
Draft

**SC&A'S EVALUATION OF NIOSH'S WELDON SPRING RESPONSE OF
APRIL 21, 2011, AND THE WORK GROUP MEETING OF MAY 9, 2011**

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S. COHEN & ASSOCIATES: <i>Technical Support for the Advisory Board on Radiation & Worker Health Review of NIOSH Dose Reconstruction Program</i>	Document No.: SC&A Evaluation of NIOSH WSS Response and WG Meeting
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Task Manager: _____ Date: _____ Joseph Fitzgerald	Supersedes: N/A
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Record of Revisions

Revision Number	Effective Date	Description of Revision
0 (Draft)	08/03/2011	Initial issue

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1. INTRODUCTION

NIOSH's Response of April 21, 2011

NIOSH provided a response to the Weldon Spring Site (WSS) SEC issues (SC&A 2010) and site profile issues (SC&A 2009) in a series of attachments to an e-mail of April 21, 2011, by Mark Rolfes (NIOSH 2011) as follows:

- (1) Evaluation of accident/incident data (Issue 2-7). [SEC Issue #8]
- (2) Comparison of operational activities [and data accuracy] (Issue 7) [also #1a, #1c].
- (3) Information for dose reconstruction in 1967 (Issue 3). [SEC Issue #3]
- (4) Personnel contamination monitoring (Finding 2). [SEC Issue #2]
- (5) Weldon Spring environmental intakes and external dose rates (covers several issues). [SEC Issue #4]
- (6) Urinalysis minimum detectable amount evaluation (previously provided to WG). [Site Profile Issue #21]

These issues mainly stem from the January 25, 2011, WSS second work group (WG) meeting.

WSS WG Meeting of May 9, 2011

The third WSS WG meeting was held on May 9, 2011. During this meeting, a number of action items for both SC&A and NIOSH were assigned by the WG. A summary of these action items is listed in Appendix A of this report. Additionally, Appendix B provides a very brief summary (mini-matrix) of the current status of the WSS SEC issues, and Appendix C provides a very brief summary (mini-matrix) of the current status of the WSS site profile issues.

The following presents SC&A's evaluation of NIOSH's April 21, 2011, response and the status of SC&A's action items resulting from the May 9, 2011, WSS WG meeting.

2. SC&A'S EVALUATION OF NIOSH'S APRIL 21, 2011, RESPONSE TO WSS ISSUES

The following is SC&A's current evaluation of each of NIOSH's attachments in the April 21, 2011, e-mail. Some of the issues were evaluated by SC&A before the WG meeting of May 9, 2011, and discussed in detail at the meeting; however, some of the more complex issues required more time to analyze. The results of the WG meeting discussion of NIOSH's responses and SC&A's further analyses are provided below.

Comparison of operational activities [and data accuracy] (Issue 7) [also 1a, 1c]

Relevant SEC Issues #1a and #1c – Accuracy and completeness of internal and external dose data. On page 6 of this attachment, NIOSH states that the dose reconstructor for WSS cases only uses copies of the original recorded data; therefore, accuracy is not an issue. The CER electronic database is not used for dose reconstruction (DR) purposes. SC&A finds that the

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recorded dose and bioassay information for WSS workers are generally legible and useful for DR. However, there has not been a verification of the completeness of the available recorded dose and bioassay data performed for the WSS; therefore, SC&A proposed an initial data completeness test to determine if there is any indication that there may be a data completeness issue at WSS. This task is described in SC&A's action item SEC Issue #1a and #1c below.

Personnel contamination monitoring (Finding 2)

Relevant SEC Issue #2 – Lack of egress monitoring. NIOSH reviewed other Atomic Energy Commission (AEC)/Department of Energy (DOE) sites that handled uranium and thorium in a similar time period and concluded that the WSS site did not present any unique issues in the area of skin contamination, and that there are DR methods available to address skin contamination doses. *The WSS WG recommended that this issue be closed as of May 9, 2011.*

Information for dose reconstruction in 1967 (Issue 3)

Relevant SEC Issue #3 – Lack of dose records for 1967. NIOSH proposes that the WSS site was in a transition state from the AEC to the Army during the year 1967, and that renovation work did not start until 1968. Therefore, NIOSH maintains that WSS workers were not exposed to doses or intakes that would exceed those during the operating years of 1957–1966. *Therefore, barring any further documentation showing otherwise, the WSS WG recommended that this issue be closed as of May 9, 2011.*

Weldon Spring environmental intakes and external dose rates (covers several issues)

Relevant SEC Issue #4 – No radon/thoron measurements. No radon measurements for the operational period have been located. SC&A found that NIOSH addressed the indoor radon model briefly on pages 13–14 of this white paper, and some calculations are provided in the Appendix of the paper. SC&A evaluated the NIOSH-recommended indoor radon model for WSS, which is based on the annual throughput of uranium and certain assumed parameters. SC&A found NIOSH's method to use a very simple air concentration model that would be conservative in most situations at WSS. Additionally, NIOSH recommends using a similar approach to derive thoron air concentrations, as described on page 58 of their April 16, 2010, SEC-00143 evaluation report (NIOSH 2010); i.e., by using the thorium material throughput coupled with certain assumed parameters. SC&A's analysis for radon, in general, also applies to the thoron issue.

