Draft

ISSUE RESOLUTION MATRIX FOR SC&A FINDINGS ON APPENDIX J TO TBD-6000

S. Cohen & Associates
1608 Spring Hill Road
Suite 400
Vienna, VA 22182

July 6, 2015

Disclaimer

This document is made available in accordance with the unanimous desire of the Advisory Board on Radiation and Worker Health (ABRWH) to maintain all possible openness in its deliberations. However, the ABRWH and its contractor, SC&A, caution the reader that at the time of its release, this report is pre-decisional and has not been reviewed by the Board for factual accuracy or applicability within the requirements of 42 CFR 82. This implies that once reviewed by the ABRWH, the Board's position may differ from the report's conclusions. Thus, the reader should be cautioned that this report is for information only and that premature interpretations regarding its conclusions are unwarranted.

INTRODUCTION

The present document summarizes and discusses the findings presented by Anigstein (2015) that arose from a review of "Site Profiles for Atomic Weapons Employers that Worked Uranium Metals: Appendix J–Joslyn" (Allen 2014). The seven findings in the latter report are presented as Issues 1–7 in the present matrix. A separate matrix of SC&A findings on the NIOSH evaluation of the Joslyn Special Exposure Cohort (SEC) petition (Harrison-Maples et al. 2012) was last updated on December 18, 2013 (SC&A 2013). The Work Group on TBD-6000 has voted to close all but three of the issues in the SEC petition matrix, and agreed that the remaining issues pertain to the site profile. These issues are presented as Issues 8–10 in the present matrix.

Time Line of Appendix J Issues Matrix

- January 16, 2014. The Work Group on TBD-6000 met by teleconference. The WG voted to close 8 of the 11 issues in the Joslyn SEC issues matrix (SC&A 2013)—all except Issues 6, 10, and 11. Paul Ziemer, chair of the WG, stated that it was agreed that the remaining three issues were no longer SEC issues but dealt with implementation of dose reconstructions. Ted Katz, Designated Federal Official to the Advisory Board, tasked SC&A with reviewing the upcoming NIOSH white paper on dose reconstruction methods for Joslyn. The WG then voted to accept NIOSH's recommendation that the SEC period for Joslyn—March 1, 1943, through December 31, 1947—be extended to July 31, 1948. The WG also voted to accept NIOSH's recommendation that the SEC be denied for the period August 1, 1948 through December 31, 1952.
- January 28, 2014. The ABRWH, at its meeting in Kansas City, Missouri, voted to recommend SEC status for Joslyn workers employed from March 1, 1943, through July 31, 1948.
- April 17, 2014. Glover and Allen (2014) issued "NIOSH White Paper: 'Determination of External Dose from Thorium Metal Machining – A TBD 6000 Approach'," presenting the methodology and results of their calculations of doses from rolling rods of thorium metal. Sharfi et al. (2014) issued "Dose Reconstruction Methods for Joslyn Manufacturing and Supply Co.," a NIOSH White Paper.
- April 23, 2014. The Work Group on TBD-6000 met by teleconference. The WG, NIOSH, and SC&A agreed to NIOSH's use of surrogate data (i.e., TBD-6000 [Allen 2011]) for the post-SEC period: August 1, 1948 through December 31, 1952. Sam Glover and Mutty Sharfi presented a summary discussion of the two NIOSH white papers issued on April 17, 2014. The WG formally tasked SC&A with reviewing the two papers.
- April 29, 2014. The ABRWH, at its meeting in Augusta, Georgia, voted not to add to the SEC workers employed at Joslyn from August 1, 1948, through December 31, 1952.
- October 7, 2014. Allen (2014) issued "Site Profiles for Atomic Weapons Employers that Worked Uranium Metals: Appendix J–Joslyn," Battelle-TBD-6000, Appendix J, which formalized the procedures in the two white papers.

