



SC&A PRESENTATION TO THE METALS AND
CONTROLS WORK GROUP: SUMMARY OF
SC&A'S "REVIEW OF SEC PETITION
EVALUATION REPORT SEC-00236
METALS AND CONTROLS CORPORATION"
MAY 3, 2018

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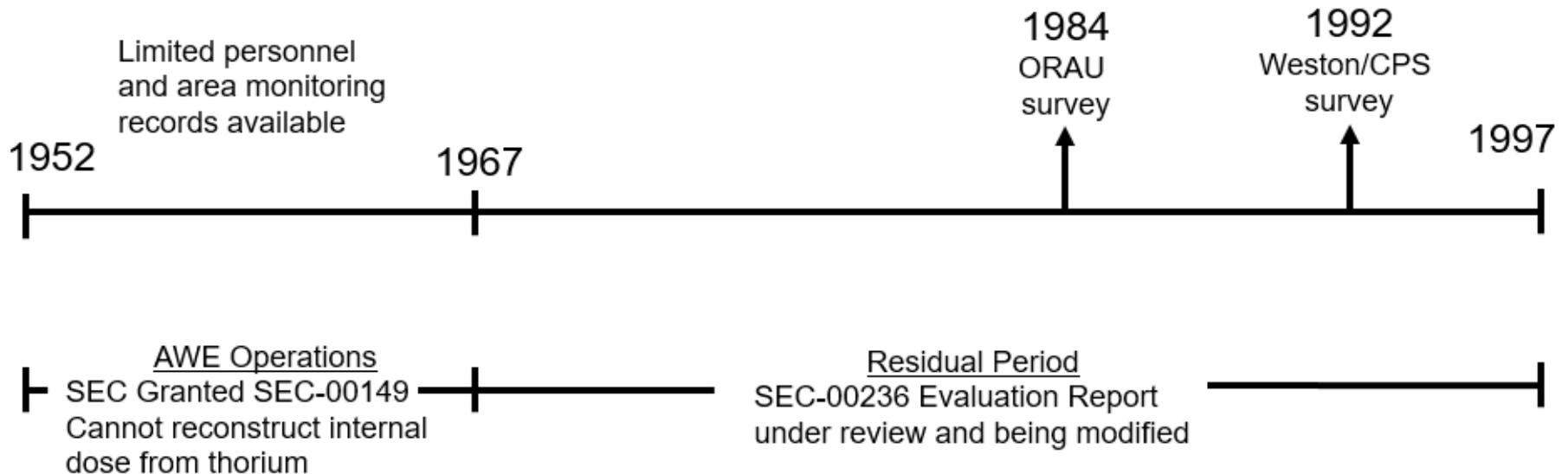
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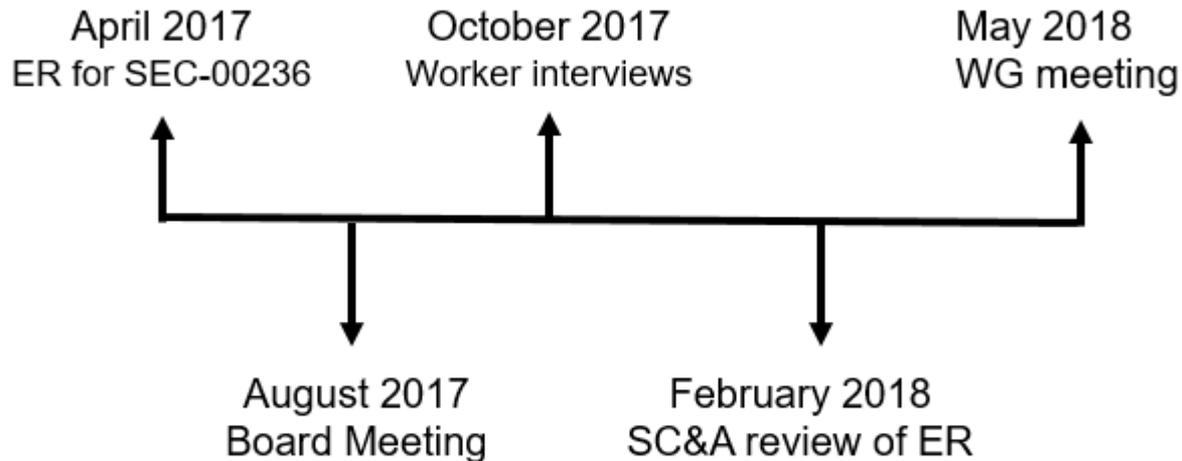
Conclusions

1. SC&A concludes that doses to workers covered by the SEC petition can be reconstructed in a scientifically sound and claimant-favorable manner.
2. SC&A found errors and deficiencies in the scenarios, data, assumptions, and models described in the evaluation report (ER) for reconstructing doses, which will require revisions to the ER.

