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ADVISORY BOARD ON

RADIATION AND WORKER HEALTH

National Institute for Occupational Safety and Health

PARTIAL REVIEW OF THE REVISED NIOSH PETITION EVALUATION REPORT FOR THE ELECTRO-METALLURGICAL CORPORATION, PETITION SEC-00136

Contract No. 200-2009-28555
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(Addendum to SCA-TR-SEC2010-0010)

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S. COHEN & ASSOCIATES: ***Technical Support for the Advisory Board on Radiation & Worker Health Review of NIOSH Dose Reconstruction Program***	Document No. SCA-TR-SEC2012-0010 (Addendum to SCA-TR-SEC2010-0010) Effective Date: Draft – February 21, 2012 Revision No. 0 – Draft
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Record of Revisions

Revision Number	Effective Date	Description of Revision
0 (Draft)	02/21/2012	Initial issue – Addendum to SCA-TR-SEC2010-0010. This addendum is a partial review of a revised SEC Petition Evaluation Report and NIOSH white paper.

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1.0 INTRODUCTION

On February 7, 2012, in anticipation of the February 14, 2012, meeting of the Atomic Weapons Employer (AWE) Work Group, the National Institute for Occupational Safety and Health (NIOSH) issued a revised evaluation report (ER) on Petition SEC-00136 relating to workers at the Electro-Metallurgical Company (Electro-Met). In that ER, NIOSH recommended that a Special Exposure Cohort (SEC) be granted for the early years, due to a lack of adequate air sampling data, and that the entire Electro-Met site should be covered by the SEC. At the request of the Work Group, SC&A did its best to review the February 7, 2012, ER and presented a verbal summary of its preliminary findings at the Work Group Meeting. SC&A expressed concern that there appears to be evidence that internal doses in the early years could, in fact, be reconstructed due to the availability of a considerable amount of bioassay data in the early years, which compared favorably with the bioassay data in the later years. SC&A also expressed concern that should an SEC be granted, it appears that the scope of the SEC could be limited to workers in the Area Plant and not extend to the entire Electro-Met facility. During the meeting, in response to SC&A's concerns, NIOSH referred to a May 16, 2011, report (NIOSH 2011) that was described as providing information arguing that it was difficult to limit the scope of the SEC to only the Area Plant. The May 16, 2011, NIOSH report did not address the issue of whether internal doses prior to December 1947 could be bounded.

SC&A was not aware of the existence of the May 16, 2011, report, and as a result, SC&A was requested to review the report and complete its review of the February 7, 2012, revised ER. We were requested to provide the Work Group with a written report on these matters as soon as possible, so that these matters could be thoroughly discussed at the upcoming Advisory Board meeting scheduled for March 28–29, 2012, in Oakland, California. This report is provided in response to this request. We note that, given the limited time available, SC&A did not conduct a complete review of the ER dated February 7, 2012. However, SC&A did re-examine its findings prepared in response to the original NIOSH ER dated July 2009 and compared these findings with the new ER. SC&A also reviewed the May 16, 2011, NIOSH report. SC&A's original findings were presented in SC&A 2010, which was updated[1] to Revision 1 in SC&A 2011, dated May 2011. Detailed comments on each of the SC&A findings based on currently available information are included in Attachment A.

Based on the limited review, SC&A continues to believe that there are two over-arching issues that require further examination:

- The ability to identify and differentiate employees who worked in the Area Plant where Atomic Energy Commission (AEC)/Manhattan Engineer District (MED) activities were conducted as compared to employees who worked in the commercial operations that constituted the majority of the activities at Electro-Met

- The ability to calculate bounding doses for the "early operations" from August 13, 1942, through December 31, 1947

[1] The only difference between Revision 0 and Revision 1 was the inclusion of additional interviews in the later document.

Each of these two issues is discussed below.

