

Carborundum Work Group

SEC Petition 00223 Recommendations

ABRWH Meeting
Santa Fe, NM
November 30, 2016

Work Group Members

- Genevieve S. Roessler, Chair
- Bradley P. Clawson
- R. William Field
- John W. Poston, Sr.

Carborundum Company

- Located in Niagara Falls, New York
- Atomic Weapons Employer: June–Sept. 1943, 1959–1967
- Residual Radiation: 1943–1958, 1968–1992

EEOICPA Facility Listing

- **June–Sept. 1943:** “In June of 1943, the Carborundum Company at its Global Plant and Buffalo Avenue locations performed experimental grinding of uranium metal using a centerless grinder. Uranium slugs were received in June and return shipped in September 1943.”

EEOICPA Facility Listing

- **1959 through 1967:** Carborundum manufactured uranium and plutonium carbide pellets for an Atomic Energy Commission (AEC) research program.
- Carborundum also performed work during the 1950s that is not covered under EEOICPA, including the fabrication of nuclear fuel elements for commercial purposes.

Proposed and Evaluated SEC Class

- Petitioner-requested class definition:

“All employees who worked in any area of the Carborundum Company facility on Buffalo Avenue, Niagara Falls, NY, from January 1, 1943 through December 31, 1976.”
- Note: Because there are no identified dose reconstruction infeasibilities for the site, NIOSH limited its evaluation to the petitioner’s class period from 1943 through 1976, rather than to 1992, the end of the residual period.

Feasibility Summary

June–Sept. 1943 and 1959–1967 (operational periods)
1943–1958 and 1968–1976 (residual periods)

Source of Exposure	Feasible	Not Feasible
Internal	Yes	
External	Yes	

SEC Petition 00223

- Received November 19, 2014
- Qualified for evaluation February 2, 2015
- Revised Evaluation Report (ER) issued by NIOSH on June 3, 2015
- SC&A review of NIOSH Evaluation Report issued January 27, 2016
- NIOSH responded to SC&A Review: June 8 & 13, 2016
- SC&A Issue Resolution Matrix: June 5, 2016
- Work group meeting: August 18, 2016

SC&A Findings on Carborundum SEC Petition 00223 and the NIOSH SEC Petition Evaluation Report

1. NIOSH Failed to Prescribe a Methodology to Assess Doses to Skin of Hands and Forearms from X-Ray Diffraction (XRD) Apparatus (Closed)
2. NIOSH Failed to Address Thorium as a Possible Radiation Source (Site Profile Issue)
3. NIOSH Failed to Account for the Use of ^{90}Sr in Thickness Gauges at Carborundum (Closed)
4. NIOSH Failed to Assign Doses from Medical X Rays During the First Operational Period (Closed)
5. “Example DR” Failed to Assign Doses from Medical X Rays During the Second Operational Period (Closed)
6. Inappropriate and Incorrect Use of FGR 12 (Closed)
7. Dose Calculations in “Example DR” Are Not Reproducible (Site Profile Issue)

Finding 1. NIOSH Failed to Prescribe a Methodology to Assess Doses to Skin of Hands and Forearms from X-Ray Diffraction (XRD) Apparatus

SC&A Finding: The ER does not present a valid description of how NIOSH intends to assess doses to operators of XRD equipment. The methodology is based on exposures to XRD equipment at Sandia National Laboratory – Livermore. However, the same equipment and technical factor information is not available for Carborundum, so SC&A cannot determine how NIOSH intends to bound the XRD doses.

Resolution: NIOSH acquired additional information and reassessed the dose to the XRD operators. It was concluded that the dose to the skin of hands and forearms will be assigned by using the exposure in the uranium work areas because it is bounding. SC&A agreed. The work group concluded that this finding is closed.

Finding 2. NIOSH Failed to Address Thorium as a Possible Radiation Source

SC&A Finding: The ER does not address exposures to thorium, despite a former worker's having reported producing fuel pellets made from ThO_2 and ThC in the mid-1950s. The worker said the thorium was a powder and that spills were likely. Carborundum had two facilities for handling radioactive materials: one for uranium and thorium, another for plutonium. Since there is no record of a cleanup prior to the second operational period, workers exposed to intakes of uranium during the 1950s could also have been exposed to residual thorium contamination. Such exposures should be addressed in evaluating doses during the second operational period.

