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**ADVISORY BOARD ON
RADIATION AND WORKER HEALTH**

National Institute for Occupational Safety and Health

**A FOCUSED REVIEW OF THE NIOSH SEC-00235 PETITION
EVALUATION REPORT FOR SANTA SUSANA FIELD
LABORATORY AREA IV**

**Contract No. 211-2014-58081
SCA-TR-2017-SEC011, Revision 0**

Prepared by

**Douglas Farver, CHP
Robert Barton, CHP**

SC&A, Inc.
2200 Wilson Boulevard, Suite 300
Arlington, Virginia, 22201

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

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DOCUMENT REVIEWER(S):	John Stiver, MS, CHP [signature on file]

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ABBREVIATIONS AND ACRONYMS

Advisory Board or ABRWH	Advisory Board on Radiation and Worker Health
AEC	Atomic Energy Commission
CATI	computer-assisted telephone interview
CEP	Controls for Environmental Pollution
D&D	decontamination and decommissioning
DEEOIC	Division of Energy Employees Occupational Illness Compensation
DOE	U.S. Department of Energy
DOL	U.S. Department of Labor
DR	dose reconstruction
EE	energy employee
EEOICPA	Energy Employees Occupational Illness Compensation Program Act of 2000
ER	evaluation report
ETEC	Energy Technology Engineering Center
HHS	U.S. Department of Health and Human Services
LMEC	Liquid Metal Engineering Center
MFP	mixed fission products
mrem	millirem
NAA	North American Aviation
NIOSH	National Institute for Occupational Safety and Health
ORAU	Oak Ridge Associated Universities
ORAUT	Oak Ridge Associated Universities Team
OTIB	ORAUT technical information bulletin
SEC	Special Exposure Cohort
SNAP	Systems for Nuclear Auxiliary Power
SRDB	Site Research Database
SRE	Sodium Reactor Experiment
SSFL	Santa Susana Field Laboratory

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1.0 BACKGROUND AND STATEMENT OF PURPOSE

On August 9, 2016, the National Institute for Occupational Safety and Health (NIOSH) received Special Exposure Cohort (SEC) petition SEC-00235 for workers at the Santa Susana Field Laboratory (SSFL) facility. NIOSH qualified the petition on February 1, 2017. The petition requested that NIOSH consider the following class: *“All employees of North American Aviation, to include corporate successors and subcontractors who worked at Area IV of the Santa Susana Field Laboratory (SSFL) from December 31, 1964 through the present.”*

The petitioner-requested class included a portion of the class previously evaluated by NIOSH for SEC-00234 (NIOSH 2016). Therefore, NIOSH’s qualification assessment considered only the period that was not already evaluated: the period from January 1, 1989, through the present.

The petitioner provided information in support of the belief that accurate dose reconstruction over time is impossible for the Area IV employees in question. NIOSH concluded that there is insufficient documentation to support the petitioner’s assertion that radiation exposures and radiation doses were not adequately monitored, either through personal monitoring or area monitoring, for the time period as evaluated (1989–present). From August 1991 through June 1993, however, bioassay and environmental samples were analyzed by Controls for Environmental Pollution (CEP). NIOSH does not accept CEP as a quality supplier of dosimetry information and has not used the dosimetry information provided by CEP for dose reconstruction of any claims related to this or other sites. NIOSH considers bioassay results from CEP as lost, falsified, or destroyed, which is a basis to qualify the petition for evaluation.

Based on research and data capture efforts related to Area IV of SSFL, NIOSH concluded that it has access to bioassay data, external monitoring records, radiological monitoring methods and procedures, environmental monitoring reports, and facility characterization records for Area IV employees during the period requested by the petitioner. However, NIOSH needed to evaluate if the rejection of the CEP data would affect NIOSH’s ability to perform sufficiently accurate dose reconstructions.

NIOSH therefore changed the petitioner-requested class to include only the period during which the site contracted CEP as a primary vendor for bioassay sample analysis. NIOSH evaluated the following class: *“All employees of the Department of Energy, its predecessor agencies, and their contractors and subcontractors who worked at Area IV of the Santa Susana Field Laboratory in Ventura County, California, from August 1, 1991 through June 30, 1993.”*

On August 15, 2017, NIOSH presented the results of its SEC-00235 petition evaluation report (ER) (NIOSH 2017) at the meeting of the Advisory Board on Radiation and Worker Health (hereafter referred to as the “Advisory Board”). After discussion by the Advisory Board, SC&A was tasked to review the SEC-00235 petition ER and available documentation, focusing on NIOSH’s position that the lack of CEP *in vitro* data from 1991 to 1993 does not affect NIOSH’s ability to perform sufficiently accurate internal dose reconstructions for monitored or unmonitored workers.

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2.0 DESCRIPTION OF SANTA SUSANA FIELD LABORATORY AREA IV FACILITIES AND OPERATIONS

SSFL is located approximately 30 miles northwest of downtown Los Angeles, California. SSFL consists of 2,850 acres in the Simi Hills of Ventura County and is divided into four administrative and operational portions based on ownership and operations. U.S. Department of Energy (DOE) operations are conducted in Rockwell International-owned and DOE-owned facilities in an area designated as Area IV. SSFL was initially established by North American Aviation in 1947 as a field test laboratory to static-fire rocket engines. In 1953, Area IV was established as a nuclear research and development facility; management by Atomic International started in 1955. Atomic International conducted activities in Area IV on development of civilian nuclear power and the Liquid Metal Engineering Center (LMEC), which focused on research and testing of non-nuclear components to liquid metals. LMEC was renamed the Energy Technology Engineering Center (ETEC) in 1978. Through various mergers, SSFL is now managed by Boeing.