Regardless of the validity of the indoor radon model recommended, SC&A would like to point out that indoor radon modeling was judged to be unacceptable by the Advisory Board concerning the Blockson project and the Texas Chemical site.

Comparison of operational activities [and data accuracy] (Issue 7) [also 1a, 1c]

Relevant SEC Issue #7 – Lack of air measurements at quarry and raffinate pits during 1957–1967. NIOSH summarized the WSS raffinate pits and quarry conditions during the operational, maintenance, and remediation periods. There do not appear to be significant differences in exposure potential during the operational and later periods; therefore, measurements taken in later years can reasonably be extrapolated back to the SEC period for these locations. *The WSS WG recommended that this issue be closed as of May 9, 2011.*

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Evaluation of accident/incident data (Issue 2-7)

Relevant SEC Issue #8 – Impact of accidents/incidents on dose reconstruction. NIOSH provided indications that, although not necessarily documented as radiological accident/incidents, such situations where workers were potentially exposed resulted in monitoring data being available. Most situations where a worker may have been involved in an accident/incident can be evaluated by searching the DOE files and/or the Site Research Database (SRDB) by worker name, keywords, etc. SC&A did have a question concerning the last statement on page 4 of NIOSH’s response, where it is stated, “In fact, the use of workgroup monitoring data is likely to result in a more favorable dose estimate.” NIOSH is to provide clarification/basis of this statement.

Urinalysis minimum detectable amount evaluation (previously provided to WG)

Relevant Site Profile Issue #21 – Uranium MDA needs addressed further. Discussion of this issue took place at the WSS WG meeting of May 9, 2011. SC&A asked for clarification of the last sentence on page 3 of this response; NIOSH indicated that the statement should be removed, as it was not relevant to this issue. *Considering the results of this discussion, the WSS WG recommended that this issue be closed as of May 9, 2011.*

3. SC&A’S ACTION ITEMS FROM THE MAY 9, 2011, WG MEETING

SEC Issues #1a and #1c – Accuracy and completeness of internal and external dose data:

SC&A to prepare a plan to perform initial limited internal and external data completeness review. Status: SC&A submitted the proposed plan to WSS WG for comment on May 13, 2011. When the WSS WG has notified SC&A of approval to proceed, SC&A will perform a data completeness test to determine if data appear complete, or if further sampling is needed.

SEC Issue #1d – Coworker data: Data completeness test will determine if data can be used for coworker model. However, SC&A found that NIOSH has proposed several coworker models, or advocated that one is not needed. SC&A would like for NIOSH to state a definite recommendation on a coworker model for both internal and external doses.

SEC Issue #4 – No radon/thoron measurements: *SC&A to evaluate NIOSH’s April 21, 2011, response to the radon/thoron issue. Status:* See above evaluation in the April 21, 2011, response section.

SEC Issue #6 – Lack of neutron dose data: *SC&A to evaluate Weldon Spring and Fernald neutron issue. Status:* NIOSH has recommended that, because there are no neutron dose data recorded for WSS workers, the neutron-to-photon ratio (n/p) method be used. NIOSH also recommended using the n/p values from the Fernald site technical basis document (TBD). However, SC&A has raised the issue that the Fernald n/p values were derived from neutron doses taken under one set of conditions in 1995, and the photon doses were taken under a different set of conditions in 2001; hence, the two events are not correlated. SC&A performed a re-evaluation of the Fernald neutron DR method and found a number of findings; some are applicable to WSS, and some are not. However, Finding #1 is directly applicable to WSS and contains the following finding:

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The n:p ratio developed in the “Technical Basis Document for the Fernald Environmental Management Project – Occupational External Dose” [ORAUT 2004] is not scientifically valid, since it is based on a comparison of measurements made on different materials in different years.

SC&A considers the use of the n/p method acceptable for WSS, but the method of deriving the n/p value at Fernald, and then applying it to WSS, is not scientifically valid.