2.0 IDENTIFICATION OF AREA PLANT EMPLOYEES

This issue was originally raised as Finding 1 by SC&A (SC&A 2010, SC&A 2011). The Area Plant, where AWE activities were conducted, was built by Electro-Met under MED contract specifically to convert green salt to uranium metal and to remelt the uranium and cast it into ingots for fabrication elsewhere. The Area Plant was a fenced and guarded limited-access facility erected in a corner of the Electro-Met site separate from the commercial activities. The Area Plant had a total of about 67 employees, with a staffing breakdown as follows [Site Research Database (SRDB): 8912]:

Operators: 28
- Head Remelt Operators – [redacted]
- Furnace Operators – [redacted]
- Head Reaction Operators – [redacted]
- Bomb Toppers – [redacted]
- Green Room Operators – [redacted]
- Bomb Unloading and Chipping – [redacted]
- Repairman Furnace Parts – [redacted]
- Sawman – [redacted]
- Handyman – [redacted]

Supervisors: [redacted]
- General Foreman – [redacted]
- Foreman – [redacted]
- Shift Foreman – [redacted]

Other Staff: [redacted]
- Repairman – [redacted]
- Storeroom Attendant – [redacted]
- Store Keeper – [redacted]

Janitors: [redacted]
Guards: [redacted]
Office Personnel: 11
Laboratory: [redacted]
- Chemists – [redacted]
- Technician – [redacted]
- Lab Handyman – [redacted]

In response to the SC&A finding, NIOSH contacted the Department of Labor (DOL), who opined "that they do not feel they can place workers in specific buildings" (NIOSH 2011). NIOSH accepted the DOL opinion, as reflected in the revised ER dated February 7, 2012. However, it is not apparent that this issue has been investigated as thoroughly as it should be. SC&A believes that a considerable amount of documentation exists in the SRDB that should be examined before NIOSH can reach a definitive conclusion that workers in the Area Plant cannot be defined as a distinct group from workers in the commercial facilities.

For example, SRDB 8912 (Appendix C), covering the period November 1948 through January 1949, lists 47 workers by name, job description, start date for work in Area Plant, date transferred from Area Plant or laid off, and date transferred to Area Plant, rehired, or recalled. The list includes guards, janitors, and people involved in production operations.

SRDB 8887 lists results of 78 bioassay samples by worker name (with some workers sampled more than once) from July 26 through September 8, 1944. The same document lists beta doses for a named remelt furnace operator, a billet packer, a green salt mixer, and a remelt operator.

SRDB 11547 lists the results of about 1,700 film badge measurements (with some workers sampled more than once) by name and job description taken in 1948 and 1949. SC&A has not had sufficient time to determine how many individual workers are included in this group.

SRDB 35738 (1949) provides results for the 43 urinalysis results for named workers with job descriptions.

This list is not exhaustive, but is indicative of the large amount of information that could be analyzed to more rigorously address this concern.

Since the Area Plant was a guarded, fenced, secured area, access from the main plant was limited to a few service personnel on an occasional basis. Information in Blatz 1949 (pdf pg. 32) indicates that about 30 workers provided intermittent services to the Area Plant. Intermittent services ranged from electricians, who worked about 2 days per month, to pipe fitters, who worked 2 or 3 days per year.

3.0 ABILITY TO CALCULATE BOUNDING DOSES FOR THE "EARLY OPERATIONS"

In the revised ER (February 2012), NIOSH documented that it was possible, based on extensive air monitoring, to bound internal doses during the period of "later operations" from January 1, 1948, through June 30, 1953. NIOSH concluded that a similar bounding calculation was not possible for the early period stating:

> *NIOSH has determined that neither the bioassay nor the early limited air sampling data are sufficient to bound internal dose at Electro Metallurgical for the August 13, 1942 through December 31, 1947 portion of the class under evaluation.*

SC&A has alternative logic to suggest regarding bounding internal doses for the early period.