Between 1954 and 1980, several small nuclear reactors and critical test assemblies were built, tested, and operated in Area IV. These research facilities focused on development and operation of homogeneous water boiler-type reactors, sodium-cooled graphite-moderated reactors, and uranium-zirconium hydride reactors. Starting in 1956 and continuing through 1996, operations also supported the manufacture, management, and disassembly of nuclear reactor fuel, as well as the operation of nuclear waste management facilities. Fuel manufacturing included the assembly of fuel elements for the Sodium Reactor Experiment (SRE), a plutonium fuel manufacturing facility, and a uranium carbide fuel pilot plant.

Most of the nuclear research programs and operations ceased in 1988, and all non-nuclear research ended in 1998. However, some support operations, including the Fuel Storage Facility and the Radiation Instrument Calibration Laboratory, did not cease until 1996. Beginning in the 1990s, Area IV activities focused on decontamination and decommissioning (D&D) and remediation.

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3.0 OVERVIEW OF PREVIOUS SSFL SEC PETITONS AND NIOSH'S EVALUATION REPORT FOR SEC-00235

3.1 PREVIOUS PETITIONS

NIOSH previously evaluated three other petitions for SSFL Area IV. In the petition ER for Petition SEC-00093 (NIOSH 2009a), NIOSH determined that it could not estimate internal radiation doses with sufficient accuracy for the period from January 1, 1955, through December 31, 1958, for employees at SSFL Area IV. NIOSH's decision was based primarily on a lack of internal monitoring data for potentially exposed individuals from January 1, 1955, through December 31, 1958. NIOSH also determined that it could reconstruct external dose, including occupational medical dose, for the period from January 1, 1955, through December 31, 1958. In June 2009, the U.S. Department of Health and Human Services (HHS) issued a letter designating the January 1, 1955, through December 31, 1958, period for inclusion in the SEC (HHS 2009). In October 2009, SC&A issued SCA-SEC-TASK5-0066, *Review of the Santa Susana Field Laboratory (SSFL) Area IV Special Exposure Cohort (SEC) Petition-00093 and the NIOSH SEC Petition Evaluation Report* (SC&A 2009).

In its petition ER for Petition SEC-00156 (NIOSH 2010a), NIOSH determined that it could not reconstruct internal radiation doses with sufficient accuracy for the period from January 1, 1959, through December 31, 1964, for employees at SSFL Area IV. NIOSH's decision was based primarily on incomplete bioassay, air monitoring, or process and radiological source data from January 1, 1959, through December 31, 1964. NIOSH also determined that it could reconstruct external dose, including occupational medical dose, for the period from January 1, 1959, through December 31, 1964. In April 2010, HHS issued a letter designating the January 1, 1959, through December 31, 1964, period for inclusion in the SEC (HHS 2010).

In its petition ER for Petition SEC-00234 (NIOSH 2016), NIOSH determined that it could not reconstruct internal radiation doses with sufficient accuracy for the period from January 1, 1965, through December 31, 1988, for employees at SSFL Area IV. NIOSH's decision was based primarily on insufficient internal dosimetry data or air monitoring data available to bound intakes of thorium and americium, including their associated progeny, for the period from January 1, 1965, through December 31, 1988. Consistent with prior determinations, NIOSH also determined that it could reconstruct external dose, including occupational medical dose, for the period from January 1, 1965, through December 31, 1988. In January 2017, HHS issued a letter designating the January 1, 1965, through December 31, 1988, period for inclusion in the SEC (HHS 2017).

3.2 SEC-00235 PETITION EVALUATION REPORT

Although NIOSH has disqualified Area IV *in vitro* data analyzed by CEP during the period August 1991 through June 1993, NIOSH has determined that the lack of CEP *in vitro* data has not affected NIOSH's ability to perform sufficiently accurate internal dose reconstructions for monitored or unmonitored workers. The NIOSH determination is based on the following.

NIOSH has compared remediation period bioassay data to the operational period data (through 1988) used to develop the intake rates of ORAUT-OTIB-0080, Revision 00, *Internal Coworker*

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Dosimetry Data for Area IV of the Santa Susana Field Laboratory and the De Soto Avenue Facility (NIOSH 2014). NIOSH believes the ORAUT-OTIB-0080 intake rates assigned for the end of the Area IV operation period (circa 1988) bound the potential remediation period exposures for unmonitored workers.

NIOSH examined the D&D and waste handling operations throughout the remediation period (1989–present) to evaluate the exposure conditions before, during, and after the CEP period being evaluated in this report. NIOSH’s review indicates that work remained consistent as to procedures, personnel protection equipment, and exposure risks. NIOSH has found no major radiological project that occurred in the CEP period 1991–1993 that would not have had workplace and/or personnel monitoring performed outside the CEP-related period.

During the August 1991 through June 1993 period with disqualified CEP bioassay results, the site was performing routine *in vivo* whole-body scans for fission products with a different contractor, Helgeson Scientific Services (Helgeson 1993). The site reported that the whole-body scans showed no measurable exposures (Rockwell 1994).

3.3 NIOSH RESPONSES TO MAJOR ISSUES RAISED IN SEC-00235

3.3.1 Issue 1: General Covered Employment Status

The petitioner claimed that the employee’s job location at SSFL cannot be reliably or accurately determined for all DOE contracted employees. As such, NIOSH cannot rule out Area IV employment among employees of North American Aviation, its divisions, its corporate successors, or its subcontractors.