M&C Timeline of Key Activities and Events



Key SEC-Related Dates 2017/2018



Approach Used in SEC Petition Evaluation Report 00236 for Reconstructing Internal Exposures during the Residual Period

Reconstructing Internal Exposures

1. During the residual period, although all fuel handling and assembly operations were completed, there remained surface contamination of uranium and thorium that could be resuspended and result in internal exposures.
2. In 1966 and 1967 (the last years of Atomic Weapons Employer [AWE] operations), a total of 7,765 swipe samples were collected in Building 10 (the building of primary interest). A subset of swipes was used to characterize the nature and extent of the gross alpha surface contamination.
3. NIOSH used these data in a conservative manner to derive the upper 95th percentile removable surface contamination of gross alpha activity, which was determined to be 54.8 dpm/100 cm².

Reconstructing Internal Exposures

4. Given a surface contamination level of 54.8 dpm/100 cm², a resuspension factor (RF) of 1E-6/m was used to derive an airborne concentration of resuspended alpha emitters of 0.00548 dpm/m³ (i.e., $54.8 \text{ dpm}/100 \text{ cm}^2 \times 1\text{E-}6/\text{m} \times 1\text{E}4 \text{ cm}^2/\text{m}^3 = 5.48\text{E-}3 \text{ dpm}/\text{m}^3$) at the beginning of the residual period in 1968.
5. Considering that the gross alpha activity could be either uranium or thorium or both, NIOSH elected to assume the limiting radionuclide based on the organ of concern.
6. The residual activity declined at a rate of 0.000245/day based on the gross alpha survey data collected in 1982 and assuming that only 10% of the gross alpha activity observed was resuspendable. This is as compared to the default natural attenuation rate of 0.00067/day used in ORAUT-OTIB-0070.

Reconstructing Internal Exposures

7. Assuming an inhalation rate of $1.2 \text{ m}^3/\text{hr}$, the inhalation rate as a function of time is used to convert intake rate to annual doses to the organs of concern using IMBA.
8. The rate of inadvertent ingestion was derived based on the default assumption that $1\text{E}-4$ of the activity per m^2 on surfaces was ingested per hour due to hand-to-mouth activities.

SC&A Issues Associated with Internal Dose Reconstruction Protocols Described in the ER

Issues Associated with the Specific Approach Used in the ER

- **Observation 1:** SC&A suggests that a more appropriate approach to deriving the chronic airborne concentration of uranium and thorium from resuspension during the residual period would be to use the mean value of the swipe data (i.e., 12.3 dpm/100 cm², as opposed to the 95th percentile value of 54.8 dpm/100 cm²) and an RF of 1E-5/m, as opposed to 1-E6/m.
- **Observation 2:** The distinction between production and non-production workers should be better defined in the ER.
- **Observation 3:** NIOSH should consider adopting the approach used in the TBD and ER for Carborundum and General Steel Industries for deriving ingestion doses during the residual period.

Issues Not Explicitly Addressed in the ER

Based on interviews with workers held October 24–October 26, 2017, SC&A found that many unique maintenance and repurposing activities were performed during the residual period by many workers who were not aware of any residual radioactivity. These activities could have resulted in internal exposures that are not addressed in the ER, including:

- ❑ Recurring subsurface maintenance and repurposing activities performed in contaminated soil, conduits, and pipelines beneath Building 10
- ❑ Periodic replacement of air filters potentially containing uranium and thorium
- ❑ Outdoor activities in the vicinity of the low-level radioactive waste burial grounds
- ❑ Ongoing treatment of wastewater that might have contained residues of uranium and thorium

Approach Used in Petition Evaluation Report SEC-00236 for Reconstructing External Exposures during the Residual Period

Reconstructing External Exposures

The ER uses the upper 95th percentile value of the external dosimetry data collected in the last year of AWE operations to serve as a surrogate to bound the external exposures experienced by workers during the residual period.

