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**ADVISORY BOARD ON  
RADIATION AND WORKER HEALTH**

*National Institute for Occupational Safety and Health*

**SC&A'S EVALUATION OF RESOLUTION OF PANTEX SITE  
PROFILE ISSUES IN REVISION 03 TO PANTEX EXTERNAL  
DOSE TECHNICAL BASE DOCUMENT**

**Contract No. 211-2014-58081  
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**SC&A, INC.:**                      *Technical Support for the Advisory Board on Radiation and Worker Health Review of NIOSH Dose Reconstruction Program*

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## ABBREVIATIONS AND ACRONYMS

MDA	minimum detectible activity
NIOSH	National Institute for Occupational Safety and Health
NTA	neutron track emulsion, Type A (film)
ORAUT	Oak Ridge Associated Universities Team
TBD	technical basis document
SEC	Special Exposure Cohort
WG	Work Group

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## 1.0 INTRODUCTION AND BACKGROUND

The National Institute for Occupational Safety and Health (NIOSH) has issued four revisions of the Pantex Plant external dose site profile technical basis document (TBD), ORAUT-TKBS-0013-6 (hereafter “TBD-6”). These are as follows:

1. Revision 00 on July 27, 2006
2. Revision 01 on June 22, 2007
3. Revision 02 on November 24, 2015
4. Revision 03 on November 29, 2016

SC&A, Inc. evaluated the latest, Revision 03, of TBD-6 to determine if the revised TBD resolved the Pantex site profile external dose issues as listed in the issues matrix for Pantex (SC&A 2016a) and discussed during the Pantex Work Group (WG) meetings (the latest on August 4, 2016). The May 2016 Pantex issues matrix is enclosed as Attachment 1 to this report.

SC&A did not evaluate the technical aspects of the entire revised TBD, as that is outside the scope of this task; only the sections relevant to resolving the TBD issues were evaluated.

## 2.0 SC&A EVALUATION

The following four issues were to be resolved by NIOSH making changes in the Pantex TBDs:

- **Site Profile Issue 1: Interpretation of external dosimetry data.** NIOSH was to provide clarification of “zero” entries in the electronic database beyond 1976. (In addition, NIOSH was to clarify the use of the year 1988 instead of 1989 as the year all personnel were monitored for exposures in its response in the Pantex issues matrix [NIOSH 2016a].)

**Current Status:** NIOSH provided clarification of this issue during the August 4, 2016, Pantex WG meeting (NIOSH 2016b, pages 7–10, 13). NIOSH clarified the issue by verifying that zeros were recorded only if a person was monitored and the results were read and found to be zero or the readings were less than the lower limits of detection. In addition, NIOSH stated that the use of 1988 as the year all personnel at Pantex were monitored for external exposures was incorrect in the issues matrix and that the year 1989 is correct, as used in TBD-6. SC&A verified that 1989 was the year used in the revised TBD (e.g., pages 13, 39, etc.). However, SC&A would like to point out that the text on page 5 of ORAUT-OTIB-0086, *Pantex External Coworker Model*, uses the incorrect wording “In such cases for years before 1988...” The phrase “before 1988” should be changed to “before 1989” to refer to a period when all personnel were not monitored for external exposure.

**SC&A’s Evaluation:** SC&A found the issue resolved as per the August 4, 2016, Pantex WG meeting (NIOSH 2016b, pages 7–10, 13). Note that this was an issue identified in SC&A’s review of ORAUT-OTIB-0086 (SC&A 2015); it did not originate in TBD-6 but was included in the Pantex matrix. SC&A recommends closure in the Pantex site profile

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matrix, and that the use of the year 1988 be changed to 1989 in the next revision of ORAUT-OTIB-0086.