SC&A accepts the NIOSH conclusion that internal doses can be bounded for later operations. However, as discussed in SC&A 2010 and 2011, NIOSH has obtained a total of 111 urinalysis results from 48 different employees, collected during 1944 and 1949, with approximately half of the results being recorded as zero. The 1944 results comprise 60% of the measurements. These results are non-specific as to job category, but at least in some cases, job descriptions can be assigned based on other sources. In SC&A 2010, SC&A compared the bioassay results from the

early and later operations and demonstrated that the results were not statistically different. If results for bioassay for the two periods were not statistically different and doses can be bounded for later operations, then the logic suggests that doses can be bounded for the early period, as well, using the air sampling results from later operations. This argument is buttressed by the fact that bioassays during the period of later operations were taken during a standby period and thus would represent lower excretion levels. In addition, the limited air sampling data available from the early operations do not show higher results than from the later operations (see NIOSH 2011).

4.0 REFERENCES

Blatz 1949. *Proper Film Badge Placement*, correspondence to Mr. Winterhaler [Electro-Met]; Hanson Blatz [Chief, Radiation Section]; June 20, 1949; SRDB Ref ID: 8897, p. 28.

Dosimetry Results, Aug. 1944, Dosimetry Results for Electro-Metallurgical Employees from August 26, 1944 through August 29, 1944; SRDB Ref ID: 8887, pp. 9–10.

Dosimetry Results, March 1948–Jan. 1949, *Dosimetry Results for Electro-Metallurgical Employees from March 15, 1948 through January 24, 1949*; SRDB Ref ID: 11547.

Dust Sample Results, Nov. 1948–Jan. 1949. *Dust Sample Results from November 3, 1948 through January 12, 1949*, includes Job Analysis Sheets; SRDB Ref ID: 8912.

NIOSH 2009. *SEC Petition Evaluation Report, Petition SEC-00136 – Electro Metallurgical Corporation*. National Institute for Occupational Safety and Health (NIOSH), Cincinnati, Ohio. July 21, 2009.

NIOSH 2011. *NIOSH Update on Electro Metallurgical, May 16, 2011 Working Group Meeting.* Prepared by Sam Glover (NIOSH). National Institute for Occupational Safety and Health (NIOSH), Cincinnati, Ohio.

SC&A 2010. *Review Of NIOSH Petition Evaluation Report For Petition Sec-00136 Dated July 21, 2009, Electro-Metallurgical Corporation*. Contract No. 200-2009-28555. SCA-TR-SEC2010-0010, Rev. 0. SC&A, Inc., Vienna, Virginia. April 12, 2010.

SC&A 2011. *Review Of NIOSH Petition Evaluation Report For Petition Sec-00136 Dated July 21, 2009, Electro-Metallurgical Corporation*. Contract No. 200-2009-28555. SCA-TR-SEC2010-0010, Rev. 1. SC&A, Inc., Vienna, Virginia. May 5, 2011.

Urinalysis Results, July 1944–Sept. 1944. Urinalysis Results for Electro-Metallurgical Employees from July 10, 1944 through September 8, 1944; SRDB Ref ID: 8887, pp. 3–7.

Urinalysis Results, Oct. 1949–Dec. 1949. *Urinalysis Results for Electro-Metallurgical Employees from October 11, 1949 through December 2, 1949*; SRDB Ref ID: 35738, pp. 78–83.

ATTACHMENT A: UPDATED ELECTRO-MET ISSUES MATRIX FOR SEC-00136

(Reference SC&A 2011 for detailed discussion of these findings.)

