only 16 releases had the potential to affect other INL facilities. As a result of those reviews, IETs #3, #4, and #10 were determined to not affect other INL facilities, and no onsite intakes for those episodic releases were calculated and included in the environmental TBD. [NIOSH 2013]

The NIOSH (2013) white paper provides detailed information on the trajectories of the plumes associated with IET 3 and 4. Based on this material, SC&A recommends closing these aspects of Issue 2. With respect to IET 10, the white paper explains that trajectories are not available for these releases. However, the white paper explains the following:

Dispersion factors and air concentration values were generated for the 32 runs associated with IET #10 (DOE 1991d). When the dispersion factors and air concentrations for the 4 downwind locations in the shaded portions of Figure 5 are zero, the releases associated with that specific run would not have affected the INL workers. Of the 32 runs, 12 of the runs (i.e. runs 5, 9, 11, 19, 20, 26, 32, 38, 40, 48, 49, and 57) had air concentrations of zero for all 4 downwind locations, and thus did not have the potential to contribute to the internal doses of the INL workers. The dispersion factors and air concentrations for 20 of the runs indicate that 20 of the runs had the potential to contribute to the internal doses of the INL workers at varying degrees.

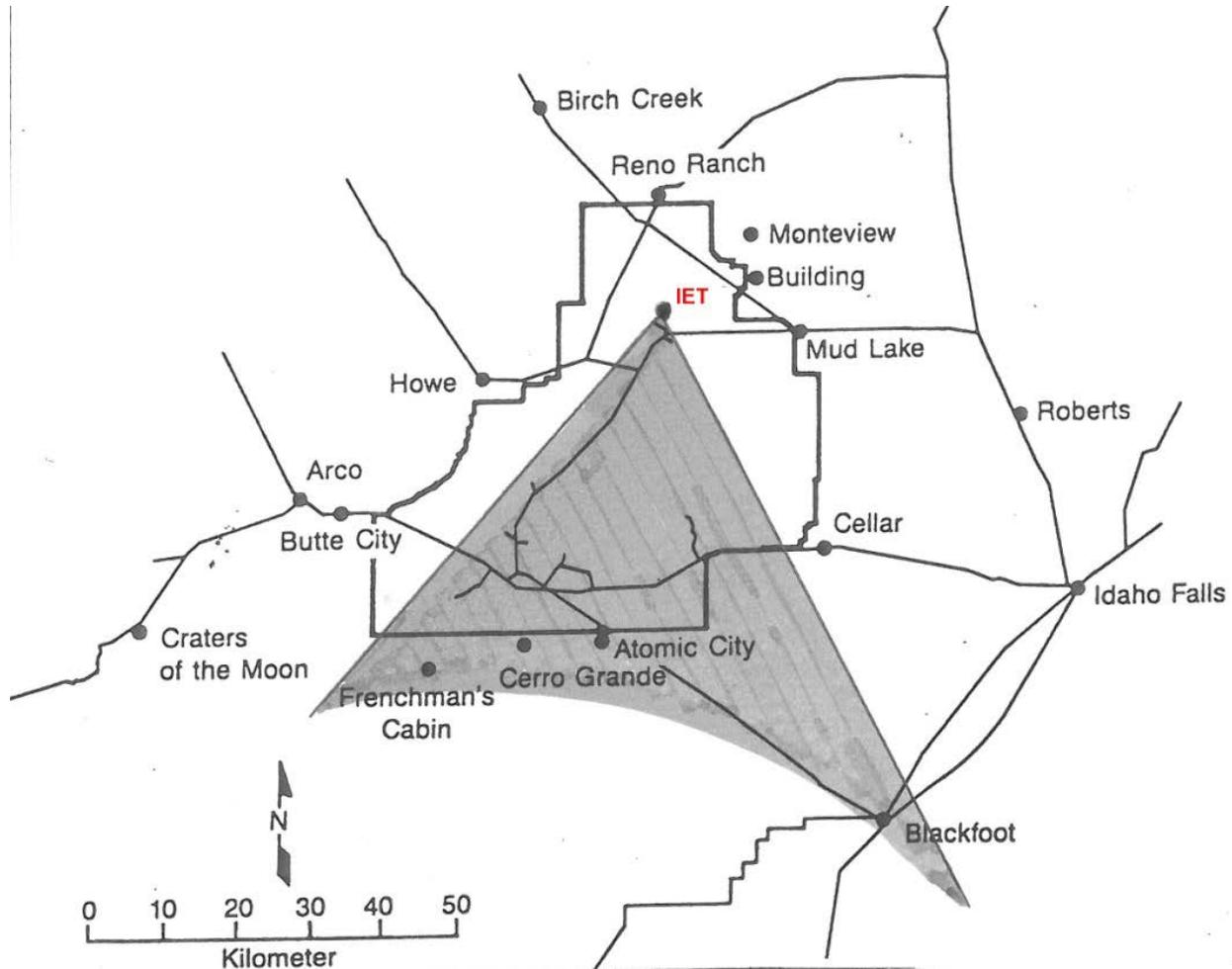


Figure 1. Figure 5 – Trajectory Area Affecting Other INL Facilities (from the NIOSH white paper dated September 3, 2013)

The white paper (NIOSH 2013) later states the following:

IET #10 was divided into three phases (Foster et al. 1958). Phase I consisted of the initial IET runs; Phase II started with the runs that occurred after January 17, 1958; and Phase III included the runs that occurred after February 4, 1958 (Foster et al. 1958). The document Critical Review of Source Terms for Select Initial Engine Tests Associated with the Aircraft Nuclear Propulsion Program at INEL indicates that the radioactive releases from the Phase III runs (i.e. runs 37, 38, 40, 42, 43, 45, 46, 47, 48, 49, 52, 53, 54, 55, 56, and 57) were underestimated in the INEL-HDE (Behling et al. 2005). After reviewing the information presented in that document, NIOSH agrees that the radioactive releases for those runs were likely underestimated in the INEL-HDE, but NIOSH does not necessarily agree with the magnitude of the underestimates. Further research is needed to determine the magnitude of those underestimates. It should also be noted that the review of the dispersion factors and air concentrations for the Phase III runs 38, 40, 48, 49, and 57 previously determined that these runs did not have the

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potential to contribute to the internal doses of the INL workers. Therefore, the releases from runs 38, 40, 48, 49, and 57 do not need to be reevaluated.

During the INL WG meeting held on November 10, 2015, this issue was discussed, and NIOSH stated that it is continuing to investigate IET 10 but has confirmed that the trajectories of the releases of IET 3 and 4 were off site and away from workers. As such, NIOSH concluded that these releases are not an issue (ABRWH 2015b, see pages 214 through 218 of the transcript of the November 10, 2015 WG meeting). During the meeting, NIOSH committed to provide the WG with a white paper on this subject. SC&A would like to look into NIOSH's conclusion with respect to this issue before recommending closure.

2.2 ISSUE 19 (ANGLE OF INCIDENCE)

On March 11, 2014, NIOSH issued a white paper, *NIOSH Investigation into the Issues Raised in Comment 19 from SCA-TR-TASK1-005* (NIOSH 2014f), prepared by Brian Gleckler. As indicated earlier, SC&A has a draft report close to completion that addresses this issue. NIOSH's (2014f) white paper indicates that both OCAS-IG-001 (NIOSH 2007) and ORAUT-OTIB-0010 (ORAUT 2006) address this issue to some degree, and that the ANL-W site profile, *Technical Basis Document for the Idaho National Laboratory and Argonne National Laboratory-West – Occupational External Dosimetry* (ORAUT 2011), provides additional information and guidance pertaining to this matter. In addition, the white paper also refers to SC&A's discussion of this issue, as it applies to the Mallinckrodt site profile review, *Third Supplemental Review of the Mallinckrodt Site Profile* (SC&A 2005), and to Hine and Brownell's *Radiation Dosimetry* (1956), which is the technical document SC&A used as the basis for this issue. This matter was also discussed at an INL WG meeting held in March 2014. On page 305 of the transcript (ABRWH 2014), NIOSH states that this issue is addressed in ORAUT-OTIB-0010 (ORAUT 2006), and that generic issues related to that OTIB were closed out by the Procedures Subcommittee. However, SC&A had not reviewed that OTIB at that time from the perspective of specific site profiles. In revisiting the OTIB, it appears that it addresses inverse square law issues, but not angle of incidence, as described in detail in the Hines and Brownell (1956) textbook.