- December 1, 2014. Anigstein (2014) issued a review of the NIOSH White Paper: "Determination of External Dose from Thorium Metal Machining – A TBD 6000 Approach."
- March 24, 2015. Ted Katz, Designated Federal Official to the Advisory Board, asked SC&A to review Appendix J (Allen 2014).
- March 25, 2015. Paul Ziemer, Chair of the Work Group on TBD-6000, concurred with Ted Katz' request.
- May 12, 2015. Anigstein (2015) issued "Review of 'Site Profiles for Atomic Weapons Employers That Worked Uranium Metals: Appendix J–Joslyn'."
- June 29, 2015. Ted Katz, Designated Federal Official to the Advisory Board, asked SC&A to prepare an Appendix J issues matrix.
- July 6, 2015. SC&A issued the matrix.

Status Summary

- Issue 1 (uranium workdays): *Open*
- Issue 2 (inhaled intakes): *Open*
- Issue 3 (external exposure to contaminated floor): *Open*
- Issue 4 (external exposure to penetrating radiation from uranium): *Open*
- Issue 5 (exposures combined with $H_p[10]$): *Open*
- Issue 6 (skin dose): *Open*
- Issue 7 (external exposure to thorium): *Open*
- Issue 8 (use of TBD-6000 not sufficiently prescriptive): *In abeyance*
- Issue 9 (external exposure assumptions): *In abeyance*
- Issue 10 (thorium hazard sources): *In abeyance*

Level of Importance

We have assigned four levels of importance to these issues, which we define in the following manner:

- **High:** Capable of having a significant impact on individual dose reconstructions and hence on the probability of causation (POC) for the claimants.
- **Medium:** Could alter the POC for some individuals.
- **Low:** Recommended technical improvements in the accuracy of dose reconstructions, but unlikely to have major impacts in most cases.
- **N/A:** Not applicable because issue was closed by action of the Work Group or SC&A recommends that the issue be closed.

We have assigned the following levels of importance to these issues:

- Issues 1, 2, 6, 8, and 9: *High*
- Issue 4, 7, and 10: *Medium*
- Issue 3 and 5: *Low*

Issue Resolution Matrix for SC&A Findings on Appendix J to TBD-6000

Issue 1: Uranium Workdays

SC&A Finding: In all but 2 years of the 10-y period of MED/AEC operations at Joslyn, Allen (2014), using (without citation) data tabulated by Sharfi et al. (2014), underestimated the number of days that uranium was processed or handled at Joslyn. The discrepancies result from a very narrow evaluation of the data available in the SRDB: rolling and/or machining were assumed to take place only on dates specifically cited in correspondence or reports. Some additional workdays were assumed if there was a reference to quantities or masses of uranium billets or rods. However, except for a passing reference by Harrison-Maples et al. (2012), no attention was paid to Joslyn's contracts with the University of Chicago. The billings under those contracts represent work that is not specifically cited in reports of rolling and machining. It is not surprising that the records of uranium-handling activities at Joslyn are not complete—this has been our experience reviewing other AWE facilities. It is therefore incumbent on NIOSH to use all available information to make claimant-favorable assumptions about the duration and number of uranium operations. In the present case, we find that NIOSH did not do so.

NIOSH Response:

Board Action:

Status (7/6/15): **Open**

Issue 2: Inhaled Intakes

SC&A Finding: In all but one year of the post-SEC period, Allen (2014) underestimated the inhaled intakes of uranium dust. These results stem directly from the estimates of uranium workdays, discussed in Issue 1.

NIOSH Response:

Board Action:

Status (7/6/15): **Open**

Issue 3: Photon and Electron Dose Rates from Contaminated Floor

SC&A Finding: Allen (2014) failed to account for the enhanced concentrations of short-lived uranium progenies on the surface of freshly cast uranium billets supplied to Joslyn from Mallinckrodt and ElectroMet, which we have called the Putzier effect (Putzier 1982). This effect would have resulted in much higher photon and electron dose rates, since the dust that accumulated on the contaminated floor during rolling operations would have come primarily from the surface of the billets.