NIOSH (2017) stated that it does not determine the eligibility for covered employment. NIOSH also stated:

Additionally, worker eligibility by worksite or location at a covered facility is not an SEC determining basis. Petitions are qualified for evaluation for inclusion into the SEC based on circumstances related to an entire class of employees that prevent accurate reconstruction of potential radiation exposure for that class of workers. [page 47]

3.3.2 Issue 2: Area IV of the SSFL Site Profile Concerns

The petitioner claimed that the 2006 SSFL site profile lacks information pertinent to additional radiological facilities within Area IV and outside Area IV.

NIOSH reviewed the documentation provided by the petitioner and will evaluate the need to update the site profile. In the petition ER, NIOSH stated:

Site profile documents are general working documents that provide guidance concerning the preparation of dose reconstructions at particular sites or categories of sites. Much of the information provided as additions to the 2006 site profile is informational but does not directly support more accurate dose reconstruction. Information on broad scope incidents likely to be relevant to dose

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reconstruction across the site population is generally included in the site profile, although smaller-scale incidents are not included in the site profile. When the EEOICPA program makes a request for an individual's dosimetry records for the purposes of dose reconstruction, the request includes any incident reports involving that individual. Such incident reports become part of the file and the specifics of the incident are considered in reconstructing the radiation dose. NIOSH routinely evaluates the need to update the site profile and will include information provided in this petition package, relevant to performing dose reconstructions, during the next update cycle.

3.3.3 Issue 3: Radiological Incidents

The petitioner claimed that Boeing's Incident database contains many incident reports where workers either not assigned to a radiological location, or not equipped with appropriate radiation protection, were involved in an exposure incident. The petitioner further claimed that the workers were unauthorized subcontractor employees who had access to radiological locations and radioactive materials.

NIOSH reviewed the Incident database and did not find evidence of routine radiological processes at non-radiological facilities or incident summaries indicating that "unauthorized subcontractor employees" had access to radiological locations and radioactive materials.

NIOSH stated in the petition ER (page 48):

NIOSH reviewed the incident summary listing and located a total of 56 incidents (once instances of natural radon deposition, procedural violation with no potential for exposure, and incidents at non-Area IV locations were screened out) for assessment during the period being evaluated. The Area IV facilities in the incident summary listing are all known radiological facilities, with the exception of a loading dock where a carbon-14 source was improperly controlled. These radiological facilities include buildings containing reactors, critical test facilities, the Hot Laboratory, the Radioactive Materials Handling Facility, the Fuel Storage Facility, the Calibration Laboratory, and the Uranium Carbide Fuel Manufacturing Pilot Plant.

NIOSH also reviewed a Building 4066 incident from October 1966, which the petitioner provided as an example of a non-radiological location being used for radioactive processes and a non-nuclear and unmonitored worker associated with the location and potentially present in proximity to radiological materials. NIOSH concluded that the example does not include radiological processes, but rather a failure of procedure, allowing an internally contaminated piece of equipment to be brought for maintenance without proper assessment and radiological controls.

3.3.4 Issue 4: Employment Records

The petition describes an incident from 1966 as an example of the contractor withholding worker records based on the worker being "unmonitored" and presumably not a designated radiation

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worker. The petitioner further asserted that exposure locations of monitored workers cannot be determined because of the loss of the translation key for the building codes used on the visitor logs. Commentary from Boeing to the Advisory Board (Boeing 2014) includes discussion of employment records for 8,400 employees that contained radiation records that were “blank.”

NIOSH responded in the petition ER that the administrative policies of Rocketdyne created these 8,400 empty radiation records. Until the late 1970s, the site policy was to prepare a radiation exposure record folder with employee identification information for every new employee in anticipation of job conditions that would require a worker to be monitored for radiation exposure. This created 14,200 worker radiation dose folders (Lang 1960; Atomics International 1960, PDF p. 4), of which 5,800 were for monitored radiation workers. The remaining 8,400 so-called “blank” records were unmonitored non-radiation workers. These records do not indicate unmonitored radiation exposure.

3.3.5 Issue 5: Lack of Monitoring

The petitioner asserted that radiation exposures and radiation doses potentially incurred by members of the proposed class that relate to this petition were not monitored, either through personal monitoring or through area monitoring. Multiple documents were provided to support this claim in support of the F.1 basis.

NIOSH reviewed all of the documentation and found there was insufficient evidence to support the claim of lack of monitoring for Area IV workers. In addition, NIOSH stated that it has access to personal monitoring data, work area and breathing zone air monitoring data, contamination and radiation survey reports, and bioassay data for Area IV workers, including examples throughout the period evaluated, August 1991 through June 1993.

3.3.6 Issue 6: Falsified Documents or Statements

The petitioner claimed that radiation-monitoring records for members of the proposed class have been lost, falsified, or destroyed, and that there is no information about monitoring, source, source term, or process from the site where the employees worked. The petitioner attached documents to support the claim.

NIOSH did not find any of the petitioner-supplied documents or information to support the basis that monitoring records at SSFL were lost, falsified, or destroyed for the period after 1988. However, as noted in Section 1.0, NIOSH considers the bioassay data processed by CEP from 1991 to 1993 to be unreliable unless the results are also verified. NIOSH qualified the petition for evaluation under the basis of lost, falsified, or destroyed dosimeter data due to the site’s use of CEP as a contractor providing internal dosimeter data for the period August 1991 to June 1993.

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3.4 SC&A COMMENTS

SC&A reviewed the SEC-00235 petition and NIOSH's SEC-00235 petition ER. The SEC-00235 petition included approximately 50 documents submitted by the petitioner, listed in Attachment A to this report.

NIOSH qualified the petition on February 1, 2017, and completed the petition ER on May 11, 2017.