It is appropriate to also summarize SC&A's comments on this subject as outlined in SC&A's pending draft report. That draft report is useful because it provides a more complete discussion of the history of issues related to angle of incidence and further argues that the issue is not actually addressed in ORAUT-OTIB-0010 (ORAUT 2006), as stated by NIOSH; nor does OCAS-IG-001 (NIOSH 2007) provide explicit guidance with respect to this matter. In fact, OCAS-IG-001 explicitly addresses the need to address angle of incidence. NIOSH also refers to DCAS-TIB-0013 (DCAS 2010) as another document that addresses angle of incidence. Our pending draft report reviews this assertion and finds that this matter has still not been resolved. DCAS-TIB-0013 uses computer simulations to estimate doses to specific organs from specific sources of uranium located at different distances and angles relative to the organs of interest. However, DCAS TIB-0013 does not appear to address the complex interactions of photons, especially low energy photons, that strike the film badge at sharp angles. SC&A believes that there is a need for additional discussion of this matter with the Advisory Board.

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2.3 ISSUES 9 AND 23 (HOT PARTICLES)

On March 18, 2014, NIOSH issued a white paper, *Investigation of “Hot Particles” and the Health Physics Programs at the Idaho National Laboratory (INL)* by Jodi Jenkins (NIOSH 2014a). As discussed in Section 2.0, SC&A believes that Issue 9, which deals with exposures to skin due to the deposition of hot particles on clothing and skin, has been resolved from the perspective that NIOSH has adopted generic protocols for performing these types of dose reconstruction, and they were reviewed and approved by the procedures subcommittee during the review of OTIB-0017 (ORAUT 2005) and other site profile reviews. Hence, SC&A agrees that NIOSH has developed scientifically sound and claimant-favorable protocols for performing these types of dose reconstructions and recommends that NIOSH reference these protocols in the INL site profile.

However, it is SC&A’s position that care must be taken to avoid rushing to judgment to dismiss this issue for particular claims. SC&A recommends that NIOSH provide additional guidance to dose reconstructors regarding when doses to skin from hot particle exposure at INL and ANL-W need to be considered, taking into consideration information that identifies skin cancer cases where hot particle exposures were likely but not included in the dose reconstruction. In its white paper (NIOSH 2014a), NIOSH provides a thorough review of the hot particle issue as it might apply to INL (and presumably also ANL-W), along with a summary of the generic literature addressing hot particles. At the end of the white paper, NIOSH draws the following conclusion:

Based upon the above, NIOSH concludes that the likelihood of a “hot particle” going undetected on an employee’s skin for a significant period of time is remote. There is no evidence that INL employees were contaminated with undetected “hot particles” for significant periods of time. Also, no other site-specific TBDs, with the exception of Hanford, provide guidance for undetected “hot particles.” The Hanford “hot particle” situation is unique and the same issue did not exist at INL. In addition, there is complex wide guidance in place that addresses skin contaminations and “hot particle” exposures as they relate to skin cancers.

SC&A believes that hot particle exposures are, in fact, an issue at INL, and that the site profile should provide guidance to dose reconstructors regarding when exposures to hot particles need to be explicitly addressed, especially for claimants with skin cancer.

On close inspection, Issue 23, which deals with hazardous jobs, is primarily concerned with hot particles deposited on skin and clothing. Hence, SC&A reaffirms its earlier opinion (which was adopted by the WG and NIOSH) that Issue 23 is similar to Issue 9, and that the issues should be grouped together.

2.4 ISSUE 24 (EXTREMITY MONITORING)

On March 6, 2014, NIOSH issued a white paper, *NIOSH Investigation into INL Site Profile Review - Issue 24*” by Jodi Jenkins (NIOSH 2014d). The white paper explains that 53 claimants were diagnosed with 62 cancers at INL/ANL-W and that 3% involved cancer of the extremities. The white paper explains that the external dosimetry monitoring programs at INL/ANL-W involved the use of extremity monitoring beginning in 1953 but, prior to the 1980 time period,

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multi-badge monitoring was rare. The white paper further explains the conditions where extremity monitoring was performed but also states that not all operators were provided with extremity dosimetry in the early years. As a follow-up to this white paper, and with the objective of closing this issue, SC&A recommends that we review the cases that involved extremity cancers (especially before 1980) and assess how the doses were reconstructed. SC&A is currently reviewing radiological monitoring practices among randomly sampled claimants at ANL-W and preparing a white paper. Our draft observation at this time (referred to in our draft report as Observation 4) is as follows:

Observation 4: Even among sampled workers who were most likely to require extremity monitoring on a semi-regular basis, extremity monitoring is often sparse from year to year for many workers. Nonetheless, it may be instructive for NIOSH to evaluate available extremity monitoring data to determine if the typical methods employed in DCAS-OTIB-0013 (DCAS 2010) are applicable and claimant favorable for ANL-W claimants.

2.5 ISSUE 34 (HIGH RISK NEUTRON EXPOSURES)

On March 11, 2014, NIOSH issued a white paper, *NIOSH Investigation into the Issues Raised in Comment 34 from SCA-TR-TASK1-005* (NIOSH 2014g). Issue 34 deals with whether potential doses to personnel performing “high-risk” jobs, with respect to neutron exposures, are adequately identified. As indicated in the March 2014 issues resolution matrix (NIOSH 2014c), both NIOSH and SC&A were directed to look into this matter further. The NIOSH (2014g) white paper cited above addresses this concern. SC&A concurs with NIOSH with regard to its response to the neutron dosimetry issues raised by SC&A and how NIOSH plans to remedy these issues. However, NIOSH’s position in its white paper is that all sources of potentially significant neutron exposures have been accounted for, and that employees who had the potential of receiving significant neutron exposures were adequately monitored. SC&A is addressing this issue in a white paper currently in preparation. In addition, our preliminary review of the ANL-W ER for SEC-00224 identifies potential data gaps in the neutron dosimetry records. At the time of the preparation of this review, NIOSH is in the process of capturing additional external dosimetry data that might help fill these gaps, or at least put NIOSH into a position to develop coworker models applicable to specific facilities, campaigns, and experiments at ANL-W.

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3.0 STATUS OF INL SEC ISSUES

NIOSH released the *SEC Petition Evaluation Report for SEC-000219 for the Idaho National Laboratory* (NIOSH 2015a) on March 12, 2015. On March 25, 2015, NIOSH presented the petition ER at the 104th meeting of the Advisory Board on Radiation and Worker Health, which took place in Richland, Washington. At that time, NIOSH recommended the following class definition of workers for inclusion to the SEC class:

All employees of the Department of Energy, its predecessor agencies, and their contractors and subcontractors who worked at Idaho National Laboratory in Scoville, Idaho, and were monitored for external radiation at the Idaho Chemical Processing Plant (CPP) (e.g., at least one film badge or TLD dosimeter from CPP) between January 1, 1963 and December 31, 1974 for a number of work days aggregating at least 250 work days, occurring either solely under this employment, or in combination with work days within the parameters established for one or more other classes of employees in the Special Exposure Cohort.
[NIOSH 2015a]

When this class definition was proposed, it was defined only for workers at the CPP and included the time period January 1, 1963, through December 31, 1974. One of the main issues addressed by the Advisory Board with respect to this definition of the class was difficulties in providing assurance that some INL workers might have worked at CPP but did not have dosimeters that clearly indicated their work location, and, as a result, these workers would be missed using this definition of the class (see ABRWH 2015a, pp. 187–210). SC&A was then tasked by the Advisory Board to investigate the available dosimetry records in order to assess the validity of the class definition, as proposed by NIOSH. In response to that request, on June 29, 2015, SC&A issued *SC&A Evaluation of Idaho Chemical Processing Plant Class Definition Requiring Evidence of External Dosimetry (1963–1974)* (SC&A 2015h). That report contained a number of findings related to weaknesses in the available external dosimetry that confirmed many of the Board’s concerns regarding the definition of the class and how it would be implemented.

One of the outcomes of these investigations and deliberations was the apparent need to revise the definition of the class by expanding the definition to all workers at INL but limiting the time period covered by the class from March 1, 1970, through December 31, 1974, until such time that NIOSH completes its research on the adequacy of the external dosimetry data. In order to accommodate this need, NIOSH issued a revised petition ER (NIOSH 2015b) on July 21, 2015, and, on May 2, 2016, the Advisory Board recommended a revision to the class definition, as follows:

All employees of the Department of Energy, its predecessor agencies, and their contractors and subcontractors who worked at the Idaho National Laboratory (INL) in Scoville, Idaho, and were monitored for external radiation at INL (e.g., having at least one film badge or TLD dosimeter) during the period from March 1, 1970, through December 31, 1974, and were employed for a number of work days aggregating at least 250 work days, occurring either solely under employment during the period from March 1, 1970, through December 31, 1974,

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or in combination with work days within the parameters established for one or more other classes of employees in the Special Exposure Cohort. [ABRWH 2016]

During its deliberations on this matter, NIOSH indicated that it believed that there are sufficient external dosimetry data for the first time period (i.e., January 1, 1963, through February 28, 1970) to limit the definition of the class to CPP workers. At the time of the preparation of this report, NIOSH was compiling external dosimetry data that it believes will allow limiting the definition of the class to CPP workers for this earlier time period.