Site Profile Issue #24 – EU <1%. SC&A to review SRDB Ref #3644 [DOE 2000], page 15 (as provided at May 9, 2011, meeting), to determine if Weldon Spring only received EU of $\leq 1\%$.

Status: SC&A reviewed the reference and determined that this issue was satisfactorily addressed, and as of June 2011, recommends that this issue be closed.

4. REFERENCES

DOE 2000. *DOE Ohio Field Office Recycled Uranium Project Report*, Final; Department of Energy (DOE); May 15, 2000; SRDB Ref ID: 3644.

NIOSH 2010. *SEC Petition Evaluation Report, Petition SEC-00143*, Rev. 0. National Institute for Occupational Safety and Health, Office of Compensation Analysis and Support, Cincinnati, Ohio. April 16, 2010.

NIOSH 2011. *NIOSH Responses to Weldon Spring Plant Review – may contain Privacy Act information*, 4/21/2001 e-mail from Mark Rolfes, with six attachments. National Institute for Occupational Safety and Health, Office of Compensation Analysis and Support, Cincinnati, Ohio. October 12, 2010.

ORAUT 2004. *Technical Basis Document for the Fernald Environmental Management Project – Occupational Environmental Dose*, ORAUT-TKBS-0017-4, Rev. 00, Oak Ridge Associated Universities Team, Cincinnati, Ohio. April 2004.

SC&A 2009. *Review of the NIOSH Site Profile for the Weldon Spring Site in Weldon Spring, Missouri*, Revision 0. SCA-TR-TASK1-0028, February 10, 2009.

SC&A 2010. *Preliminary Issues from SC&A’s Review of NIOSH’s Evaluation Report for the Weldon Spring Site, Weldon Spring, Missouri, Special Exposure Cohort Petition SEC-00143*. SCA-TR-TASK5-0015, October 2010.

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APPENDIX A: SC&A AND NIOSH ACTION ITEMS FROM THE MAY 9, 2011, WSS WG MEETING

SC&A's Action Items:

1a and 1c. Accuracy and completeness of internal and external dose data: *SC&A to prepare a plan to perform initial limited internal and external data completeness review and submit plan to WSS WG for comment. SC&A will then perform approved data completeness test to determine if data appear complete, or if further sampling is needed.*

1b. DWE: *No action items for SC&A.*

1d. Coworker data: Data completeness test will determine if data can be used for coworker model.

2. Lack of egress monitoring: *Issue closed May 9, 2011.*

3. Lack of dose records for 1967: *Issue closed May 9, 2011.*

4. No radon/thoron measurements: *SC&A to evaluate NIOSH's April 21, 2011, response to the radon/thoron issue.*

5. Validity of method used to assign recycled uranium intakes: *No action items for SC&A.*

6. Lack of neutron dose data: *SC&A to evaluate Weldon Spring and Fernald neutron issue.*

7. Lack of air measurements at quarry and raffinate pits during 1957-1967: *Issue closed May 9, 2011.*

8. Impact of accidents/incidents on dose reconstruction: *No action items for SC&A.*

9. Geometry and extremity monitoring: *No action items for SC&A.*

Site profile Issue #24 – EU <1%: *SC&A to review SRDB Ref #3644, page 15, to determine if Weldon Spring only received EU of $\leq 1\%$.*

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NIOSH's Action Items:

1a & 1c. Accuracy and completeness of internal and external dose data: *No action items for NIOSH.*

1b. DWE: *NIOSH to determine the magnitude and impact of mistakes in air monitoring data (“blunders”) on assigning dose, and solution(s) to correct/compensate for them.*

1d. Coworker data: Data completeness test will determine if data can be used for coworker model.

2. Lack of egress monitoring: *Issue closed May 9, 2011.*

3. Lack of dose records for 1967: *Issue closed May 9, 2011.*

4. No radon/thoron measurements: *No action items for NIOSH.*

5. Validity of method used to assign recycled uranium intakes: *NIOSH to review cases to determine if 100 ppb is being applied consistently/correctly, starting with the 5 cases forwarded by SC&A, and to also verify if the 100 ppb is bounding in light of operations that may concentrate plutonium; i.e., uranium bomb process.*

6. Lack of neutron dose data: *No action items for NIOSH.*

7. Lack of air measurements at quarry and raffinate pits during 1957-1967: *Issue closed May 9, 2011.*

8. Impact of accidents/incidents on dose reconstruction: *NIOSH to show why group bioassay data are claimant favorable, and how they are applied in individual DR cases; especially accident/incident situations (as per page 4 of NIOSH's April 21, 2011, response to Incident/Accident).*