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4.0 SUMMARY OF DOSIMETRY DATA AT SANTA SUSANA FIELD LABORATORY AREA IV

4.1 REVIEW OF EXTERNAL DOSIMETRY DATA

4.1.1 Monitored Workers

NIOSH has access to photon, beta, and neutron external dosimetry results, as well as other supporting data for the entire period evaluated in this report (available for all years of site operation). The policy at SSFL was to assign the applicable dosimetry to anyone with the potential for photon, beta, or neutron exposure. Dosimetry was assigned based on job assignments that required exposure to radioactive materials (NIOSH 2010b). Summaries of the available external monitoring data can be found in the NIOSH petition ER for Petition SEC-00093 (NIOSH 2009a). Details about the various analyses used, and the associated minimum detectable activities, are presented in ORAUT-TKBS-0038-6, Revision 02, *Area IV of the Santa Susana Field Laboratory, the Canoga Avenue Facility, the Downey Facility, and the De Soto Avenue Facility (sometimes referred to as Energy Technology Engineering Center [ETEC] or Atomics International)* (NIOSH 2010b).

The NIOSH external dosimetry database for Area IV of the SSFL contains dosimetry data for penetrating dose, including gamma and fast neutron dose.

4.1.2 Unmonitored Workers

Through the course of ongoing dose reconstruction efforts and investigations associated with both SEC-00093 and SEC-00156, NIOSH determined that although external monitoring data are available for most employees at Area IV, some employees could have received external radiation exposures that went unmonitored. To assess potential external dose to unmonitored employees, NIOSH developed a coworker dose distribution model, ORAUT-OTIB-0077, Revision 00, *External Coworker Dosimetry Data for Area IV of the Santa Susana Field Laboratory, the Canoga Avenue Facility (Vanowen Building, and the De Soto Avenue Facility (sometimes referred to as Energy Technology Engineering Center [ETEC] or Atomics International)* (NIOSH 2009b). This current evaluation of the SEC-00235 petition ER, dealing with the disqualification of internal bioassay data, has identified no concerns with the external coworker dose distribution models of ORAUT-OTIB-0077.

In March 2010, SC&A conducted a review of the external dosimetry database used to develop the coworker model in ORAUT-OTIB-0077 and issued a white paper on the findings (SC&A 2010).

4.1.3 Ambient Environmental External Dose

ORAUT-TKBS-0038-4, Revision 02, *Area IV of the Santa Susana Field Laboratory, the Canoga Avenue Facility, the Downey Facility, and the De Soto Avenue Facility (sometimes referred to as Energy Technology Engineering Center [ETEC] or Atomics International) – Occupational Environmental Dose* (NIOSH 2010c), presents ambient external radiation dose information for Area IV of the SSFL for the period 1975 through 1999. During the period under evaluation,

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lithium-fluoride chips were used. The baseline dose during this period is based on the minimum dosimeter sensitivity of 10 mrem/quarter or 40 mrem/year. This minimum sensitivity baseline results in a higher annual dose than subtraction of offsite background dose from onsite environmental dosimeter results. ORAUT-TKBS-0038-4 presents annual ambient Area IV dose rates for assignment for the years under evaluation, 1991 through 1993. This current evaluation dealing with the disqualification of internal bioassay data has identified no concerns with the assignment of ambient environmental external doses.

4.1.4 Occupational Medical Data

In its previous SEC class designation for SEC-00234, for the period through December 31, 1988 (HHS 2017, page 3), HHS stated:

NIOSH finds that it is feasible to reconstruct occupational medical dose for Area IV workers using information and methods in Dose Reconstruction from Occupationally Related Diagnostic X-Ray Procedures (ORAUT-OTIB-0006) and the Area IV site profile documents.

The SEC-00235 petition ER found no evidence to the contrary for the remediation period (post 1988) or for the period under evaluation, August 1, 1991, through June 30, 1993. NIOSH determined that it is feasible to reconstruct occupational medical dose for Area IV workers for the period from August 1, 1991 through June 30, 1993, using information and methods in ORAUT-OTIB-0006, Revision 04 (NIOSH 2011), and the Area IV site profile documents (ORAUT-TKBS-0038-1,-2, -3, -4, -5, and -6).

4.1.5 External Dose Reconstruction Feasibility

In its previous SEC-00093 and SEC-00156 class designations, NIOSH found that it has access to sufficient employee monitoring and workplace monitoring data to bound potential external exposures for employees at Area IV of the SSFL for January 1, 1955, through December 31, 1958, and January 1, 1959, through December 31, 1964. This petition evaluation found no evidence to the contrary for the period from August 1, 1991, through June 30, 1993. SC&A concurs with NIOSH's external dose reconstruction feasibility determination.

4.2 REVIEW OF INTERNAL DOSIMETRY DATA AT SANTA SUSANA FIELD LABORATORY AREA IV

4.2.1 Air Monitoring Data

NIOSH determined the principal source of internal dose to the workers during the period from 1991 to 1993 was from airborne radiological particulates generated during D&D activities (NIOSH 2017). Air sample results for onsite D&D work, including job-specific breathing-zone air sample results and continuous air monitor results for various buildings, are contained in the site's quarterly reports for 1991–1993 (Rockwell 1993). The quarterly reports also describe the radiological conditions, radiological activities, and any significant events that occurred during the time period.