During this time period, there was also some discussion regarding whether a group of workers referred to as the CADRE should be included in the definition of the class. The outcome of these investigations was a NIOSH report, *CADRE Evaluation (Area Code 71) for Consideration as Part of the Idaho Chemical Processing Plant Special Exposure Cohort*, prepared by Timothy D. Taulbee and dated February 25, 2016 (NIOSH 2016a). The conclusion of those investigations is that the personnel referred to as CADRE should not be included in the class.

3.1 SC&A PRELIMINARY REVIEW OF THE INL EVALUATION REPORT FOR SEC-00219

In addition to matters related to the definition of the class, and as part of the review of the NIOSH Petition ER for SEC-00219 (NIOSH 2015a) (dated March 12, 2015), SC&A performed a number of focused reviews, which identify technical issues that require additional investigation. On July 6, 2015, SC&A issued *Interim Summary Report on the Evaluation of NIOSH's Idaho National Laboratory SEC-00219 Petition Evaluation Report* (SC&A 2015a). This report, referred to as the July 6, 2015, interim summary report, is not a conventional complete ER review but served as a status update of SC&A's review as of the date of its publication, along with a recommendation for follow-up investigations.

In its July 6, 2015, interim summary report (SC&A 2015a), SC&A reviewed the Site Research Database (SRDB) in support of the INL site profile and ER for areas, subareas, and time periods at INL, including various research projects and special campaigns, where external and internal dosimetry data might be incomplete (i.e., data gaps). Unlike most reviews of this type, it does not contain findings but provides a number of preliminary commentaries and recommendations for consideration by NIOSH and the Advisory Board for further investigation. This approach was employed because it was acknowledged by NIOSH and the Board that the SEC review process was a work in progress, and the review should be performed in a graded manner. Specifically, the ER (NIOSH 2015a), in addition to identifying an SEC class, also identified operations and time periods that were held in reserve, meaning that additional investigations were needed by NIOSH in order to determine whether any of these reserved operations and associated time periods should be included in the class. The ER also identified operations and time periods where NIOSH judged that doses could be reconstructed and recommended denial of those portions of the SEC petition (see Table 1). SC&A focused its preliminary review of the ER on the latter operations and time periods, where NIOSH determined that doses could be reconstructed with sufficient accuracy.

Given the complexity of the site, SC&A divided its review into different categories of investigation corresponding primarily to different areas within INL (not including ANL-W) with

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respect to dose reconstructability and gap analysis and providing a plan for more detailed reviews. Table 1 of SC&A's July 6, 2015, interim summary report (SC&A 2015a) is reproduced here, because it provides a convenient roadmap of SC&A's preliminary review of the ER.

Table 1. INL SEC 00219 Evaluation Report: Feasibility of Reconstructing Internal Doses for January 1, 1963, to December 31, 1974 (a), (b)

Operating Area (c)	Reconstruct?
Chemical Processing Plant (CPP)	Yes: 1/1/53–12/31/62: Bioassay data available. No: 1/1/63–12/31/74: Insufficient bioassay data to support reconstruction of internal exposures to U, Np, Pu, and other related transuranics. Beginning in 1963, increased α -contamination levels were detected with no accompanying increase in Pu bioassay. Reserved: 1/1/75–?: Evaluate CPP HP Program Improvements 1971–1980.
Test Reactor Area (TRA)	Yes: • 1/1/55–12/31/66 • 1/1/67–12/31/70: coworker model. Reserved: 1/1/61–12/31/70: TAN-607 (Fuel Storage Vaults) and TAN-615 (Actuator Building) due to potential U exposures in the absence of MFPs.
Test Area North (TAN)	Yes: • 1/1/55–12/31/66 • 1/1/67–12/31/67 and 1/1/69–12/31/70: coworker model. Reserved: 1/1/68–12/31/68: Insufficient data currently available for ARA-I (Auxiliary Reactor Area-I) due to potential unmonitored exposures to Pa-233 from separation of that isotope from irradiated Th slugs.
Central Facilities Area (CFA)	Yes: • 1/1/49–12/31/66 • 1/1/67–12/31/70: coworker model.
Burial Grounds	Yes: • 1/1/52–12/31/66 • 1/1/67–12/31/68: coworker model. Reserved: 1/1/69–12/31/70: Evaluate a newly-implemented procedure of waste exhumation and retrieval

(a) SEC-00219 time period evaluated by NIOSH is 1/1/63–12/31/74 for CPP based on insufficient data to reconstruct internal doses.

(b) Operations at INL began 1/1/49, but some of the areas began operations later.

(c) ANL-W is not included in this SEC, but will be the subject of SEC-00224, which is under development.

(d) NIOSH is developing an internal, mixed fission product (MFP) coworker model stratified by area for time periods beginning 1/1/67.

Source: SC&A 2015a.

Each of these areas were investigated to a limited extent in the July 6, 2015, interim summary report (SC&A 2015a). The following summarizes the results of these preliminary investigations.

3.1.1 Definition of the Class

SC&A's initial investigation pertaining to class definition involved a review of 30 semi-randomly selected claimants, emphasizing contract workers, in order to determine if they had sufficient dosimetry records for 1963 through 1974 to identify those workers exposed at CPP. The results of these inquiries were presented at the July 2015 full Advisory Board meeting.

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SC&A was then directed to continue its review of claimants in the context of the proposed class definition.

Subsequently, SC&A performed a mock class implementation for the entire claimant population at INL, so all claims were looked at but with varying degrees of scrutiny (if a claim already met the requirements of the class it was not looked at further). This was delivered in September 2015 (SC&A 2015e) and resulted in the follow-up for 18 claims with the site and another report (discussed in January and March 2016). During discussions in March 2016, the INL Work Group requested that SC&A and NIOSH update their respective analyses to include claims that had been filed after the initial studies had been completed in the summer of 2015. SC&A delivered its updated analyses in May 2016 (SC&A 2016f); this report is planned to be discussed during the upcoming WG meeting in August 2016.

In addition, SC&A also reviewed interview summaries of about 50 sets of workers. Based on those interviews, SC&A found no contradictory evidence to suggest that workers entered CPP without external dosimetry badging. However, there were indications that the requirement of a specific CPP badge may have been relaxed at some later date to only require a dosimetry badge for any INL facility. The results of these investigations partly contributed to the revised definition of the class, as described in Section 3.0, and some of the follow-up investigations related to the scope and definition of the class that are continuing at the time of the preparation of this report.

3.1.2 Fission and Activation Product (FAP) Bioassay Indicator Radionuclides

SC&A assessed the appropriateness of the methods that NIOSH proposes to use to determine internal doses for areas and times where it asserts that it can reconstruct doses. NIOSH's basis for assigning internal doses for most years and locations not covered by the proposed SEC class and the reserved areas and dates relies on the following four assumptions (as stated in SC&A 2015a):

- A. FAP Bioassays – Sufficient worker records containing FAP bioassay (in-vitro and in-vivo) results are available to assign intakes and resulting doses from FAP (some periods/areas may need an FAP coworker model developed).
- B. FAP Intakes – Except for special situations, all the dosimetrically significant FAP intakes are directly tied to an indicator radionuclide (strontium-90 [Sr-90] or cesium-137 [Cs-137]). The FAP ratios and intake assignment methods provided in ORAUT-OTIB-0054 (ORAUT 2015; hereafter referred to as “OTIB-0054”) bound all FAP exposure potentials at INL
- C. Actinide Intakes – Except for special situations, the actinide (uranium, plutonium, thorium, etc.) intakes are directly tied (in a constant ratio) to the FAP; therefore, actinide intakes and resulting doses can be assigned using Table 5-22 (Sr-90 ratios) and/or Table 5-23 (Cs-137 ratios) of ORAUT-TKBS-0007-5 (ORAUT 2010).
- D. Special Situations Actinides – Personnel involved in operations and situations (planned or unplanned) with actinides present, that were not directly tied to an FAP in a constant

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ratio, were adequately monitored, and the results are available in the workers' records. Therefore, actinide intakes and resulting doses can be reconstructed in these special situations.

SC&A's July 6, 2015, interim summary report (SC&A 2015a) provides commentary on Items B and C. Item A is the topic of a separate report described in Section 4.6 and Item D requires further investigation. SC&A's commentaries regarding Items B and C are summarized as follows.

Item B: The use of OTIB-0054 protocols for reconstructing internal doses from mixed FAPs associated with reactor operations at INL is questionable because of the very unique nature of the reactor design, operations, and experiments performed at many of the areas at INL. Though ANL-W is not addressed in SC&A's July 6, 2015 (SC&A 2015a), and October 26, 2015, ER reviews (SC&A 2015f, 2015g), this comment is also applicable to ANL-W reactors.