- **Site Profile Issue 2: Data do not support assumption that 95th percentile neutron-to-photon ratio is bounding for all exposure scenarios.** From reviewing the revised ORAUT-TKBS-0013-6 and the related document ORAUT-OTIB-86, SC&A found that instead of using the neutron-to-photon method, NIOSH recommends using the recorded neutron dose, with the neutron track emulsion, Type A (NTA) film results adjusted for energy response, angular response, and track fading. As previously summarized and detailed in SC&A's review of ORAUT-OTIB-86 (SC&A 2015), SC&A does not find the neutron adjustment factors to be claimant favorable for Pantex workers.

**Current Status:** SC&A performed a study and comparison of the various correction factors and reached the consensus, in view of the information currently available, that an overall modification factor of 2.9 for NTA film is reasonable for the Pantex site. SC&A released a memo with this information to the Pantex WG on October 19, 2016 (SC&A 2016b).

**SC&A's Evaluation:** SC&A finds the issue resolved and recommends closure.

- **Site Profile Issue 3: Completeness and interpretation of historic radiological exposure sources.**

**Current Status:** SC&A had previously found that sections had been added in 2015 in ORAUT-TKBS-0013-5, Revision 04 (the occupational internal dose TBD), and ORAUT-TKBS-0013-6, Revision 02, with information concerning Pantex's history and workers at other U.S. Atomic Energy Commission/Department of Energy facilities that resolves this issue and recommended closure.

- **Site Profile Issue 4: Exposure from tritium.**

- SC&A found that Revision 04 to ORAUT-TKBS-0013-5 (mainly Table 5-3) provides for tritium dose assignments based on recorded minimum detectable activity (MDA) values and also simplifies tritium dose assignment for the dose reconstructor and allows for consistency in dose assignments. SC&A considers this part of the issue resolved.
- SC&A found the explanation (change in MDA values) reasonable for using the period 1956–1990 instead of 1956–1991 and considers this part of the issue resolved.
- The remaining issue can be addressed by a change in the statement in the footnote to Table 5-3 of ORAUT-TKBS-0013-5 concerning the maximum intake and dose.

**Current Status:** This is an internal dose issue to be resolved by rewording the footnote to Table 5-3 of ORAUT-TKBS-0013-5. This issue does not apply to TBD-6, or this report but was mentioned here because it was listed in the Pantex issues matrix.

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### 3.0 SUMMARY AND CONCLUSIONS

SC&A's reviewed the revised Pantex TBD-6 and found that all the site profile external dose issues have been resolved and recommends closure.

### 4.0 REFERENCES

NIOSH 2016a. *DCAS Responses to SCA Pantex Review 5-24-2016*, National Institute for Occupational Safety and Health, Division of Compensation Analysis and Support, Cincinnati, Ohio. May 24, 2016.

NIOSH 2016b. Transcript of the teleconference meeting of the Advisory Board on Radiation and Worker Health, *Pantex Plant Work Group*. August 4, 2016.

ORAUT-OTIB-0086. 2015. *Pantex External Coworker Model*, Revision 00, Oak Ridge Associated Universities Team, Oak Ridge, Tennessee. August 7, 2015.

ORAUT-TKBS-0013-5. 2015. *Technical Basis Document for the Pantex Plant – Occupational Internal Dose*, Revision 04, Oak Ridge Associated Universities Team, Cincinnati, Ohio. June 1, 2015.

ORAUT-TKBS-0013-6. 2006. *Technical Basis Document for the Pantex Plant – Occupational External Dose*, Revision 00, Oak Ridge Associated Universities Team, Cincinnati, Ohio. July 27, 2006.

ORAUT-TKBS-0013-6. 2007. *Technical Basis Document for the Pantex Plant – Occupational External Dose*, Revision 01, Oak Ridge Associated Universities Team, Cincinnati, Ohio. June 22, 2007.

ORAUT-TKBS-0013-6. 2015. *Technical Basis Document for the Pantex Plant – Occupational External Dose*, Revision 02, Oak Ridge Associated Universities Team, Cincinnati, Ohio. November 24, 2015.

ORAUT-TKBS-0013-6. 2016. *Technical Basis Document for the Pantex Plant – Occupational External Dose*, Revision 03, Oak Ridge Associated Universities Team, Cincinnati, Ohio. November 29, 2016.