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SC&A reviewed the 1991–1993 air monitoring results in Rockwell 1993 and finds them to be incomplete. For example, the 1991 quarterly reports provide air sampling information for the Systems for Nuclear Auxiliary Power (SNAP) facility, the Hot Laboratory, and the Radiological Material Disposal Facility. The Hot Laboratory and the Radiological Material Disposal Facility had fixed air monitors, and results are provided. However, the SNAP did not have fixed air monitors and only reported job-specific air sample results that were greater than 0.10 of the derived air concentration. Also, quarterly reports for 1992 and 1993 are only provided for the Hot Laboratory. According to Rockwell 1993, page 176, reports for the SNAP facility and the Radiological Material Disposal Facility were not required by regulations and were suspended pending the implementation of the DOE Radiological Control Manual. Although the air monitoring data are not complete for each facility, SC&A believes the results provide an adequate representation of the airborne activity levels of site activities during the evaluated period.

However, given that NIOSH intends to use surrogate bioassay data and associated intakes from the operational period to reconstruct internal doses during the evaluated period for SEC-00235, it becomes particularly important to establish that radiological conditions during the surrogate period are representative and/or bounding of the evaluated period. NIOSH 2017 presents a visual comparison of bioassay values during the operational period to limited bioassay identified before and after the evaluated period to demonstrate that the magnitude of available monitoring data was likely similar to or lower than the operational period. In addition, NIOSH 2017 notes that D&D activities were ongoing at SSFL Area IV both before and after the evaluated period and also notes there were no major radiological operations identified that might represent a significant change in exposure potential. SC&A does not disagree with these assertions.

Nonetheless, it would be beneficial to perform an analysis of available general area and breathing zone air sampling results for the evaluated period in comparison to the operational period (i.e., the surrogate data period) to assure that radiological conditions are sufficiently similar and/or bounding for use during the evaluated period. This type of analysis would have the added benefit of providing a direct link from the internal exposure potential reflected in the surrogate data to the exposure potential during the period of interest.

4.2.2 Bounding Internal Dose to Unmonitored Workers

ORAUT-OTIB-0080 contains derived intake rates for uranium, plutonium, and mixed fission products (MFP) through the years 1988, 1986, and 1991, respectively. SC&A’s review of ORAUT-OTIB-0080 and associated findings are in SCA-TR-OTIB2014-0080, *A Review of ORAUT-OTIB-0080, Rev. 00: Internal Coworker Dosimetry Data for Area IV of the Santa Susana Field Laboratory and the DeSoto Avenue Facility* (SC&A 2014). SC&A’s report identified 15 findings and 10 observations that remain unresolved. While some of the findings and observations are only relevant for the operational period (e.g., extrapolation of intakes to earlier periods of operation), many of these issues relate to the formulation of coworker intakes in general. Because those derived intakes are proposed for use during the evaluated period, they are relevant to the evaluation of SEC-00235.

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According to the SEC petition ER (NIOSH 2017, page 43),

Though there are no available urinalysis data for the August 1991 through June 1993 period, due to the invalidation of the CEP-analyzed sample results, NIOSH has determined that the data available from before 1991, and following 1993, are of a similar or reduced value to that in the operational-era coworker data for all three coworker-study analytes: uranium, plutonium, and MFP.

The plutonium intake rates are shown in Tables 5-1 and 5-2 of ORAUT-OTIB-0080 and end in 1986. Likewise, the uranium intake rates are shown in Tables 5-3 to 5-5, ending in 1988. The MFP intake rates are shown in Table 5-6, ending in 1991. ORAUT-OTIB-0080 allows for the intake rates to be extended past the end dates as a measure favorable to claimants.

Based on the available pre-1991 and post-1993 data as presented in Figures 7-2, 7-3, and 7-4 of the SEC petition ER (NIOSH 2017), SC&A agrees that the intakes indicated by the data before 1991 and after 1993 are similar or less than those during the operational period.

4.2.3 Internal Dose Reconstruction Feasibility

Based on NIOSH's research and the information presented in the SEC petition ER (NIOSH 2017), NIOSH believes it can estimate radiation doses for all members of the class with sufficient accuracy. This class includes all employees who worked at Area IV of SSFL from August 1, 1991, through June 30, 1993. NIOSH based its determination on the following key items:

- The remediation period bioassay data are not significantly different from the operational period data (through 1988) used to develop the intake rates of ORAUT-OTIB-0080. NIOSH believes the ORAUT-OTIB-0080 intake rates assigned for the end of the Area IV operation period (1988) bound the potential remediation period exposures for unmonitored workers.
- The exposure conditions from D&D and waste handling operations during the remediation period (1989–present) did not significantly change before, during, and after the CEP period (1991–1993). Also, NIOSH did not find any major radiological project that occurred in the CEP period that would not have had workplace and/or personnel monitoring performed outside the CEP-related period.
- During the CEP period, the site was performing routine *in vivo* whole-body scans with a different contractor, and the site had confirmatory *in vitro* resamples analyzed by the new contractor, Teledyne-Brown Engineering. The site reported that these follow-up *in vitro* results confirmed no measurable internal exposures (Rockwell 1994).

Based on our review, SC&A believes that before, during, or after the CEP period of 1991–1993, the radiological exposure conditions and the bioassay data did not significantly change. As such, the derived intake rates for uranium, plutonium, and MFP in ORAUT-OTIB-0080 would likely bound any potential internal exposures for unmonitored workers during the CEP period.

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However, NIOSH 2017 does not address the potential internal dose to other actinide contaminants that would likely be found during D&D activities at the site. As noted in Section 3.1 of this report, SEC-00234 was granted on the basis of the inability to reconstruct internal exposures to thorium and americium during the operational period. NIOSH should address how it intends to reconstruct exposures to these contaminants during the evaluated period.

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5.0 SUMMARY OF FINDINGS

SC&A was tasked to review the SEC Petition-00235 ER (NIOSH 2017) and available documentation focusing on the feasibility of NIOSH performing sufficiently accurate internal dose reconstructions for unmonitored workers without using the of CEP *in vitro* data from 1991 to 1993.