9. Geometry and extremity monitoring: *NIOSH to show how geometry correction factors and extremity monitoring from other DOE sites and OCAS-TIB-0013 can be applied to Weldon Spring recorded dose data to correct for lack of geometry and extremity monitoring at Weldon Spring.*

Site profile Issue #24: EU <1%: *No action items for NIOSH.*

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APPENDIX B: WELDON SPRING SEC ISSUES MINI-MATRIX AS OF JUNE 2011

SEC Issue #1a & 1c	TKBS Finding # P-21, 26	Item: Validation/Verification (V/V) of Internal/External Data
SC&A Original Concerns: Accuracy of the data used in DR? CER database used?		Action Items from 1/25/2011: Check V/V & CER used?
NIOSH Reply of April, 21, 2011: Dose reconstructor (DR) uses copies of original data, not CER. Accuracy is okay.		
SC&A & NIOSH Action Items from 5/9/2011 Work Group (WG) meeting: SC&A proposed completeness test 5/13/2011.		
SEC Issue #1b		Item: Daily Weighted Exposure (DWE)
SC&A Original Concerns: Use of air monitoring data.		Action Items from 1/25/2011: SCA's paper => 2-4-2011.
NIOSH Reply of April, 21, 2011: NA		
SC&A & NIOSH Action Items from 5/9/2011 WG meeting: NIOSH to assess accuracy of data (blunder, etc.)		
SEC Issue #1 d	TKBS Finding #P-3, 21, 27	Item: Coworker (CW) Data
SC&A Original Concerns: Sufficient data for CW? Model?		Action Items from 1/25/2011: Sample for gaps, roster, etc.
NIOSH Reply of April, 21, 2011: Not needed, or will be in revised TBD, or 50% of monitored (p. 23).		
SC&A & NIOSH Action Items from 5/9/2011 WG meeting: NIOSH needs to define method for DR purposes.		
SEC Issue #2	TKBS Finding #P-1	Item: Lack of Egress Monitoring
SC&A Original Concerns: No egress monitors. Cohort bioassays miss intakes?		Action Items from 1/25/2011: Will check B.S. & MCW.
NIOSH Reply of April, 21, 2011: B.S. & MCW => no different than WSS. Use skin dose programs.		
SC&A & NIOSH Action Items from 5/9/2011 WG meeting: Issue was closed by WG 5/9/2011.		
SEC Issue #3	TKBS Finding #P-2, S-13	Item: Lack of Data for 1967
SC&A Original Concerns: No external or bioassay data for 1967. Different situation?		Action Items from 1/25/2011: Will check legal docs.
NIOSH Reply of April, 21, 2011: WSP transferred 1-31-67, WSQ & Pits not transferred. 1966->67, no Army work until 3/68. 17 claims 1967		
SC&A & NIOSH Action Items from 5/9/2011 WG meeting: Issue was closed by WG 5/9/2011.		
SEC Issue #4	TKBS Finding #P-10, 11; P-12, 19; S-13, 16; S-17	Item: Radon and Thoron
SC&A Original Concerns: [P-10, 11] Equal out/in radon conc & environmental model not justified. [P-12, 19] Thoron model is not clear or substituted.		Action Items from 1/25/2011: Reference radium/radon concentrations.
NIOSH Reply of April, 21, 2011: [P-10, 11] Perimeter uranium air measurements 1959-65 for environmental uranium & Th230 @ 100m = 30x. [P-12, 19] Thorium/uranium mass throughput ratio => thorium environmental air concentration. [S-13, 16] Radon model 34 Ci/y indoor => Appendix; & at 100 m outside.		
SC&A & NIOSH Action Items from 5/9/2011 WG meeting: SC&A analyzed NIOSH's response and found that, while the model is reasonable, indoor radon models have not been acceptable for DR in the past at other AEC/DOE sites.		