NIOSH Response:

Board Action:

Status (7/6/15)**: Open**

Issue 4: Doses from External Exposure to Penetrating Radiation from Uranium

SC&A Finding: Allen (2014) underestimated the doses from external exposure to penetrating radiation from uranium in 7 years of the 10-year period of MED/AEC operations. This underestimate is due to underestimated dose rates from the contaminated floor and to the underestimated uranium workdays. It is partly offset by the assumption that the worker was exposed to penetrating radiation from the uranium billet during his entire workday, which was assumed to have a duration of 10 h during the entire period. Both these assumptions are contrary to the methodology of calculating external doses from uranium metal prescribed in TBD-6000.

NIOSH Response:

Board Action:

Status (7/6/15)**: Open**

Issue 5: Exposures Improperly Combined with Personal Dose Equivalents $H_p(10)$

SC&A Finding: Allen (2014), in determining doses from external exposure, added the calculated exposures from contaminated surfaces, which are expressed in milliroentgens, to doses from uranium metal, which are expressed as personal dose equivalents, Hp(10), in units of millirem. This mixed quantity cannot be used for calculating organ doses, since there are significant differences between the exposure-to-organ dose and personal-dose-equivalent-to-organ dose conversion factors.

NIOSH Response:

Board Action :

Status (7/6/15)**: Open**

Issue 6: Doses to Skin from Nonpenetrating Radiation from Uranium

SC&A Finding: Allen (2014) underestimated the doses to the skin from external exposure to nonpenetrating radiation from uranium in each year of MED/AEC operations. The main factors are failure to incorporate the Putzier effect in estimating the dose rates from electrons emitted from uranium metal and uranium dust on contaminated floors and an underestimate of uranium workdays.

NIOSH Response:

Board Action:

Status (7/6/15)**: Open**

Issue 7: External Exposure to Thorium
SC&A Finding: Allen (2014) underestimated the doses to the skin from external exposure to thorium rods. The major difference is in the contact dose to the skin on the hands and forearms, which is due to an incorrect geometry in the NIOSH MCNP analysis (Anigstein 2014). Allen listed photon doses taken from Glover and Allen (2014) that were based on MCNP calculations of effective dose. Effective doses are incompatible with OCAS-001 (OCAS 2007), which makes no provision for converting such doses to the organ dose equivalents that are required for dose reconstruction.
NIOSH Response:
Board Action:
Status (7/6/15)**: Open**

Issue 8 – Use of TBD-6000 for Dose Reconstruction Not Sufficiently Prescriptive[a]
SC&A Finding: The NIOSH approach for reconstructing internal doses due to metal-working operations at Joslyn for 1948 through 1952 does not adequately describe how the dose reconstruction methods in TBD-6000 are to be applied.
Board Action (1/28/14): Paul Ziemer, chair of the Work Group on TBD-6000, stated that this was no longer an SEC issue but dealt with implementation of dose reconstructions. Dr. Ziemer said the issue remained in progress pending the issuance of a NIOSH white paper.
NIOSH Response (10/7/14): Allen (2014) presented detailed prescriptions for reconstruction of internal doses from uranium handling and metal-working from August 1, 1948, through December 31, 1952.
SC&A Reply (5/12/15): Anigstein (2015) reviewed the NIOSH prescriptions for reconstruction of internal doses.
Status (7/6/15): **In abeyance**, pending resolution of Issue 2 in the present matrix.

Issue 9 – Need for Revised External Exposure Assumptions[b]
SC&A Finding: NIOSH should document the sources of information they propose to use regarding the relative radiological hazard from thorium.
Board Action (1/28/14): Paul Ziemer, chair of the Work Group on TBD-6000, stated that this was no longer an SEC issue but dealt with implementation of dose reconstructions. Dr. Ziemer said the issue remained in progress pending the issuance of a NIOSH white paper.
NIOSH Response (10/7/14): Allen (2014) presented detailed prescriptions for reconstruction of external doses from uranium handling and metal-working from March 1, 1943, through December 31, 1952.
SC&A Reply (5/12/15): Anigstein (2015) reviewed the NIOSH prescriptions for reconstruction of external doses.
Status (7/6/15): **In abeyance**, pending resolution of Issues 1 and 3–7 in the present matrix.