SC&A's focused review of the SEC Petition-00235 ER concluded:

- There are sufficient employee monitoring and workplace monitoring data to bound potential external exposures.
- The nature of radiological work (namely, D&D activities) does not appear to significantly change before, during, or after the 1991–1993 time period.
- It would be beneficial to compare general air and breathing zone data from the 1991–1993 period to the operational period (surrogate data period) to assure radiological conditions are sufficiently similar or bounding for use in internal dose assessment.
- The bioassay data obtained during the remediation period did not exceed the bioassay data from the operations period (pre-1988).
- Extending uranium, plutonium, and MFP intake rates in ORAUT-OTIB-0080 would likely bound any potential intakes that may have occurred during the CEP period (see previous suggestion concerning air sampling comparisons). However, SC&A's review of ORAUT-OTIB-0080 identified several findings and observations that are directly relevant to the calculation of intake values proposed for use during the 1991–1993 period. These findings and observations have yet to be discussed or resolved.
- NIOSH has not established how it will reconstruct internal exposures to other actinide contaminants, such as americium and thorium, during the evaluated period. Such methods should be developed to assure that dose reconstruction is feasible for all radionuclides with the potential for exposure.

In addition, SC&A suggests that example dose reconstructions be provided (whether actual or hypothetical) to demonstrate the implementation and application of coworker doses, ambient doses, or a combination of the two in an actual dose reconstruction context. Section 7.5 of the SEC Petition-00235 ER notes:

As of April 24, 2017, a total of 29 claims have been submitted to NIOSH for individuals who worked at Area IV of the SSFL during the period under evaluation in this report. Dose reconstructions have been completed for 22 individuals (~76%).

SC&A has reviewed the available claimant population and provided an overview that includes an assessment of available monitoring records, relevant computer-assisted-telephone interview (CATI) statements, and the methods used in previous dose reconstructions. Appendix B

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summarizes this information, which shows that a large portion of previously reconstructed claims used ambient, instead of coworker, dose assignment. It has been found in the past that providing examples using either real or hypothetical claimants has helped illustrate the intended approach to dose reconstruction moving forward. Obviously, such information is beyond questions of the general feasibility of dose reconstruction during the evaluated period.

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NIOSH 2005b. *Internal Dose Overestimates for Facilities with Air Sampling Programs*, ORAUT-OTIB-0018, Revision 01, National Institute for Occupational Safety and Health, Cincinnati, OH. August 9, 2005.

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NIOSH 2010b. *Area IV of the Santa Susana Field Laboratory, the Canoga Avenue Facility, the Downey Facility, and the De Soto Avenue Facility (sometimes referred to as Energy Technology Engineering Center [ETEC] or Atomics International) – Occupational External Dose*, ORAUT-TKBS-0038-6, Revision 02, National Institute for Occupational Safety and Health, Cincinnati, OH. April 26, 2010. [SRDB Ref. ID 80538]

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NIOSH 2011. *Dose Reconstruction from Occupational Medical X-Ray Procedures*, ORAUT-OTIB-0006, Revision 04, National Institute for Occupational Safety and Health, Cincinnati, OH. June 20, 2011. [SRDB Ref. ID 98147]

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SC&A 2010. *Review of Database Used to Develop ORAUT-OTIB-0077: External Coworker Dosimetry Data for Area IV of the Santa Susana Field Laboratory*, White Paper, Revision 1, SC&A, Inc., Vienna, VA. March 15, 2010.

SC&A 2014. *A Review of ORAUT-OTIB-0080, Rev. 00: Internal Coworker Dosimetry Data for Area IV of the Santa Susana Field Laboratory and the DeSoto Avenue Facility*, SCA-TR-OTIB2014-0080, Revision 0, SC&A, Inc., Vienna, VA. November 24, 2014.

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ATTACHMENT A: SEC PETITION 00235 DOCUMENTS

Special Exposure Cohort Petition—Form B, with attachments; received August 9, 2016; DSA Ref ID: 127147

Two Affidavits; signed January 11, 2017; DSA Ref ID: 127726

Select page from October 1966 Monthly Progress Report; author not specified; November 8, 1966; DSA Ref ID: 127201

Press release on NASA contract to develop SNAP power systems; Atomics International; May 20, 1963; DSA Ref ID: 127202

Transfer of Neutron Source; correspondence from A.R. Yarrow; August 21, 1963; DSA Ref ID: 127203

Plan of Action for RMDF; correspondence from Jim Harris; December 18, 1975; DSA Ref ID: 127204

Transfer of Neutron Source Approval; correspondence from A.R. Yarrow; May 24, 1963; DSA Ref ID: 127205

KEWP Health Physics Log Book; dated September 18, 1959 through April 9, 1963; DSA Ref ID: 127206

Accidental Exposure of Film Badges; correspondence from R.R. Garcia; May 18, 1965; DSA Ref ID: 127207

Duty Cycle SNAP 10A Actuators; correspondence from I. Rowe; May 28, 1963; DSA Ref ID: 127208

Operational Safety Unit Weekly Newsletter for Week Ending June 1, 1968; correspondence from R.E. Alexander; June 6, 1968; DSA Ref ID: 127209

Steam Accumulator Blowdown Evaluation Rig (SABER) Large Scale Steam Valve Test; author not specified; June 29, 1990; DSA Ref ID: 127210

Approval for More Than 600 MREM Exposure during S8ER Core Vessel Removal and Disassembly; correspondence by R.M. Hill; September 27, 1965; DSA Ref ID: 127211