Item C: The methods used in the ER for reconstructing internal doses for actinides, using indicator radionuclides, as provided in Tables 5-22 and 5-23 in the TBD (ORAUT 2010) are questionable because of the unique nature of operations at the various facilities at INL, including ANL-W.

The interim summary report (SC&A 2015a) recommended a number of follow-up investigations related to these matters. These investigations were subsequently performed, and the associated white papers are discussed below (see Sections 4.1–4.3, 4.5 and 4.7).

3.1.3 Reactor Modeling

The July 6, 2015, interim summary report (SC&A 2015a) further investigated the limitation of OTIB-0054 (ORAUT 2015) as applied to reactor workers at INL and recommended that further study should be done for off-normal operations, including "special" materials irradiation runs, and for any incidents that might have occurred and exposed personnel to radiation. It also recommended that these investigations should be extended to other reactor areas, especially TAN, which hosted very unusual reactor experiments, such as the Aircraft Nuclear Propulsion (ANP) reactors, which were decidedly different in fuel composition and arrangement and operation than other types of reactors. These investigations were subsequently performed, and the associated white paper (SC&A 2015b) is discussed in Section 4.1.

3.1.4 Burial Grounds

The July 6, 2015, interim summary report (SC&A 2015a) investigated issues associated with the reconstruction of doses, primarily internal doses, of workers at the burial grounds. SC&A looked into the adequacy of the health physics oversight programs and contamination controls, waste characterization, data completeness, and the methods used to reconstruct internal doses using the available bioassay data. SC&A's review identified key concerns with NIOSH's ability to reconstruct worker exposures, especially internal exposures to mixed FAPs and transuranics. SC&A 2015a provides a number of recommendations for follow-up investigations pertaining to waste characterization, contamination controls, bioassay data, and air sampling and swipe data, and the feasibility of relying on OTIB-0054 and ORAUT-OTIB-0060 (ORAUT 2014; hereafter

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referred to as “OTIB-0060”), that are currently being accomplished through additional onsite data captures and former worker interviews.

3.1.5 Central Facilities Area (CFA)

The July 6, 2015, interim summary report (SC&A 2015a) investigated issues primarily associated with the reconstruction of internal exposures at CFA using gross beta/gamma analysis of urine samples, and OTIB-0054 and OTIB-0060 and the need to separately evaluate exposures to uranium. We found limitations in the bioassay and air sampling programs that raise questions regarding the ability to reconstruct internal exposures at CFA. As may be noted, these are recurring issues throughout the INL complex that require further investigation.

3.1.6 Chemical Processing Plant Pre-1963

The July 6, 2015, interim summary report (SC&A 2015a) focused on the external and internal dosimetry monitoring data at CPP pre-1963 because this is the time period where NIOSH believes that sufficient data are available to reconstruct doses. The time period from 1963 to 1970 is under investigation by NIOSH for possible SEC consideration, and an SEC was recommended for 1970 to 1974. SC&A looked at the operations and the external and internal dosimetry data pre-1963, especially contamination events, and recommended continuing these investigations.

3.1.7 Test Area North (TAN)

The July 6, 2015 interim summary report (SC&A 2015a) divided its investigations into the various subareas at TAN because of the unique nature of the research and campaigns associated with each subdivision and time period. We found that, as a whole, there are extensive external monitoring data for workers at TAN throughout its history. However, the records cannot always be grouped according to subdivisions within TAN. As a result, it appears that it might be difficult to construct external dosimetry coworker models for the various subdivisions. If it is determined that coworker models are needed due to data gaps at TAN, this could become an SEC issue because of the unique nature of the activities at the different subdivisions at TAN (i.e., the data cannot be pooled for the purpose of constructing coworker models for individual TAN subdivisions). SC&A also found limitations in the completeness of neutron dosimetry data at TAN. SC&A 2015a recommends a number of follow-up investigations, including additional data capture, to help create a more complete external dosimetry record. Shortly after submission of this report, NIOSH indicated that it had plans for additional data capture.

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4.0 SC&A FOLLOW-UP INVESTIGATIONS

During the July 8, 2015, INL WG teleconference, which followed delivery of the July 6, 2015, interim summary report (SC&A 2015a), SC&A was tasked to prepare a series of white papers in accordance with the recommendation provided by SC&A in the interim summary report. These reports were delivered to NIOSH and the Board in September (SC&A 2015b, 2015c, 2015d, 2015e) and October of 2015 (SC&A 2015f, 2015g). In addition, a follow-up report pertaining to the SEC class definition for CPP was delivered in January 2016 (SC&A 2016b). The following subsections present a brief summary of each report. Each summary was excerpted directly from the executive summary of each report, with slight modifications to references and acronyms to fit this report.

4.1 REVIEW OF NIOSH STRATEGY FOR RECONSTRUCTING INTERNAL DOSES TO WORKERS AT TEST AREA NORTH (SEPTEMBER 2015)

This report addresses selected aspects of the TAN operations and facilities that SC&A identified as particularly important. The topics noted for more detailed investigation in this follow-up report include: (1) the applicability of OTIB-0054 (ORAUT 2015) and Tables 5-22 and 5-23 of the site profile internal dosimetry TBD, ORAUT-TKBS-0007-5 (ORAUT 2010) to the performance of internal dose reconstruction for facilities that handled and stored spent and irradiated fuel; (2) the very unique circumstances associated with the ANP program; and (3) an evaluation of the completeness of the external dosimetry data at the various TAN facilities.

SC&A's primary findings are as follows:

1. The reactor, fuel, and operational combinations that underpin the OTIB-0054 methodology reflect situations where burnup often occurred over protracted periods of time (hundreds of days) and the fuel maintained its integrity during burnup. The fuel at some of the TAN operations, however, had very short burnup times and the reactors operated at high enrichments and at temperatures where the fuel was allowed to melt. The implications of these findings are that the isotopic mix of radionuclides used in OTIB-0054 may not apply to the fuel handled at many TAN facilities.
2. It is likely that some onsite workers were exposed to some of these emissions from the IETs, even though the emissions were released under controlled conditions to minimize both onsite and offsite exposures. In addition, there were likely maintenance operations where workers might have been exposed to residue from these tests and their emissions. The emissions associated with the IETs, as reported by DOE and its contractors, were often significantly underestimated. The implications are that the reconstruction of doses to workers at INL involved with the IETs and who may have been exposed to airborne emissions associated with them, must take into consideration the revised information cited by the SC&A investigations regarding the emissions and not depend entirely on the data reported at that time by DOE and its contractors.
3. The most significant finding of our investigations is that we do not believe we can consistently assign the external dosimetry monitoring data to the different work areas, operations, and campaigns within TAN, at least given the data we reviewed. The

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implications are that NIOSH might not be able to build coworker models for many of the different subdivisions at TAN. This could be an important SEC issue for TAN, because the types of activities at TAN were so diverse that different coworker models might be required.

4.2 EVALUATION OF AVAILABLE SURVEY DATA FOR THE CENTRAL FACILITIES AREA AT IDAHO NATIONAL LABORATORY (SEPTEMBER 2015)

This report (SC&A 2015c) presents a review of the available survey data for the CFA, both during operations and prior to decontamination and decommissioning (D&D), in order to determine the actinide to Sr-90 and actinide to Cs-137 ratios and compare these ratios to the values in Tables 5-22 and 5-23 of ORAUT-TKBS-0007-5 (ORAUT 2010). The report provides a summary of NIOSH's proposed methods for bounding operational period internal doses for the CFA, a review of the available survey data, and a comparison of the derived values to the values in Tables 5-22 and 5-23 of ORAUT-TKBS-0007-5.

SC&A identified and reviewed 79 radiological contamination smear results and 18 soil sample results. Our analyses of the smear data and soil sample results indicated at least general agreement in the magnitude of the maximum contamination ratios for uranium and plutonium given in Tables 5-22 and 5-23 of ORAUT-TKBS-0007-5 (ORAUT 2010). However, there are several limitations in the data, as follows:

1. The CFA-669 Hot Laundry operated from 1950 until 1981. The survey data found were very limited and for 1954–1956, the period of early operations.
2. The survey data are written given in units of counts per minute (cpm). While assumptions regarding the equipment and detection efficiencies can be made based on the time period and equipment used at that time, it may be more beneficial to use more recent and well documented survey information.
3. The soil samples were collected during D&D operations from a trench and berm formed during the excavation of the 8-in contaminated sanitary sewer line on the north side of CFA-669. It may be more useful to use more sample results, particularly those obtained during the characterization survey, prior to D&D.

SC&A believes the approach used by NIOSH to reconstruct doses at the CFA could be improved if the above three data limitations could be minimized.