Resolution: NIOSH and SC&A agreed that the thorium work was most likely not weapons related, so the operational period need not be extended to cover these activities. NIOSH observed that any residual airborne thorium activity would have been measured in the air samples of dust from the joint uranium/thorium facility. SC&A agreed, but noted that the dose conversion factors (DCFs) for ^{232}Th are significantly higher than those for ^{234}U . Consequently, the internal doses from uranium should reflect the possibility that some of the airborne activity was ^{232}Th . NIOSH responded that the issue requires further study. However, NIOSH asserted, and SC&A agreed, that this is a site profile, not an SEC issue. The work group agreed that this is a site profile issue.

Finding 3: NIOSH Failed to Account for the Use of ^{90}Sr in Thickness Gauges at Carborundum

SC&A Finding: The 1952 acquisition of five thickness gauges by Carborundum for quality control in the manufacture of sandpaper was reported in the *New York Times*. However, NIOSH was unaware of this information. AEC licensing documents related to the supplier of these gauges indicate that such devices can contain as much as 2 Ci of ^{90}Sr . Strontium-90 and its short-lived ($t_{1/2} = 64 \text{ h}$) ^{90}Y progeny, both almost pure β emitters, would have been in secular equilibrium. This would have created a strong source of bremsstrahlung x rays, which could have contributed to doses from penetrating radiation and posed a radiation hazard to the skin of a worker. NIOSH needs to obtain more information on the use of such sources at Carborundum.

Resolution: NIOSH did further research and determined that the Carborundum Division that used these gauges was located in Wheatfield, NY—a town near Niagara Falls. SC&A confirmed that information. Since this was not a covered facility, the issue is moot. The work group agreed that the finding is closed.

Finding 4: NIOSH Failed to Assign Doses from Medical X Rays During the First Operational Period

SC&A Finding: NIOSH did not to assign a medical x-ray dose during the first operational period on the basis of internal correspondence at DuPont, a wartime government contractor, that said that the grinding of uranium at Carborundum did not require medical supervision. This is irrelevant to routine physical examinations, which might have included medical x rays. According to a DCAS guidance document, doses from screening x rays are to be assigned if they were part of a required annual physical examination. The ER is inconsistent in prescribing the assignment of medical x rays during the second operational period but not the first. Furthermore, one of the petitioners stated that another worker had physical exams at the site, raising the possibility that medical x rays were performed on site.

Resolution: NIOSH agreed that dose from a single x-ray examination should be assigned in dose reconstructions for claimants with employment in 1943. SC&A agreed that the issue was therefore resolved. The work group agreed that the finding is closed.

Finding 5: “Example DR” Failed to Assign Doses from Medical X Rays During the Second Operational Period

SC&A Finding: According to the ER, “NIOSH will assume that pre-employment, annual, and termination PA radiographic chest x-ray screenings were performed for workers during the second operational period.” However, “Example DR,” a document in support of the ER that is posted on the DCAS restricted website, explicitly states that no medical x-ray doses were assessed to the hypothetical worker who was employed during both operational periods. This inconsistency needs to be resolved.

Resolution: NIOSH agreed to include medical x rays in dose reconstructions (DRs) for this period. SC&A concurred with this resolution. The work group agreed that the finding is closed.

Finding 6: Inappropriate and Incorrect Use of Federal Guidance Report No. 12

SC&A Finding: The ER used several scenarios described in Battelle-TBD-6000 to estimate internal and external doses from intakes of uranium dust and from exposure to uranium metal. However, NIOSH used Federal Guidance Report No. 12 (FGR 12) to calculate doses from submersion in a cloud of radioactive dust and from exposure to contaminated surfaces instead of using the values listed in TBD-6000. The photon dose coefficient for a surface contaminated with uranium used by NIOSH is only ~29% of the value in TBD-6000. This procedure is inconsistent with the use of TBD-6000 for other pathways and for DRs at other work sites. Furthermore, it is not scientifically correct, since NIOSH does not have a prescribed method of deriving organ dose equivalents from effective dose equivalents, the dosimetric quantities listed in FGR 12. However, in the case of Carborundum, the external doses from penetrating radiation are a few mrem/y, so these discrepancies are not highly significant. Doses to the skin from nonpenetrating radiation from uranium-contaminated surfaces are on the order of a few hundred mrem during the first few years of the first residual period. Consequently, the value derived from FGR 12 skin doses, which is only ~72.5% of the value in TBD-6000, could affect the outcome of a DR.