Health Physics Log Book; dated October 28, 1964 through November 18, 1965; DSA Ref ID: 127212

Radiation Safety Unit Weekly Newsletter for the Period Ending July 15, 1967; correspondence from R.E. Alexander; July 25, 1967; DSA Ref ID: 127213

History of the Bowl Area, with descriptions of gasification and propellants for rocket fire tests; author not specified; date not specified; DSA Ref ID: 127214

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Neuron Radiography of S8DR Fuel Elements in STIR Facility; correspondence from R.E. Durand; May 4, 1970; DSA Ref ID: 127215

Accidental Exposure of Atomics International Film Badges during the Latter Part of November 1962; author not specified; post-November 1962; DSA Ref ID: 127217

Site Description and Historical Operations of the Bowl Area; author not specified; November 1992; DSA Ref ID: 127219

One-Quarter-Ton-Per-Hour Coal Hydrolysis Conversion Test Facility; correspondence from S.F. Iacobellis; September 15, 1978; DSA Ref ID: 127220

Presentation: Advanced Single Stage Gasifier Development Program; Pratt & Whitney Rocketdyne; October 12, 2005; DSA Ref ID: 127222

Single sheet showing dosimetry distribution points; author not specified; April 1, 2014; DSA Ref ID: 127223

Advancement of Flash Hydrogasification: Task VIII Performance Testing; A.Y. Falk, M.D. Schuman, and D. R. Kahn; June 1986; DSA Ref ID: 127224

DOE Authority for Release of Certain Facilities at SSFL; correspondence from R.T. Lancet; January 11, 1990; DSA Ref ID: 127225

List of buildings and their status; author not identified; August 9, 1995; DSA Ref ID: 127226

ETEC Co-generation Equipment; correspondence from R.W. Buckles; January 14, 1986; DSA Ref ID: 127227

Hydrogen Fluoride Chemical Laser Technology; correspondence from J.G. Byrne; June 30, 1976; DSA Ref ID: 127228

ETEC Environmental Protection Implementation Plan Pursuant to DOE Order DOE 5400.1; Rockwell International Corporation; Revision C; November 9, 1992–November 9, 1993; DSA Ref ID: 127230

Quarterly Report (July through September 1959) of Activity Released to the Atmosphere; G. Borg; November 20, 1959; DSA Ref ID: 127231

Photograph of two drums under a desk that are labeled as radioactive material contaminated waste; date not specified; DSA Ref ID: 127232

Energy Systems Group brochure; Rockwell International; date not specified; DSA Ref ID: 127234

Contract Solicitation/Modification for DOE-Boeing; official form extending contract for ETEC remediation; December 15, 1998; DSA Ref ID: 127237

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The Pied Piper—A Historical Overview of the U.S. Space Power Reactor Program; George P. Dix and Susan S. Voss; date not specified; DSA Ref ID: 127239

Presentation: RFI Data Gap Work Plan for Boeing RFI Subarea 1A North B-1, IEL, AILF, and Unaffiliated Areas; originally presented at a Santa Susana Field Laboratory technical meeting; June 7, 2013; DSA Ref ID: 127240

Commendation Regarding Uranium Fire at Canoga Facility, May 17, 1967; J.E. Stewart, Jr.; May 19, 1967; DSA Ref ID: 127241

The Gasification of Various Coals in Molten Salts; S.J. Yosim and K.M. Barclay; date not specified; DSA Ref ID: 127243

Preliminary Services for SNAP8 Flight Prototype Test Facility, Building 056 Santa Susana, California; Bechtel Corporation; August 1964; DSA Ref ID: 127244

Radiation Survey of the Downey Facility; approved by P. Rutherford and S. Reeder; release date May 7, 2001; DSA Ref ID: 127245

Health Physics Log Book for Building 12; dated October 12, 1962, through July 27, 1966; DSA Ref ID: 127246

Airborne Radioactive Contamination in SRE High Bay During Reactor Operations; correspondence from R.K. Owen; July 17, 1959; DSA Ref ID: 127247

Atomics International and Energy Technology Engineering Center; correspondence documenting DEEOIC finding that any employee of NAA at AEC where operations were conducted was potentially eligible under the Act; September 7, 2005; DSA Ref ID: 127248

Memo with License R-19 authorizing operation of L-47 reactor at Canoga; H.L. Price; issued August 1957; DSA Ref ID: 127249

Memo with License R-40 authorizing operation of L-77 reactor at Canoga; H.L. Price; issued May 17, 1958; DSA Ref ID: 127250

Confirmation of 1958 Termination of License R-19; E.R. Price; June 30, 1958; DSA Ref ID: 127251

Amendment to R-40 License; H.L. Price; issued June 28, 1960; DSA Ref ID: 127252

Rockwell International Site Visit; correspondence from Ross A. Scarano; January 29, 1996; DSA Ref ID: 127253

Photograph of a reactor at Canoga Park; date not specified; DSA Ref ID: 127254

Photograph of SNAP building complex, with a key specifying building names; date not specified; DSA Ref ID: 127255

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2006 Site Description: Santa Susana Field Laboratory (SSFL) Proposed Corrections to Technical Basis Documents 1 and 2, ORAUT-TKBS-0038-1/ORAUT-TKBS-0038-2; CORE Advocacy for Nuclear & Aerospace Workers; presented to NIOSH on August 9, 2016; DSA Ref ID: 127256

2016 SSFL Site Description Bibliography; CORE Advocacy for Nuclear & Aerospace Workers; presented to NIOSH on August 9, 2016; DSA Ref ID: 127257

EEOICPA Bulletin No. 10-10 on Designation of SEC Class for Area IV of SSFL from January 1, 1959 through December 31, 1964; Department of Labor; May 5, 2010; DSA Ref ID: 127389

Response to the SEC-00235 Consult Call Letter; CORE Advocacy for Nuclear & Aerospace Workers; December 21, 2016; DSA Ref ID: 127639

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ATTACHMENT B: OVERVIEW OF CLAIMANT POPULATION

As part of its SEC review, SC&A reviewed the affected claimant population to assess the availability of monitoring records, relevant statements from the CATI, and characterization of prior dose reconstructions/compensation decisions. Table B-4 provides SC&A's full summary of each claim during the evaluated SEC period. NIOSH 2017 also provided an analysis of the claimant population, summarized in Table 4-1 (recreated here as Table B-1 for convenience).