SC&A 2015. *SC&A's Evaluation of the Pantex External Coworker Model: ORAUT-OTIB-0086*, Revision 0, SC&A, Inc., McLean, VA, and Saliant, Inc., Jefferson, MD. September 23, 2015.

SC&A 2016a. *SC&A's Evaluation of Revisions to Pantex Technical Basis Documents Relevant to Site Profile and SEC Issues: Technical Basis Documents Issues Matrix*, SC&A, Inc., McLean, VA, and Saliant, Inc., Jefferson, MD. June 16, 2016.

SC&A 2016b. *Pantex TBD and OTIB-0086 Neutron NTA Film Correction Factor Issues*, SC&A, Inc., McLean, VA, and Saliant, Inc., Jefferson, MD. October 19, 2016.

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## ATTACHMENT 1: PANTEX SITE PROFILE MATRIX (MAY 2016)

### SC&A'S EVALUATION OF REVISIONS TO PANTEX TECHNICAL BASIS DOCUMENTS RELEVANT TO SITE PROFILE AND SEC ISSUES: TECHNCIAL BASIS DOCUMENTS ISSUES MATRIX

TBD Number	SC&A Number	OTIB Issue	NIOSH Response	SC&A Response
6-1	1	<p><b>Site Profile Issue # 1</b></p> <p><b>Interpretation of external dosimetry data.</b> SC&amp;A could not find that NIOSH addressed the issue of recorded zeros (or other markings) in the records before 1989 in the revised ORAUT-TKBS-0013-6 (Revision 02). From reviewing OTIB-0086 (ORAUT 2015), SC&amp;A recommends that the DR consider the worker's job titles and dosimetry records in totality when evaluating recorded zeros (as well as blanks, dashes, and hash marks) for deciding whether to assign coworker, missed, or environmental external dose, because the electronic database may have inserted zeros for unmonitored workers after 1976.</p>	<p>Based on NIOSH's research, beginning in 1988 all personnel entering the controlled radiation areas were required to wear a personnel dosimeter. This was addressed with the publication of OTIB-0086 which specifies:</p> <p style="padding-left: 40px;">In such cases for years before 1988, NIOSH intends to apply (after consideration of the worker's job title and the totality of the monitoring record), either: 1) Unmonitored dose based on external coworker data listed in OTIB-0086 and Tables A-1 through A-3 of the Pantex External TBD, 2) Missed dose, or 3) Ambient dose.</p> <p>For 1988 and later years, all personnel who entered the operational areas of the plant were required to wear a dosimeter as a condition for entry. The absence of a listed result, or the presence of a dash, slash, or hash mark for a given dosimeter exchange cycle in 1988 and later years, should be interpreted to mean that the worker was not monitored because he or she was not present in the operational areas. Therefore, ambient dose should be assigned for those exchange cycles.</p>	<p>5/2016</p> <p>SC&amp;A found that NIOSH's response addressed the issue, except for:</p> <p>a) The fact the word "zero" was not specifically used when considering the worker's monitoring records. This is important because the electronic database may have inserted zeros for unmonitored workers after 1976.</p> <p>b) TBD-6, page 13 states that the year when all personnel entering a rad area were monitored was 1989. Which year, 1988 or 1989, is correct?</p>