Issue 10 – Documentation on Thorium Hazard Sources [c]
SC&A Finding: NIOSH should document the sources of information they propose to use regarding the relative radiological hazard from thorium.
Board Action (1/28/14): Paul Ziemer, chair of the Work Group on TBD-6000, stated that this was no longer an SEC issue but dealt with implementation of dose reconstructions. Dr. Ziemer said the issue remained in progress pending the issuance of a NIOSH white paper.
NIOSH Response (10/7/14): Glover and Allen (2014) presented detailed prescriptions for reconstruction of external doses from thorium handling and metal-working.
SC&A Reply (5/12/15): Anigstein (2014) reviewed the NIOSH prescriptions for reconstruction of external doses from thorium.
Status (7/6/15): **In abeyance**, pending resolution of Issue 7 in the present matrix.

[a] Excerpted from Issue 6 in SEC issues resolution matrix (SC&A 2013)

[b] Excerpted from Issue 10 in SEC issues resolution matrix (SC&A 2013)

[c] Excerpted from Issue 11 in SEC issues resolution matrix (SC&A 2013)

References

Allen, D. 2011. "Site Profile for Atomic Weapons Employers that Worked Uranium Metals," Battelle-TBD-6000 Rev. 1. http://www.cdc.gov/niosh/ocas/awedocs.html#b6000

Allen, D. 2014. "Site Profiles for Atomic Weapons Employers that Worked Uranium Metals: Appendix J–Joslyn," Battelle-TBD-6000, Appendix J, Revision No. 0. http://www.cdc.gov/niosh/ocas/pdfs/tbd/b-6000-apj-r0.pdf

Anigstein, R. 2014. "Review of 'Determination of External Dose from Thorium Metal Machining - A TBD-6000 Approach'."

Anigstein, R. 2015. "Review of 'Site Profiles for Atomic Weapons Employers That Worked Uranium Metals: Appendix J–Joslyn'." http://www.cdc.gov/niosh/ocas/pdfs/abrwh/scarpts/sca-jmscsp-r0.pdf

Glover, S., and D. Allen. 2014. "Determination of External Dose from Thorium Metal Machining - A TBD-6000 Approach." http://www.cdc.gov/niosh/ocas/pdfs/dps/dc-tbd6000edth-r0.pdf

Harrison-Maples, M., J. Guido, E. Potter, and B. P. Smith. 2012. "SEC Petition Evaluation Report: Petition SEC-00200," Rev.#:1. http://www.cdc.gov/niosh/ocas/pdfs/sec/joslynman/joslyner-200-r1.pdf

Office of Compensation Analysis and Support (OCAS). 2007. "External Dose Reconstruction Implementation Guideline," OCAS-IG-001, Revision No. 3. www.cdc.gov/niosh/ocas/pdfs/dr/oc-ig-001-r3.pdf

Putzier, E. A. 1982. "The Past 30 Years at Rocky Flats: A Summary of Experiences and Observations at Rocky Flats Plant Over the Past 30 Years with Emphasis on Health and Safety."

S. Cohen & Associates (SC&A). 2013. "Issue Resolution Matrix for SC&A Findings on Petition Evaluation Report for Joslyn SEC Petition 00200" (December 18, 2013). http://www.cdc.gov/niosh/ocas/pdfs/abrwh/scarpts/sca-joslynirmsec200-r0.pdf

Sharfi, M. M., G. Potter, and B. Smith (ORAUT); S. Glover (DCAS), Reviewer. 2014. "Dose Reconstruction Methods for Joslyn Manufacturing and Supply Co.," NIOSH White Paper, Rev. 0 (April 17, 2014). http://www.cdc.gov/niosh/ocas/pdfs/dps/dc-tbd6000edth-r0.pdf