4.3 NIOSH SEC-00219 TEST REACTOR AREA (TRA) MODELING (SEPTEMBER 2015)

This report (SC&A 2015d) seeks to determine whether the reactors that have operated, or are currently operating, in TRA specifically are adequately enveloped by the representative reactors of OTIB-0054, so that the OTIB can be used to reconstruct internal doses. SC&A 2015d compares the characteristics of the reactors used to establish the isotopic mix of radionuclides in OTIB-0054 to the characteristics of the reactors at TRA. The report does not have any findings, but is used to help guide future investigations related to reconstructing internal doses for workers at INL reactors using OTIB-0054 and worker bioassay data.

NOTICE: This report has been reviewed to identify and redact any information that is protected by the Privacy Act 5 U.S.C. § 552a and has been cleared for distribution.

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4.4 EVALUATION OF THE REVISED SEC CLASS DEFINITION FOR THE IDAHO NATIONAL LABORATORY CHEMICAL PROCESSING PLANT (1963–1974)

This report (SC&A 2015e) follows up on the class definition issues discussed above. Some of the key observations are that SC&A was able to identify workers with evidence to suggest potential radiological exposures at CPP during the time period covered by the SEC that did not have sufficient external monitoring records to meet the SEC class definition requirements. The report also raised questions regarding whether CADRE workers should be included in the class. As described in Section 3.0, this issue was resolved. SC&A recommended additional data capture at that time, which NIOSH indicated was under way.

4.5 SC&A’S EVALUATION OF THE NIOSH EVALUATION REPORT PROPOSED USE OF FISSION-ACTIVATION PRODUCT BIOASSAY INDICATOR RADIONUCLIDES (IN CONJUNCTION WITH ORAUT-OTIB-0054 AND ORAUT-TKBS-0007-5) FOR ASSESSMENT OF FISSION-ACTIVATION PRODUCT AND ACTINIDE INTAKES AT IDAHO NATIONAL LABORATORY (OCTOBER 2015)

This report (SC&A 2015f) goes into further detail on the discussion provided above with respect to the four fundamental assumptions, A through D, used by NIOSH to reconstruct internal doses using bioassay data (see Section 3.1.2). Specifically, this report further investigates the validity of assumptions B, C, and D. Assumption A is addressed in a separate report (see Section 4.6). SC&A found that many of these assumption are not supported by the data reviewed with respect to (1) the Cs-137/Sr-90 ratios, (2) the relationship between Cs-137 and Sr-90 and the actinides as provided in Tables 5-22 and 5-23 in the site profile (ORAUT 2010), and (3) establishing special relationships between fission products and actinides in bioassay samples.

4.6 EVALUATION OF INTERNAL MONITORING FOR FISSION AND ACTIVATION PRODUCTS AMONG INL CLAIMANTS (1949–1970) (OCTOBER 2015)

This report (SC&A 2015g) was prepared by SC&A under the direction of the WG to further investigate an issue identified in SC&A’s July 6, 2015, interim summary report (SC&A 2015a) as Item A, which is related to the sufficiency of worker bioassay records for reconstructing doses to fission and activation products. This investigation involved the review of 92 randomly selected claimants in order to determine the availability of FAP bioassay data for the purpose of determining the need for one or more coworker models for use in reconstructing internal doses. SC&A found the data somewhat incomplete, thereby requiring the development of coworker models, but not to the extent that would preclude the development of coworker models as required for particular time periods and areas. This issue was discussed in depth during the March 2016 INL WG meeting, and it was agreed that a coworker model for FAP material was needed.

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4.7 INL SEC-00219 REACTOR PRIORITIZATION FOR EVALUATION OF ORAUT-OTIB-0054 APPLICABILITY (MARCH 2, 2016)

This report (SC&A 2016c) was prepared to help to organize the Advisory Board's investigations of one of the more substantive issues identified in SC&A's review of the ER; i.e., concerns that there might be significant limitations to using the default mixes of radionuclides adopted in OTIB-0054 for reconstructing internal doses to workers at reactors where the data characterizing the internal exposures to those workers consisted of gross beta/gamma analysis. The primary concern is that the reactors used in OTIB-0054 for establishing the radionuclide mixes in the fuel were different than many of the reactors at INL, including ANL-W. Because of the large number of reactors at INL and ANL-W, SC&A was requested by the Board to prioritize the reactors that are of greatest concern with respect to this issue. SC&A's March 2, 2016, report (SC&A 2016c) was prepared in response to this request. Following discussion with the WG, SC&A was requested to provide additional description of the basis for the prioritization of the reactors at INL and ANL-W. In response to that request, SC&A issued *INL SEC-00219 Reactor Prioritization for Evaluation of ORAUT-OTIB-0054 Applicability*, Revision 1 (SC&A 2016d) on June 10, 2016; the report was revised to include additional evaluation factors. This report is intended to help initiate and prioritize additional investigations by NIOSH and SC&A to determine the degree to which OTIB-0054 could be used for specific reactors.

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5.0 ISSUES MATRIX FOR SEC-00219

Following the publication of SC&A's July 6, 2015, interim summary report (SC&A 2015a) and the focused reviews delivered from September 2015 to January 2016, many of SC&A's concerns were discussed at three WG meetings. An issues matrix, *INL SEC-00219: Compilation of SC&A Review Issues, Comments, and Recommendations*, was published March 13, 2016 (SC&A 2016e), which captures the concerns expressed in the reports and the exchange of information at the WG meetings. Tables 2 and 3 reproduce this most recent INL SEC matrix, which can also be found at <https://www.cdc.gov/niosh/ocas/pdfs/abrwh/scarpts/sca-inlsec219im-031316.pdf>.

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Table 2. INL SEC 0219: Compilation of SC&A Review Issues, Comments, and Recommendations – March 2016

No.	Description	References	Notes & Additional Comments
<p>Issue A: Test Area North (TAN) – Scope of Review: (1) Applicability of ORAUT-OTIB-0054 (OTIB-0054 or ORAUT 2013) and Tables 5-22 and 5-23 of the site profile internal dosimetry technical basis document (TBD) to the performance of internal dose reconstruction for facilities that handled and stored spent and irradiated fuel; (2) unique circumstances associated with the Aircraft Nuclear Propulsion (ANP) program; (3) completeness of the external dosimetry data at the various TAN facilities.</p>			
<p>A-1</p>	<p>“...we do not believe we can consistently assign the external dosimetry monitoring data to the different work areas, operations, and campaigns within TAN, at least given the data we reviewed. The implications are that NIOSH might not be able to build coworker models for many of the different subdivisions at TAN. This could be an important SEC [Special Exposure Cohort] issue for TAN, because the types of activities at TAN were so diverse that different coworker models might be required.”</p>	<p><i>Review of NIOSH Strategy for Reconstructing Internal Doses to Workers at Test Area North, SC&A Report SCA-TR-2015-SEC0074A, Revision 0, draft, September 28, 2015. Executive Summary.</i></p>	<p>Resolution might require additional data capture.</p> <p>SC&A comment: At the November 11, 2015, Work Group (WG) meeting, NIOSH indicated that they only sampled the dosimetry data for TAN and that much more remains (pp. 170 & 176 of November 11, 2015, WG transcript).</p> <p>The only area that they made a concerted effort to try and get all of the dosimetry was associated with the Chemical Processing Plant (CPP), and that was just between 1963 and 1974.</p> <p>They also indicated that they do not intend to develop an external coworker model for the Idaho National Laboratory (INL) (p. 173 of November 11, 2015, WG transcript).</p> <p>The WG agreed that this is a lower priority issue compared to some of the other areas of concern (p. 177 of November 11, 2015, WG transcript).</p>

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No.	Description	References	Notes & Additional Comments
A-2	<p>“For neutron dosimeters, the data appear to be spotty. If it can be assumed that neutron dosimeters were only assigned to individuals whom the radiation protection staff deemed at risk of neutron exposure, then the temporal gaps seen in the available neutron dosimetry data might indicate that there was no need for neutron monitoring because there was no source of neutron exposure potential. Investigation into the types of activities and experiments conducted during the periods of time for which no neutron dosimeters were found might be needed to determine if neutron exposure was or was not likely.”</p>	<i>Ibid.</i> (A1), Section 5.2.	<i>Ibid.</i> (A1).
A-3	<p>“Given the unique features of the aircraft nuclear propulsion systems [ANPs] tested at INEL [Idaho National Engineering Laboratory] and their equally unique mixtures of radionuclides that were released, SC&A believes that ‘conventional’ reactors and their modeled values may not be appropriate for deriving internal dose estimates to INEL workers.” Therefore, for spent nuclear fuel associated with ANP, use of ORAUT-OTIB-0054 is inappropriate for the following reasons:</p> <ul style="list-style-type: none"> • “...highly enriched uranium fuel (enrichments in excess of 90%) would contain very little Pu-239 and other actinides related to U-238 neutron interactions. Hence, it is unlikely that a substantial portion of TAN irradiated fuel would contain mixes of actinides that resemble the default mixes employed in Tables 5-22 and 5-23 of the internal dosimetry TBD. We confirmed these concerns by performing a series of simplified ORIGEN runs. Hence, we believe that these matters could represent potential SEC issues.” • “Wafer-thin ribbons of UO₂ and absence of cladding ensured high release fraction by recoil and/or diffusion of many FPs [fission products]. Most notably are volatile radionuclides (iodine, cesium, etc.).” 	<p><i>Ibid.</i> (A1), Section 4.0.</p> <p><i>Ibid.</i> (A1), Executive Summary.</p> <p>J. Mauro PowerPoint presentation at November 10, 2015, INL Work Group Meeting, showing results of report SCA-TR-2015-SEC0074A.</p>	<p>—</p> <p>—</p> <p>—</p>