Resolution: NIOSH agreed to use TBD-6000 values for DRs. The work group agreed that the finding is closed.

Finding 7: Dose Calculations in “Example DR” Are Not Reproducible

SC&A Finding: SC&A audited doses to four organs presented in “Example DR.” Differences were found significant in both internal and external doses. The ABRWH procedures for reviews of NIOSH SEC petition ERs recommend that NIOSH include in its evaluation a demonstration that it is feasible to reconstruct individual doses for the cohort, including sample DRs. Until the results of sample DRs can be verified, it cannot be concluded that NIOSH can reconstruct doses to Carborundum workers.

Resolution: NIOSH responded that the doses in the example DR were not precise best estimates. The example DR employed some efficiency measures, some of which resulted in higher doses. The example DR used incorrect DCFs for external exposure and used solubility Type *F* for intakes from the 1943 uranium metal grinding work, while only Types *M* and *S* are applicable. NIOSH stated that it can provide an updated example dose calculation showing details of the annual dose calculations, but noted that SC&A also had comments on the interpretation of data to estimate both internal and external doses. NIOSH believes that those comments should be resolved before it provides an updated example calculation. Meeting participants agreed that these are site profile and not SEC issues. The work group agreed that this is a site profile issue.

Use of Surrogate Data from TBD-6000

- The DCAS assessment of doses relies on surrogate data in TBD-6000 to estimate external and internal doses for the 1943 experimental work with uranium metal.
- It also relies on surrogate data for the reconstruction of external doses from uranium work in 1959 through 1967.
- External doses from the mixed uranium/plutonium compounds do not rely on surrogate data, nor do estimates of intakes for 1959 through 1967.

SC&A Findings on Use of Surrogate Data from TBD-6000

• Intakes of Uranium Aerosols: First Operational Period

- Airborne activity concentrations: assumed arithmetic mean BZ = 20,192 vs. 13,000 dpm/m³ (Harris and Kingsley 1959)
- Satisfy ABRWH criteria?
 - Hierarchy of data ✓
 - No site-specific airborne dust measurements for uranium machining operations at Carborundum
 - Exclusivity constraint ✓
 - Site and process similarities ✓
 - Centerless grinding at both sites
 - No ventilation at either site
 - Temporal considerations: different time frames, but
 - Centerless grinding at both sites ✓
 - No ventilation at either site ✓
 - Plausibility ✓
 - Values comparable within variability and uncertainty
- Conclusion: surrogate data on uranium intakes satisfy all five ABRWH criteria

• External Exposure to Uranium Metal

- Actual source terms
 - 1st operational period: 13.6 kg of natural uranium metal slugs on site
 - 2nd operational period:
 - Carborundum requested 4.5 kg of uranium shot
 - Produced batches of 30 g to 2.7 kg
- NIOSH used MCNP model of 477-kg uranium ingot
- Satisfy ABRWH criteria?
 - Hierarchy of data ✓
 - Exclusivity constraint: other source terms available **X**
 - Site and process similarities: major differences in source terms **X**
 - Temporal considerations: computer model not time dependent **N/A**
 - Plausibility: major differences in actual and modeled source terms **X**
- Suggested resolution of discrepancies
 - 1st period: Use modeled dose rate from 7 slugs (total mass = 14 kg)
 - 2nd period: Use modeled dose rate from uranium plate (mass = 3.1 kg)
- Not an SEC issue: other source terms available in TBD-6000

Work Group Conclusions

- The work group concluded that, with appropriate adjustments, NIOSH can reconstruct doses for the proposed SEC class.
- The work group moves that SEC Petition 00223 be denied.



- Questions?