Issues Associated with the Specific Approach Used in the ER

- **Finding 2:** NIOSH incorrectly transcribed some of the Landauer film badge dosimetry reports and incorrectly calculated annual 95th percentile external penetrating doses to workers in the residual period.
- **Finding 3:** NIOSH incorrectly calculated annual 95th percentile beta skin doses to workers in the residual period.
- **Observation 4:** Exposures experienced by High Flux Isotope Reactor (HFIR) workers cannot be used “as supporting evidence to validate the bounding method used in Section 7 of this report” as stated on page 24 of the ER.
- **Observation 5:** SC&A is concerned that it may be inappropriate to use external dosimetry data collected during the last year of AWE operations as the basis for bounding the external doses during the residual period.

Issues Not Explicitly Addressed in the ER

Finding 1: Based on interviews with workers held October 24–October 26, 2017, SC&A found that many unique maintenance and repurposing activities were performed during the residual period by many workers who were not aware of any residual radioactivity. These activities could have resulted in external exposures that are not addressed in the ER, including:

1. Recurring subsurface maintenance and repurposing activities in contaminated soil, conduits, and pipelines beneath Building 10
2. Outdoor activities in the vicinity of the low-level radioactive waste burial grounds

Examples of How Internal Doses Associated with Maintenance and Repurposing Activities Could Be Addressed in the ER

Assumptions for Modeling Subsurface Activities in Building 10

1. Assume workers spent 1 month per year involved in subsurface maintenance and refurbishing activities (based on interviews).
2. As a non-union shop, any person on site could have been assigned to perform subsurface activities in Building 10 (based on interviews).
3. Activities included boring out clogged drain lines, excavating to a depth of 8 feet to repair, replace, and install conduits, pipelines, and new equipment (based on interviews).
4. Radionuclide concentration distributions in the pipelines and soil were similar to those observed during pre-D&D characterization activities performed in the 1990s (based on interviews).

Assumptions for Modeling Subsurface Activities in Building 10

5. Create a distribution of radionuclide concentration in pipes in Building 10, assuming that the sample activity was representative of the full pipe length. Total uranium concentrations in the pipes in Building 10 ranged from 9.75 pCi/g to 53,224.7 pCi/g. SC&A found the upper 95th percentile of total uranium in the pipes to be 5,878.1 pCi/g.
6. Airborne radionuclide concentrations assumed to be 200 $\mu\text{g}/\text{m}^3$. Higher values were possible but unlikely because the subsurface soil was chronically moist.

Assumptions for Modeling Subsurface Activities in Building 10

7. Assuming an inhalation rate of 2.5 m³/hr for 184 hours per year, the uranium intake rate would be:

$$5,878.1 \text{ pCi/g} \times 2 \times 10^{-4} \text{ g/m}^3 \times 2.5 \text{ m}^3/\text{h} \times 184 \text{ h/yr} \times 0.037 \text{ Bq/pCi} \approx 20 \text{ Bq/yr}$$

8. This intake is associated with an effective dose commitment of:

$$20 \text{ Bq/yr} \times 9.4\text{E-}6 \text{ Sv/Bq} \times 1\text{E}5 \text{ mrem/Sv} = 18 \text{ mrem/yr}$$

HVAC Maintenance

1. Specific activity of uranium dust (pCi/mg) on filters the same as in the air due to resuspension activities during the residual period
$$12.3 \text{ dpm}/100 \text{ cm}^2 \times 1\text{E}4 \text{ cm}^2/\text{m}^2 \times 1\text{E}-5/\text{m} \div 200 \text{ }\mu\text{g}/\text{m}^3 = 6.15\text{E}-5 \text{ dpm}/\mu\text{g}$$
2. Using a dust loading of $100 \text{ mg}/\text{m}^3$ and 8 hours to perform a filter replacement activity, the intake of uranium would be:
$$6.15\text{E}-5 \text{ dpm}/\mu\text{g} \times 1,000 \text{ }\mu\text{g}/\text{mg} \times 100 \text{ mg}/\text{m}^3 \times 1.2 \text{ m}^3/\text{hr} = 7.4 \text{ dpm}/\text{hr}.$$
3. This intake rate is associated with doses on the order of 1 mrem/yr (based on DCFs in FGR No.13).

Questions?