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No.	Description	References	Notes & Additional Comments
	<ul style="list-style-type: none"> “Release and depletion of FPs from fuel elements must further be assumed by the fact that for some IETs [Initial Engine Tests], intentional fuel failure (and unintentional fuel failure) resulted from temperatures exceeding 3,200°F.” 	<i>ibid.</i>	—
A-4	<p>“Independent analyses of airborne emissions associated with the major IETs, as performed by SC&A under contract to CDC, revealed that the DOE [Department of Energy] significantly underestimated the airborne emissions for the IETs with the largest airborne emission.” “Outdoor exposures associated with releases from the ANP need to consider the results of CDC’s investigations into these source terms.”</p>	<i>ibid.</i>	<p>SC&A comment: At the November 11, 2015, WG meeting, NIOSH was tasked to prepare a white paper on IET #10.</p> <p>NIOSH indicated that they will not be prepared to discuss IET #10 at the March 1, 2016, WG meeting, as it has been delayed due to other priorities.</p>

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No.	Description	References	Notes & Additional Comments
<p>Issue B: Central Facilities Area (CFA) – Scope of Review: Evaluate available survey data for the CFA, both during operations and prior to demolition and dismantlement, to determine the actinide-to-Sr-90 and actinide-to-Cs-137 ratios and compare these ratios to the values in Tables 5-22 and 5-23 of the internal dosimetry TBD (ORAUT-TKBS-0007-5).</p>			
<p>B-1</p>	<p>“Analyses of the smear data and soil sample results...indicates at least general agreement in the magnitude of the maximum contamination ratios for uranium and plutonium given in Tables 5-22 and 5-23 of ORAUT-TKBS-0007-5.... However, there are several limitations in the data used.”</p> <ol style="list-style-type: none"> 1. The CFA-669 Hot Laundry operated from 1950 until 1981. The survey data found were very limited and from 1954–1956, the period of early operations. 2. The survey data are written given in units of counts per minute (cpm). While assumptions regarding the equipment and detection efficiencies can be made based on the time period and equipment used at that time, it may be more beneficial to use more recent and well-documented survey information. 3. The soil samples were collected during decontamination and decommissioning (D&D) operations from a trench and berm formed during the excavation of the 8-inch contaminated sanitary sewer line on the north side of CFA-669. It may be more useful to use more sample results, particularly those obtained during the characterization survey, prior to D&D. 	<p><i>Evaluation of Available Survey Data for the Central Facilities Area at Idaho National Laboratory, SCA-SEC-2015-0074-B, Revision 0, draft, September 28, 2015. Section 4.0.</i></p>	<p>SC&A comment: Data capture in January 2016 sought relevant information. The items recovered for the Site Research Data Base (SRDB) may provide some insight when available. — We still have the Seattle and return INL data captures coming up later in 2016.</p>

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No.	Description	References	Notes & Additional Comments
Issue C: Test Reactor Area (TRA) – Scope of Review: Does the methodology of ORAUT-OTIB-0054 (Fission and Activation Product Assignment for Internal Dose-Related Gross Beta and Gross Gammas Analysis) adequately model the reactor characteristics and operations of the Test Reactor Area (TRA)?			
C-1	<p>“The MTR [Materials Test Reactor]...ran for a period of time with plutonium rather than uranium fuel.... It is not clear which, if any, of the nine OTIB-0054 cases...would adequately envelope this situation.”</p> <p>“The issue of whether OTIB-0054 adequately envelopes the MTR when fueled with plutonium merits further investigation and discussion.”</p>	<p><i>NIOSH SEC-00219 Test Reactor Area Modeling, SC&A Report SCA-SEC-2015-0074-C, Revision 0, draft, September 28, 2015. Section 3.2.</i></p>	<p>SC&A comment: Discussed pp. 132–144, November 11, 2015, WG transcript.</p> <p>SC&A is tasked to develop a prioritized list of the 52 reactors at INL, to ascertain if OTIB-0054 methods are bounding and sufficiently accurate. That report will be delivered in March 2016.</p>
Issue D: Chemical Processing Plant (CPP; 1963–1974) – Scope of Review: Evaluate if the revised SEC class definition may unintentionally exclude workers from the SEC class due to contemporaneous dosimetry requirements.			
D-1	<p>“Observation 1: While the class definition provides the example of ‘at least one film badge,’ SC&A has assumed that <i>any</i> evidence of monitoring during the latter SEC period (3/1/1970–12/31/1974) will satisfy the intended criteria.” [i.e., one badge, one area → one badge, multiple areas (3/1/1970) → one badge, one area (12/1974)]</p>	<p><i>Evaluation of the Revised SEC Class Definition for the Idaho National Laboratory Chemical Processing Plant (1963–1974), SCA-SEC-2015-D, Revision 0, draft, September 28, 2015. Section 2.1.</i></p>	<p>SC&A comment: All 6 observations related to this issue were discussed at the November 11, 2015, and January 15, 2016, WG meetings. Review of the remaining 18 cases in coordination with NIOSH is complete. Issue D was the focal point of the March 1, 2016, WG meeting.</p>
D-2	<p>“Observation 2: SC&A identified a single claim that contained in-vivo dosimetry related to CPP, but did not have related external dosimetry. It is recommended that this claim be included with the claims requiring additional data capture at INL.”</p>	<p><i>Ibid.</i> Section 2.1.</p>	<p>—</p>

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No.	Description	References	Notes & Additional Comments
D-3	"Observation 3: Clarification is warranted to establish how 'temporary' and/or 'visitor badges' are utilized in the implementation of the class definition during the latter SEC period (3/1/1970–12/31/1974)."	<i>Ibid.</i> Section 2.1.	SC&A comment: NIOSH clarified at the November 11, 2015, WG meeting that temporary and visitor badges and location cards are adequate if the 250-day requirement is met.
D-4	"Observation 4: Absent additional information to the contrary, dosimetry associated with 'CADRE' should be considered CPP for the purposes of determining SEC eligibility. Similar to the CPP dosimetry records, it is important to establish that 'CADRE' badging records have all been captured from INL."	<i>Ibid.</i> Section 2.2. <i>CADRE Evaluation (Area Code 71) for consideration as part of the Idaho Chemical Processing Plant Special Exposure Cohort.</i> NIOSH. February 25, 2016.	SC&A comment: NIOSH clarified at the November 11, 2015, WG meeting that it will reach out to site personnel to clarification. NIOSH releases findings on 'CADRE' issue in February 25, 2016, memo. Issue was discussed at March 1, 2016, WG meeting and consensus was reached that 'CADRE' refers to Emergency Response Center personnel who were not likely at CPP during the SEC period. Issue was closed by WG. <i>Note: the issue of monitoring practices for other emergency response personnel that may have entered CPP (such as "firemen") is pending NIOSH response.</i>