Finding 1:	***NIOSH should discuss the issue of access controls explicitly in the Evaluation Report to justify the basis for including all workers at Electro-Met, rather than just those who worked in the Area Plant.***
SC&A Comment – 2/16/12: In their May 16, 2011, report (NIOSH 2011), NIOSH reported that DOL had indicated they could not place workers in individual buildings. It is not clear to what extent DOL reviewed relevant information in the SRDB. The staff at the Area Plant was small – about 67 people. Of these, only 28 (or 42%) were operators with the highest expected exposures. Guards, office personnel, and laboratory staff combined made up about the same percentage of the total staff. The exposures of this group should be relatively low, as compared to the operators. Workers' names and periods worked are available for many workers. It would seem that with a few days effort, DOL should be able to develop a comprehensive list of those who worked in the Area Plant on a regular basis. It is probably not possible to identify support personnel who occasionally entered the Area Plant; however, their exposures should be minimal. As noted in SC&A 2011, this group would include electricians who worked about 2 days per month and pipefitters who worked 2 or 3 days per year.	
Status:	
Finding 2:	***Research and Development (R&D) work with uranium ores was not mentioned in NIOSH 2009. While the information reviewed here does not indicate that significant quantities of uranium-bearing materials other than green salt were used by Electro-Met, NIOSH should address the scope of work that might actually have been done at Electro-Met (and in which facilities).***
SC&A Comment – 2/15/12: According to the revised ER*:* *Electro Met was also contracted to conduct research into ore processing (ore beneficiation program) as part of its initial contract. Minimal documentation is available, but from all indications this program was conducted for a short time beginning in April 1945 and concluding in August 1945 using small quantities of low-grade African ore (MED, 1945).* Very little specific information is available regarding the facilities and activities associated with these materials. However, based on the detailed material transfer forms and summary research reports, it is believed that only very small quantities were used at Electro Met during the period of performance. No specific information is available to NIOSH regarding operational exposure levels or clean-up. By employing a wet process involving chemical leaching, the exposure potential from these processes was low (Ore Beneficiation, 1945a; Ore Beneficiation, 1945b). NIOSH has not located any documentation indicating that there were other sources of radiation at Electro Met during the later part of period under evaluation (i.e., January 1, 1948 and June 30, 1953).* SC&A is satisfied with this explanation and concludes that the source term is adequately represented by processing green salt into uranium ingots. ** This reference could not be located on the reference list of the revised Evaluation Report.*	

Finding 3:	***NIOSH should review the start and end dates for the operational period to insure that all relevant documentation has been evaluated.***
SC&A Comment – 2/16/12: The start date was modified to August 1942 to reflect the start date of the MED contract, and the end date was fixed at June 30, 1953, the end date of the contract. This resolution is satisfactory, since this was a DOE facility where evaluation of residual contamination is not required. However, we note that the Electro-Met TBD (DCAS-TKBS-0007) states in Section 5.0 that no external doses will be calculated prior to April 1943. The ER and the TBD should be reconciled.	

Finding 4:	***The NIOSH assumption that the uranium metal reduction process and associated industrial production and industrial hygiene conditions were unchanged from 1943 to 1949 may not be correct. The changes that appear to have been made in 1947 would need to be investigated before this assumption can be used to implicitly back-extrapolate post-October 1947 data to the 1943–1946 period. (See also Finding 17.)***
SC&A Comment – 2/16/12: NIOSH has concluded in the revised ER that internal doses cannot be constructed prior to January 1948. Originally, NIOSH had proposed to back extrapolate to early operations where air monitoring data were limited by assuming that exposures during early operations were bounded by the 95th percentile obtained from post-1947 operations. SC&A believes that another approach can be taken to bound exposures prior to January 1948.	

Finding 5:	***NIOSH should clarify the text to remove what appears to be an inconsistency regarding the availability of internal exposure data during standby periods.***
SC&A Comment – 2/16/12: NIOSH modified text in Revised ER to indicate that "little" information was available. This resolution is satisfactory.	

Finding 6:	***NIOSH should take into account the difference between fixed head samplers, process samplers, and general area samplers and actual intake, and the uncertainties this creates for estimating bounding intakes.***
SC&A Comment – 2/16/12: This finding relates to how dose reconstructions are performed. It is not related to an SEC determination as to whether or not dose reconstructions can be performed.	

Finding 7:	***NIOSH needs to establish that job titles corresponded to the jobs actually done for the period of employment. NIOSH's job title consolidation scheme would not produce bounding estimates for all workers in the proposed class in the absence of such an analysis.***
SC&A Comment – 2/16/12: This is a dose reconstruction issue, not an SEC issue.	