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TBD Number	SC&A Number	OTIB Issue	NIOSH Response	SC&A Response
6-2	2	<p><b>2.0 Data do not support assumption that 95th percentile neutron-to-photon ratio is bounding for all exposure scenarios.</b> From reviewing the revised ORAUT-TKBS0013-6 (Revision 02) and the related document, OTIB-0086 (ORAUT 2015), SC&amp;A found that instead of using the n/p method, NIOSH recommends using the recorded neutron dose, with the NTA film results adjusted for energy response, angular response, and track fading. As previously summarized, and detailed in SC&amp;A's review of OTIB-0086 (SC&amp;A 2015), SC&amp;A does not find the neutron adjustment factors to be claimant favorable for Pantex workers.</p>	<p>NIOSH notes that the comments on the site profile document were similar in nature to those made during SC&amp;A's review of OTIB-0086 (ORAUT 2015). NIOSH recently determined that the Pantex Plant ended its contract with Landauer for NTA film at the end of 1973, and likely transitioned to TLDs in 1974 for neutron monitoring. As a consequence of this recent determination, NIOSH intends to revise OTIB-0086 and ORAUT-TKBS-0013-6 (Revision 02) to reflect the use of NTA film through 1973 and the use of TLDs for 1974 and subsequent years. NIOSH contends that the correction factors applied to the NTA film results to account for energy response, angular response, and track fading are favorable to claimants and are applicable through 1973.</p>	<p>5/2016 SC&amp;A will need to review the revised OTIB-0086 and TBD-6 to evaluate the changes made for the transition from NTA film to TLDs.  However, the NTA film correction factors recommended by NIOSH has not been justified and the issues raised by SC&amp;A are still applicable.</p>
5-6	3	<p><b>Site Profile Issue #3 Completeness and interpretation of historic radiological exposure sources.</b> SC&amp;A found that sections had been added to ORAUT-TKBS-0013-5, Revision 04 (2015), and ORAUTTKBS-0013-6, Revision 02 (2015), with information concerning Pantex's history and workers at other AEC/DOE facilities that resolves this issue.</p>	<p>No response necessary. SC&amp;A deems the issue resolved.</p>	<p>5/2016 SC&amp;A recommends closure.</p>

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TBD Number	SC&A Number	OTIB Issue	NIOSH Response	SC&A Response
5-4	4	<p><b>Site Profile Issue #4 (SEC Issue #15): Exposure from tritium.</b> SC&amp;A found that Revision 04 to ORAUT-TKBS0013-5 (mainly Table 5-3) provides for tritium dose assignments based on recorded MDA values and also simplifies tritium dose assignment for the DR and allows for consistence in dose assignments. SC&amp;A found this issue to be addressed, except for the statement in the footnote to Table 53 of ORAUT-TKBS-0013-5, Revision 04 (2015), concerning the maximum intake and dose, and the reason for using the period 1956–1990 instead of 1956–1991.</p>	<p>Although the sentence “Note that these values exceed any recorded doses or intakes the site reported for any year of operation, including 1989 when a major tritium released occurred.” is misleading, the listed maximum and mode annual intakes are greater than those listed in the ORAUT-TKBS0013-5, Revision 01 (2007). The footnote in the next revision of ORAUTTKBS-0013-5 will be revised to read “Note that these values exceed any recorded intakes the site reported for any year of operation, including 1989 when a major tritium released occurred.”</p> <p>All doses reflected in Table 5-3 of ORAUT-TKBS-0013-5, Revision 04 (2015) are based on the current ICRP Publication 68 tritium dose coefficients. Moreover, the ORAUT-TKBS-0013-5, Revision 04 (2015) Table 5-3 missed and/or unmonitored doses are only applied for those claimants with recorded zero results or reasonable expectation that they should have been monitored and were not. In cases where workers have recorded doses in excess of “zero” TEDE, then the dose reconstructor will assign tritium dose in accordance with the instructions listed in Attachment C, ORAUT-TKBS-0013-5, Revision 04 (2015).</p> <p>The rationale for assigning doses through 1990 based on an MDA of 0.500 uCi/L is based on a review of claimant records which showed that value to be the highest through 1990. For 1991 and all subsequent years, the highest listed MDA in claimant records listed was 0.135 uCi/L. The SEC dates were not considered for the time periods listed in Table 5-3.</p>	<p>5/2016 SC&amp;A agrees that the changing in wording would clarify the maximum 1989 dose and intake issue.</p> <p>SC&amp;A accepts the rational for using the period of 1956-1990, instead of 1991.</p> <p>This issue can be closed after the revision is made in the wording for the maximum intake.</p>

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