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No.	Description	References	Notes & Additional Comments
D-5	“Observation 5: NIOSH should consider the additional claims identified by SC&A as candidates for upcoming data-capture efforts at INL to assure that all monitoring records are complete for these workers.”	<i>Ibid.</i> Section 3.0.	SC&A Comment: Supplemental dosimetry records were received from the site in December 2015. SC&A delivered the white paper: “Evaluation of Claims with Supplemental Dosimetry Requests.” This white paper was discussed at the January 2015 WG teleconference (see Sub Issue DD, below, for noted observations).
D-6	“Observation 6: A review of the ten claimants NIOSH identified as requiring follow-up research and data capture at INL indicates a thorough search to identify potential workers who were exposed at the CPP for which the required dosimetry currently is not available. SC&A agrees with NIOSH’s assessment that these claimants warrant further investigation.”	<i>Ibid.</i> Section 4.0.	See response to Item D-5 and Sub Issue DD.
<i>Sub Issue DD: Chemical Processing Plant (CPP; 1963–1974) – Evaluation of Claims with Supplemental Dosimetry Requests.</i>			
DD-1	“Observation 1: Five of the 18 claims contained a listing of a ‘box’ and ‘record number’ for the relevant claimant dosimetry records. In one of those five claims, it appears that an ‘area exposure report’ related to the claimant could not be located. It should be noted that NIOSH has undertaken a comparison of monthly Health Physics (HP) reports versus the available dosimetry printouts, and NIOSH concluded the records available (at least for CPP in the 1963–1970 timeframe) are complete for the purposes of SEC administration.”	<i>Evaluation of Claims with Supplemental Dosimetry Records</i> , SCA-2016-SEC-0074F, Revision 0, draft, January 12, 2016, Section 2.1.	SC&A Comment: NIOSH noted that the particular missing record was related to MTR and prior to the SEC period, this confirmed SC&A’s assertion stated in the white paper. On the issue of missing records in general, NIOSH reaffirmed that they feel they have a complete set of CPP dosimetry for the purposes of SEC implementation. (INL WG teleconference, January 15, 2016, pp. 87–94)

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No.	Description	References	Notes & Additional Comments
DD-2	"Observation 2: SC&A identified evidence (specifically an in-vivo record) of a claimant entering CPP in 1966 that did not have associated external dosimetry for CPP."	<i>Ibid.</i> Section 2.2.	<p>SC&A Comment: NIOSH identified a set of visitor badges associated with this claimant for MTR and the Special Power Excursion Reactor Test (SPERT) but no evidence of monitoring at CPP. It is NIOSH's position that this in vivo record at CPP is likely a typo. (INL WG teleconference, January 15, 2016, p. 55)</p> <p>Issue also briefly discussed during March 1, 2016, WG meeting; no new information was provided.</p>
DD-3	"Observation 3: Case #3 provides an example where internal monitoring indicates CPP during the latter SEC period (1970); however, there is no external monitoring at INL after 1960."	<i>Ibid.</i> Section 2.3.	<p>SC&A Comment: NIOSH obtained visitor badges at CPP for this individual which correspond to the internal monitoring result identified in Observation 3. (INL WG teleconference, January 15, 2016, pp. 85–86)</p> <p>March 1, 2016, WG: NIOSH identified an INL policy, which was not to index some visitor cards that reported zero dose in the general timeframe of 1968–1974. NIOSH has captured all visitor cards for CPP during this time and is working to index visitor cards for the remaining site areas (projected to take 6–9 months).</p>

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No.	Description	References	Notes & Additional Comments
DD-4	"Observation 6: The 'annual dose summary' report for Case #6 indicates that the claimant was monitored from 1963 to 1966; however, individual dosimetry reports are not available to ascertain the exact work location during this time."	<i>Ibid.</i> Section 2.6.	<p>SC&A Comment: NIOSH indicated that they have searched all available temporary and film badge reports at CPP for this individual and did not locate any records. However, NIOSH also stated they have not searched through temporary and/or visitor records at other INL areas where the Energy Employee may have been monitored but not captured in the DOE response. (INL WG teleconference, January 15, 2016, pp. 111–116)</p> <p>March 1, 2016, WG: This issue was not specifically discussed. Resolution pending capture and indexing of all visitor/temporary badge records for INL (projected 6–9 months).</p>

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No.	Description	References	Notes & Additional Comments
Issue E1: Fission and Activation Product (FAP) Bioassay Indicator Radionuclides – Scope of Review: Analyze FAP indicator ratios, actinide-to-FAP ratios, and special situations/bioassays.			
E1-1	“FAP intakes assigned using NIOSH’s recommendations in ORAUT-OTIB-0054...based on Sr-90 intake values are generally (but not always) equal to, or greater than, those derived from actual measured values.”	<i>SC&A’s Evaluation of the NIOSH Evaluation Report Proposed Use of Fission-Activation Product Bioassay Indicator Radionuclides (in Conjunction with ORAUT-OTIB-0054 and ORAUT-TKBS-0007-5) for Assessment of Fission-Activation Product and Actinide Intakes at Idaho National Laboratory, SCA-SEC-2015-0074-E1, Revision 0, draft, October 26, 2015. Executive Summary.</i>	<p>SC&A comment: It needs to be determined if records of analyses of dissolver contents are available, preferably for a variety of INL reactor fuel elements and also fuel elements from offsite reactors.</p> <p>Data capture in January 2016 sought relevant information. The items recovered for the SRDB may provide some insight when available. — We still have the Seattle and return INL data captures coming up later in 2016.</p> <p>SC&A tasked at the November 11, 2015, WG meeting to update the Issue E1 report when the relevant data are obtained.</p> <p>March 1, 2016: process of capturing relevant data still ongoing.</p>
E1-2	“The Cs-137/Sr-90 intakes are not always 1:1 as assumed in ORAUT-OTIB-0054...and ORAUT-TKBS-0017-5 ...; frequently, large variations in the ratio exist. This brings into question the validity of using an indicator radionuclide when deriving FAP and actinide intakes, because the assigned intakes/doses are dependent on the indicator radionuclide bioassayed at the time. This may be the most important result of this study because a Cs-137/Sr-90 value of approximately 1:1 is one of the cornerstones for use of the ratio method at the INL.”	<i>ibid.</i>	<p>SC&A comment: Further INL document research is needed to evaluate NIOSH’s recommended ratio values, especially for actinides and Cs-137/Sr-90.</p> <p>See response to Item E1-1.</p>

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No.	Description	References	Notes & Additional Comments
E1-3	"Actinide intakes assigned using NIOSH's recommendation in ORAUT-TKBS-0017-5..., Table 5-22 based on Sr-90 intake values, or Table 5-23 based on Cs-137 intake values, are sometimes significantly less than those derived from actual measured values."	<i>Ibid.</i>	SC&A comment: Resolution is contingent on revised Issue E1 report.
E1-4	"It is difficult to evaluate when 'special' (situations where actinides were not tied to a fission product in a given ratio) bioassays were needed, if they were performed, and if they are indicated as such in the bioassay records."	<i>Ibid.</i>	<p>SC&A comment: It needs to be determined if special or non-routine bioassays were associated with special exposure events...or, if instead, the terms were applied to the priority of processing over "routine" bioassays.</p> <p>Future data capture will seek to address these concerns.</p> <p>See response to Item E1-1.</p>
Issue E2: Fission and Activation Product (FAP) Bioassay Worker Records – Scope of Review: Determine, through a semi-random sample of claimants, if sufficient workers records containing FAP bioassay (in-vitro and in-vivo) results are available to assign intakes and resulting doses from FAP.			
E2-1	Observation 1: SC&A believes that coworker models should be developed for the period of 1967–1970 for each relevant area under consideration.	<p><i>Evaluation of Internal Monitoring for Fission and Activation Products Among INR Claimants (1949-1970)</i>, SCA-SEC-2015-0074-E2, Revision 0, draft, October 26, 2015. Executive Summary.</p> <p><i>Response to Observations presented in "Evaluation of Internal Monitoring for Fission and Activation Products among INL Claimants (1949-1970)," SCA-SEC-2015-0074-E2, Revision 0.</i> NIOSH, February 25, 2016.</p>	<p>SC&A comment: Issue E2 discussed pp. 221–244 of the November 11, 2015, WG meeting. Tasking from the November 11, 2015, WG meeting: NIOSH to evaluate the need for additional coworker analysis.</p> <p>February 15, 2016: NIOSH releases white paper response to coworker requirements.</p> <p>March 1, 2016: Issue E2 was briefly discussed at WG meeting. NIOSH agrees that further coworker models are required for the various facilities of INL.</p>

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No.	Description	References	Notes & Additional Comments
E2-2	“Observation 2: Based on SC&A’s review of sampled claimants, it is not apparent that the lack of internal monitoring data is indicative of a lack of internal exposure potential. Given the uncertainty in establishing work areas, activities and ultimately exposure potential for claimants (particularly in the early years), it is recommended that coworker models be evaluated and developed for workers who were unmonitored, but likely should have been monitored during all periods for which such exposures are possible.”	<i>ibid.</i>	SC&A comment: See response to Item E2-1.
E2-3	“...it appears there are credible situations where it would be appropriate and claimant favorable to assign coworker intakes of FAPs and actinides to account for unmonitored portions of the claimants’ work history. Many of these examples predate the period currently identified by NIOSH as requiring coworker evaluations (1967–1970).”	—	SC&A comment: See response to Item E2-1.