Finding 8:	***We note that the graphical method used by NIOSH in Appendix C of TBD-6001 (Battelle 2007) to calculate the inhalation intakes for operators results in the lowest estimate of the 95th percentile among possible alternative calculational approaches. Arguably, in this case, the graphical method is not claimant favorable.***
SC&A Comment – 2/16/12: This is a dose reconstruction issue, not an SEC issue.	

Finding 9:	***The site-specific values for inhalation intakes for Electro-Met from Appendix C are significantly more claimant favorable than the generic intakes proposed in Table 8.29 of TBD-6001 (Battelle 2006), which raises questions as to whether TBD-6001 is appropriately conservative for its intended purpose. This is noted for the record, but it is not an Electro-Met finding.***
SC&A Comment: As noted, this is not an Electro-Met finding.	

Finding 10:	***Given the high frequency of blowouts at other facilities using the same equipment, NIOSH should re-examine the possibility that blowouts occurred at Electro-Met.***
SC&A Comment – 2/16/12: Additional reviews by NIOSH and SC&A have not uncovered evidence of blowouts.	

Finding 11:	***NIOSH should address residual exposures in the SEC-00136 Petition Evaluation Report.***
SC&A Comment – 2/16/12: SC&A was advised that, since the Area Plant was an AEC facility, evaluation of exposures during the residual period is not required.	

Finding 12:	***NIOSH should provide more detailed information to support their position stated in Section 7.2.3 of NIOSH 2009 that, "Considering the intake scenarios established in Battelle-TBD-6001 Appendix C, the calculated urinary excretion of uranium from these intakes was compared to actual data and was found to be bounding in each case." Independent calculations by SC&A do not support this conclusion as to the bounding nature of the intakes in Appendix C, Table C.2.***
SC&A Comment – 2/16/12: The Electro-Met TBD (DCAS-TKBS-0007) and the Revised ER eliminated any discussion about comparing actual and calculated excretion rates.	

Finding 13:	***The approach taken to bound external photon exposure values in Table C.4 of TBD-6001, Appendix C, appears to be reasonable for the operating period beginning June 1948. However, NIOSH must demonstrate that this approach is bounding for the earlier operating period, when essentially no film badge data are available. In addition, NIOSH should explicitly define in Appendix C how to proceed with dose reconstruction when the job description is uncertain or unknown.***
SC&A Comment – 2/16/12: NIOSH concluded in the revised ER (see Table 7-1) that it is possible to reconstruct external doses during the early operations. As stated in Section 7.3.4.1 of the revised ER, "NIOSH has obtained sufficient personnel dosimetry records to reconstruct occupational photon and beta dose for the covered period." NIOSH does not explain why, although the significant dosimetry is only available beginning in June 1948, external doses can be constructed prior to that date, while a comparable argument cannot be made with regard to internal dose.	

Finding 14:	***NIOSH should state in the Petition Evaluation Report for SEC-00136 and in Appendix C of TBD-6001 that estimates of occupational medical exposure should be based on photofluorography, unless there is evidence that this technique was not used at AWE sites and only at DOE sites. This is a dose reconstruction issue, not an SEC issue.***
SC&A Comment – 2/16/12: This issue has been discussed by NIOSH and SC&A at various meetings and a consensus was reached that photofluorography was practiced only at larger AEC facilities.	