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APPENDIX B: WELDON SPRING SEC ISSUES MINI-MATRIX AS OF JUNE 2011

SEC Issue #5	TKBS Finding #S-4	Item: <i>Recycled Uranium (RU) Dose Assignment</i>
SC&A Original Concerns: Start 1961, 1962, 1963? 1 out of 5 DRs got 100 ppb SC&A => 5 cases to Mark 2-2-2011.		Action Items from 1/25/2011: Determine 1960, 1961, 1962? Check if 100 ppb used in DR.
NIOSH Reply of April, 21, 2011: External ambient => Use 50 th percentile of monitored dose for unmonitored workers. Not yet addressed by NIOSH.		
SC&A & NIOSH Action Items from 5/9/2011 WG meeting: NIOSH still addressing this issue.		
SEC Issue #6	TKBS Finding #S-28	Item: <i>Neutron Exposures</i>
SC&A Original Concerns: 1995 canister neutrons, 2001 drums gammas.		Action Items from 1/25/2011: SCA to provide neutron & gamma references. SC&A ref => 2-2-2011.
NIOSH Reply of April, 21, 2011: n/p approved by SC&A 10/28/2008 for Fernald? NIOSH considers issue closed as of 2/3/2011.		
SC&A & NIOSH Action Items from 5/9/2011 WG meeting: The n/p values are reasonable, but not technically sound. SC&A does not consider this issue closed.		
SEC Issue #7	TKBS Finding #NA	Item: <i>Quarry and Pits</i>
SC&A Original Concerns: Measured only later, different conditions than operations?		Action Items from 1/25/2011: NIOSH to address.
NIOSH Reply of April, 21, 2011: Radon measured 1977-82 -> operational period because of in-growth. Workers at Quarry monitored & conditions same in operations & maintenance periods. Pits fenced & wet, pit workers monitored.		
SC&A & NIOSH Action Items from 5/9/2011 WG meeting: Issue was closed by WG 5/9/2011.		
SEC Issue #8	TKBS Finding #S-5	Item: <i>Accidents/Incidents.</i>
SC&A Original Concerns: Potential rad accidents/incidents not always recorded. SC&A => 3 cases to Mark 3-11-2011		Action Items from 1/25/2011: NIOSH to address.
NIOSH Reply of April, 21, 2011: Accidents by claim search in SRDB. No comprehensive list available. Many bioassays for 3 claims. Cohort bioassays catches high uranium levels.		
SC&A & NIOSH Action Items from 5/9/2011 WG meeting: NIOSH to address advantage of cohort monitoring.		
SEC Issue #9	TKBS Finding #P-25	Item: <i>Geometry/Extremities</i>
SC&A Original Concerns: Beta shielded? Geometry & extremities factors?		Action Items from 1/25/2011: NIOSH to review MCW.
NIOSH Reply of April, 21, 2011: Not yet addressed by NIOSH.		
SC&A & NIOSH Action Items from 5/9/2011 WG meeting: NIOSH to address this issue in view of MCW.		

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APPENDIX C: WELDON SPRING SITE PROFILE ISSUES MINI-MATRIX AS OF JUNE 2011

TKBS Finding #	SEC Related Issue #	SC&A Original TKBS Concerns	Status
P-1	2	Lack of egress monitoring	See SEC issue
P-2	3	Lack of data for 1967–1984	See SEC issue
P-3	1	Individual vs. average exposures and V/V data	See SEC issue
S-4	5	RU dates and dose assignments	See SEC issue
S-5	8	Accidents/incidents	See SEC issue
S-6, 7, 8, 9	NA	X-ray exams records/issues	Exams conducted off site - Closed
P-10	4	Lack of atmospheric monitoring for operational period	See SEC issue
P-11	4	Insufficient environmental internal data for unmonitored workers	See SEC issue
P-12	4	Lack of maximum environmental doses	See SEC issue
S-13	4	Lack of sufficient effluent data prior to 1967	See SEC issue
S-14	NA	Stated U/Th/Ra ratios should be used with caution	As of 1/25/2011, NIOSH to issue white paper & TBD revision.
S-15	NA	Natural Th-232 not always negligible	As of 1/25/2011, NIOSH to issue white paper & TBD revision.
S-16	4	Use of environmental external doses from Fernald data	See SEC issue
S-17	4	Episodic releases	See SEC issue
P-18	NA	Incomplete assessment of uranium decay products	As of 1/25/2011, NIOSH to provide TBD revision.
P-19	4	Radon exposures	See SEC issue
P-20	NA	Many different solubility types listed	As of 1/25/2011, NIOSH to clarify in TBD revision.
P-21	1a, 1d	MDA and coworker data not adequately addressed	MDA addressed. Coworker in SEC #1d. SC&A => closure as of June 2011.
S-22	NA	Using cost center codes	NIOSH stated that these will not be used for WSS data - Closed
S-23	NA	Thorium in-vivo counts not reliable	NIOSH stated that these will not be used for WSS DRs - Closed
S-24	NA	Verification that EU \leq 1%	SC&A reviewed SRBD Ref #3644 and recommends closure as of June 2011.
P-25	9	Shallow, geometry, and extremity doses not addressed	See SEC issue
P-26	1	Badging not consistent	See SEC issue
P-27	1d	External dose coworker data development	See SEC issue
S-28	6	Neutron exposures	See SEC issue

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