Table 3. INL SEC 0219: Items under Investigation by SC&A

No.	Description	References	Notes & Additional Comments
Item 1: Burial Grounds (1952–1970)			
1-1	Evaluation of the adequacy of the contamination control program at the burial grounds. Evidence exists that a “strict” contamination control program was not in place. The burial grounds may have lacked adequate smear counting capabilities.	Pending.	Subject of site data captures and worker interviews: <ul style="list-style-type: none"> – January 25–28, 2016 – February 16, 2016 – February 23–24, 2016 – March 15–16, 2016
1-2	Radioactive waste was not specifically identified/labelled for most drums, boxes, and other containers (particularly in the early years). This would limit the ability for health physics staff to take proper precautions specific to the waste being handled.	Pending.	See additional comments for Item 1-1.

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No.	Description	References	Notes & Additional Comments
1-3	Waste was received from offsite sources, such as commercial, university, Atomic Energy Commission/Energy Research and Development Administration and military sources, which may not have been adequately identified or characterized.	Pending.	See additional comments for Item 1-1.
1-4	Concerns over the lack of priority being given radiation protection at the Burial Grounds as evidenced by a lack of management support, as well as the apparent conflict of interest for health physics staff who had the dual role of radiological protection and oversight of the actual operation of the burial grounds.	Pending.	See additional comments for Item 1-1.
1-5	Questionable characterization of the robust nature of the health physics program given evidence of shortcomings involving radiological controls and also internal monitoring protocol for burial ground workers.	Pending.	See additional comments for Item 1-1.
Item 2: Chemical Processing Plant (Pre-1963)			
2-1	Inadequate internal dosimetry program at CPP to allow for the direct assessment of potential intakes of transuranic/actinide contaminants.	Pending.	Subject of site data captures and worker interviews: <ul style="list-style-type: none"> - January 25–28, 2016 - February 16, 2016 - February 23–24, 2016 - March 15–16, 2016
2-2	Inadequate contamination control program to limit “hot areas” to the actual process cells (similarities to conditions found at CPP during the proposed SEC period 1963–1974).	Pending.	See additional comments for Item 2-1.

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6.0 STATUS OF ANL-W SITE PROFILE AND SEC ISSUES

Many of the issues identified above for INL also have applicability to ANL-W. However, it wasn't until relatively recently, when NIOSH issued *SEC Petition Evaluation Report, SEC Petition SEC-00224 (Argonne National Laboratory – West)*, dated February 18, 2016 (NIOSH 2016b), that explicit consideration was given to ANL-W by the Advisory Board. The Board reviewed the petition and on May 2, 2016, recommended that the following SEC be granted:

All employees of the Department of Energy, its predecessor agencies, and their contractors and subcontractors who worked at the Argonne National Laboratory-West during the time period from April 10, 1951, through December 31, 1957, for a number of work days aggregating at least 250 work days, occurring either solely under this employment, or in combination with work days within the parameters established for one or more other classes of employees in the Special Exposure Cohort.

The petition was granted based on the Board's determination that both external and internal doses could not be reconstructed with sufficient accuracy for the designated time period.

To date, SC&A has not issued a review of the ANL-W ER. However, there has been an exchange of correspondence that is noteworthy. At the request of the Advisory Board, SC&A prepared a work plan for the review of the ER, *Up-date-SC&A's Review of the NIOSH Petition Evaluation Report for SEC-00224, ANL-W*, dated May 6, 2016. One of the seven action items, Item 2, states the following: "SC&A reviewed an early version of the ANL-W site profile, and our review is captured in an integrated INL/ANL-W matrix. We need to cross walk the combined [site profile] matrix with ANL-W to identify potential commonalities." This report fulfills that part of our work plan.

Tables 4 and 5 present SC&A's understanding of all issues that are currently active for INL and identify those issues that we believe also apply to ANL-W, along with the action items delineated in our May 6, 2016, work plan for ANL-W and those issues that might be SEC issues.

**Table 4. Integrated Matrix for INL and ANL-W June 17, 2016:
Original Site Profile Review Dated December 30, 2008**

Issue No.	Issue Description‡	Applicability to INL*	Applicability to ANL-W*
1	Reconstruction of near-field exposures from routine atmospheric releases. Recommend closing the aspect of this issue for exposures beyond 100 m of the elevated release point, but remain in progress for workers located with 100 m of the release where there could be downwash from atmospheric releases and also exposures to ground level releases.	Yes	Yes
2	Resolved for most episodic releases, but there remain concerns with underestimating the releases associated with IET 10.	Yes	No
3	Closed by Work Group.	—	—
4	SC&A recommends closing.	—	—
5	Reiteration of Issues 1 and 2. No need to separately track.	—	—

NOTICE: This report has been reviewed to identify and redact any information that is protected by the Privacy Act 5 U.S.C. § 552a and has been cleared for distribution.

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Issue No.	Issue Description‡	Applicability to INL*	Applicability to ANL-W*
6	SC&A recommends closing.	—	—
7	Closed by Work Group.	—	—
8	SC&A recommends closing.	—	—
9	Recommend closing the generic aspect of this issue dealing with OTIB-0017, but there is a need for NIOSH to identify specific circumstances when hot particle exposures might be an issue, especially for workers with skin cancer.	Yes	Yes
10	Closed by Work Group.	—	—
11	Closed by Work Group.	—	—
12	Closed by Work Group.	—	—
13	Closed by Work Group.	—	—
14	SC&A recommends closing.	—	—
15	Adequacy of ability to reconstruct doses to SL-1 responders	Yes	No
16	Need for an external dose coworker model	Yes*	Yes*
17	SC&A recommends closing.	—	—
18	SC&A recommends closing.	—	—
19	Angular dependence	Yes	Yes
20	SC&A recommends closing.	—	—
21	SC&A recommends closing.	—	—
22	Closed by Work Group.	—	—
23	The issue has to do with hazardous jobs, with an emphasis on hot particles. See Issue 9.	Yes	Yes
24	Extremity exposures. SC&A would like to review the cases of extremity cancers and whether NIOSH had the data needed to reconstruct these exposures.	Yes	Yes
25	Closed by Work Group.	—	—
26	SC&A recommends closing.	—	—
27	SC&A recommends closing.	—	—
28	Need for adjustment factors for neutron exposures	Yes	Yes
29	SC&A recommends closing.	—	—
30	SC&A recommends closing.	—	—
31	Neutron dosimetry completeness issues. Merge with Issue 16.	Yes*	Yes*
32	SC&A recommends closing.	—	—
33	SC&A recommends closing.	—	—
34	Adequacy of neutron exposure monitoring.	Yes*	Yes*
35	SC&A recommends closing.	—	—
36	SC&A recommends closing.	—	—
37	Closed by Work Group.	—	—
38	Closed by Work Group.	—	—

‡ Where the issue has been closed or SC&A recommends closure, no description of the issue is provided. However, if SC&A recommends keeping the issue in progress, a brief description of the issue is provided

* An asterisk indicates that the issue may be an SEC issue.

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**Table 5. Integrated Matrix for INL and ANL-W June 17, 2016:
Issues Associated with SEC—00219 and SC&A’s July 6, 2015 Interim Status Report on the
Review of the ER and associated Special Reports****

Issue No.	Issue Description†	Applicability to INL*	Applicability to ANL-W*
Issue A	TAN	—	—
A-1	Applicability of ORAUT-OTIB-0054 (OTIB-0054 or ORAUT 2013) and Tables 5-22 and 5-23 of the site profile internal dosimetry technical basis document (TBD) to the performance of internal dose reconstruction for facilities that handled and stored spent and irradiated fuel;	Yes*	Yes*
A-2	Spotty neutron dosimetry data	Yes	?
A-3	ANP/IET unique radionuclide mixes in irradiated fuel	Yes	No
A-4	IET 10 atmospheric releases and associated outdoor exposures	Yes	No
Issue B	CFA unique radionuclide mixes	Yes*	No
Item C	Unique reactors at TRA	Yes*	Yes*
Item D	CPP	Yes*	No
D-1	Definition of the class	Yes*	No
D-2	Found CPP worker with bioassay but no film badge	Yes*	No
D-3	Temporary workers and visitors	Yes*	No
D-4	CADRE	Resolved	No
DD-1	18 claimant review	Yes*	No
DD-2	Found claimant entering CPP with in-vivo record but no film badge record	Yes*	No
DD-3	A third case with internal monitoring data after 1970 but no film badge data after 1960	Yes*	No

† Where the issue has been closed or SC&A recommends closure, no description of the issue is provided. However, if SC&A recommends keeping the issue in progress, a brief description of the issue is provided.

*An asterisk indicates that the issue may be an SEC issue.

**A more detailed matrix of issues related to SC&A’s review of the evaluation report for SEC-00219 is provided in Section 5 above and on the NIOSH website at <https://www.cdc.gov/niosh/ocas/pdfs/abrwh/scarpts/sca-inlsec219im-031316.pdf>, dated March 13, 2016. That matrix should be consulted during the issues resolution process.

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