Finding 15:	***SC&A independently developed a database for annual beta and found that the 95th percentile value was in excellent agreement with that developed by NIOSH for Table C.5. However, 50th and 5th percentiles were somewhat higher, based on the SC&A analysis. Consequently, it is possible that the dose to Supervisor/Laborers could be understated by about 40% and the dose to Others by about 80%.***
SC&A Comment – 2/16/12: The same data were included by NIOSH in DCAS-TKBS-0007, so the differences have not been resolved. While this is a dose reconstruction rather than an SEC issue, some mechanism is needed to insure that these concerns are investigated before TKBS-0007 is used for dose reconstruction. It is not clear that such a mechanism exists since TKBS-0007 has received no independent review.	
Finding 16:	***Use of 95th percentile exposures, as proposed in Tables C.4 and C.5 of TBD-6001, Appendix C, adequately accounts for enhanced exposures from high surface concentrations of Th-234 and Pa-234m produced during melting and casting of uranium ingots, except for exposures to the hands and arms. Table C.5 is specific to "Other Skin." Guidance should be added to Appendix C to specifically address exposure to the hands and arms.***
SC&A Comment – 2/16/12: The TBD did not make any distinction between doses to the hands and arms as compared to other skin areas. However, there is one caveat that must be considered in using the values in Table 3 of TKBS-0007 for dose reconstruction; these exposure values are specific to the skin other than the hands and arms. Exposure to the hands and arms would be higher, since film badges are worn at a considerable distance from these extremities. One possible approach to addressing exposures to the hands and arms is to use a factor developed by NIOSH in OCAS-TIB-0013 (OCAS 2005). That document describes a modeling approach to estimate correlations between film badge exposures and exposures to other body parts. They determined that the hands-to-badge ratio was to 3.65:1. SC&A believes that this is a dose reconstruction issue rather than an SEC issue.	
Finding 17:	***NIOSH needs to provide convincing arguments that 95th percentile values based on 1948/1949 data are bounding for the period prior to December 1947.***
SC&A Comment – 2/16/12: NIOSH has determined that they cannot reconstruct internal doses prior to December 1947. SC&A has suggested an alternative approach to bounding internal doses for the early operations. SC&A believes that this finding has not been resolved.	

Battelle 2006. Site *Profiles for Atomic Weapons Employers that Refined Uranium and Thorium*, Battelle-TBD-6001, Rev. F0; Battelle; December 13, 2006; SRDB Ref ID: 30673.

Battelle 2007. *Site Profiles for Atomic Weapons Employers that Refined Uranium and Thorium—Appendix C, Electro Metallurgical Company*, Battelle-TBD-6001, Rev. 0; Battelle; December 21, 2007; SRDB Ref ID: 41362.

DCAS 2011. Technical Basis Document for the Electro Metallurgical Company, Niagara Falls, New York. DCAS-TKBS-0007, Rev. 00. Supersedes Battelle-TBD-6001 Appendix C. Division of Compensation Analysis and Support (DCAS), National Institute for Occupational Safety and Health (NIOSH), Cincinnati, Ohio. February 15, 2011.

NIOSH 2009. *SEC Petition Evaluation Report, Petition SEC-00136 – Electro Metallurgical Corporation*. National Institute for Occupational Safety and Health (NIOSH), Cincinnati, Ohio. July 21, 2009.

NIOSH 2011. *NIOSH Update on Electro Metallurgical, May 16, 2011 Working Group Meeting.* Prepared by Sam Glover (NIOSH). National Institute for Occupational Safety and Health (NIOSH), Cincinnati, Ohio.

OCAS (NIOSH Office of Compensation and Support) 2005. *Special External Dose Reconstruction Considerations for Mallinckrodt Workers,* OCAS-TIB-0013, Rev. 0. National Institute for Occupational Safety and Health. Effective Date: November 26, 2005.

Ore Beneficiation 1945a. Status of Low Grade African Ore Beneficiation Program. Memo to General L.R. Groves, October 24, 1945. SRDB Ref ID: 91908.

Ore Beneficiation 1945b. Status of Low Grade African Ore Beneficiation Program. War Department United States Engineer Office. 6 December 1945. SRDB Ref ID: 91957.

SC&A 2011. Review Of NIOSH Petition Evaluation Report For Petition Sec-00136 Dated July 21, 2009, Electro-Metallurgical Corporation. Contract No. 200-2009-28555. SCA-TR-SEC2010-0010, Rev. 1. SC&A, Inc., Vienna, Virginia. May 5, 2011.