Table B-1. No. of Area IV of the SSFL Claims Submitted Under the Dose Reconstruction Rule (Table 4-1 of NIOSH 2017)

Description	Totals
Total number of claims submitted for dose reconstruction	316
Total number of claims submitted for energy employees who worked during the period under evaluation (August 1, 1991 through June 30, 1993)	29
Total number of claims submitted for energy employees who started their employment during the period under evaluation	6
Number of dose reconstructions completed for energy employees who worked during the period under evaluation (i.e., number of such claims completed by NIOSH and submitted to the Department of Labor for final approval)	22
Number of claims for which internal dosimetry records were obtained for the time period in the evaluated class definition	5
Number of claims for which external dosimetry records were obtained for the time period in the evaluated class definition	10

At the time of this review, an additional claim had been filed, bringing the total number of affected claims during the evaluation period to 30. It is worth noting that SC&A's review of this claimant population found that 14 individuals had at least some external monitoring records during the evaluation period (compared 10 identified by NIOSH), and six individuals had internal monitoring (compared to five identified by NIOSH). The source of these discrepancies is not known at this time; however, these small differences should not affect the SEC evaluation.

SC&A examined the available CATI reports for information relevant to the ability to reconstruct doses. While SC&A did identify at least one claim that reported an incident that was specifically during the evaluation period and involved demolition work, it is not clear from the description of the incident whether any radiological hazards were involved as opposed to the more general health and safety concerns. SC&A did not find any evidence in the CATI reports of any major changes in radiological conditions or exposure potential specific to the 1991–1993 period that might preclude dose reconstruction feasibility.

Several claimant interviews stated they were monitored externally and/or internally; however, no such records could be identified in the DOE monitoring records. The identified statements may not necessarily be referring to the evaluated period and thus may be referencing earlier monitored periods. However, given the absence of temporal specific statements about monitoring practices and/or specific information about job type, regular duties, work area, and related exposure potential, it is generally a claimant favorable practice to assign unmonitored doses as opposed to ambient doses in many cases.

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This reinforces the importance of understanding the implementation aspects of assigning unmonitored (coworker) internal and external doses to the potentially affected claims at SSFL during the period of interest.

Of the 30 identified claims during the evaluation period, 11 of the 30 would likely require dose reconstructions to be performed using the proposed methodology (either partial dose reconstructions if SEC-00235 is granted or full dose reconstructions if such reconstructions are deemed feasible). Dose reconstructions performed to date include the use of several different methods of reconstructing external and internal dose. The chosen dose reconstruction methods identified are summarized in Table B-2 (for external exposure) and Table B-3 (for internal exposure). It should be noted that, in many cases, the external dose and/or the internal dose was not evaluated for a given claimant. This can be for a variety of reasons, such as:

- The probability of causation was determined to be greater than 50% with only a partial dose reconstruction.
- The claim was compensated via one or more established SECs.
- The claim was pulled by the U.S. Department of Labor subsequent to its transmittal to NIOSH for dose reconstruction due to lack of covered employment or a covered illness.

The observed incidence of external and/or internal dose not being evaluated should not be misconstrued as a deficiency in the dose reconstruction, but rather as an efficiency measure to adjudicate claims quickly or, in some cases, adherence to the statutory requirements of the Energy Employees Occupational Illness Compensation Program Act of 2000 (EEOICPA).

As seen in Tables B-2 and B-3, a significant portion of the dose reconstructions performed used ambient external and internal exposure estimates; SC&A did not identify any dose reconstructions during the evaluation period that used the current coworker model data for SSFL. As noted in the concluding section of this report, it would be beneficial for the board and/or SC&A to review a subset of sample dose reconstructions (whether actual or hypothetical) to assess how the proposed use of coworker intake values would be implemented in practice.

Table B-2. Overview of Methods Used in Prior Dose Reconstructions

External Dose Reconstruction Method	Number of Observed Dose Reconstructions (% of Total)
External dose based on ambient exposures	11 (37%)
External dose based on personal monitoring data	9 (30%)
External dose not evaluated	9 (30%)
External dose based on regulatory standards at the time	1 (3%)

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Table B-3. Overview of Methods Used in Prior Dose Reconstructions

External Dose Reconstruction Method	Number Observed Dose Reconstructions (% of Total)
Internal dose not evaluated	12 (40%)
Environmental intake assignment	8* (27%)
OTIB-0002, <i>Maximum Internal Dose Estimates for Certain DOE Complex Claims</i> (NIOSH 2004)**	5 (17%)
OTIB-0018, <i>Internal Dose Overestimates for Facilities with Air Sampling Programs</i> (NIOSH 2005b)	5 (17%)

* One claim used whole-body count data in conjunction with ambient intakes.

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Table B-4: Overview of Claimant Population during SEC Evaluation Period (August 1, 1991–June 30, 1993)

[Table B-4 on pages 29 to 40 is withheld in its entirety to prevent the disclosure of Privacy Act protected information.]