

 **Memorandum**

To: Nevada Test Site Work Group
From: SC&A, Inc.
Date: July 15, 2020
Subject: Summary and Status of Nevada Test Site Matrix Comments

The National Institute for Occupational Safety and Health (NIOSH) effected revision 04 of the Nevada Test Site (NTS) technical basis document (TBD) on occupational environmental dose, ORAUT-TKBS-0008-4, on February 19, 2020 (NIOSH, 2020). SC&A was tasked with reviewing the revised TBD with the narrow focus of the disposition of current SC&A findings related to the NTS site profile. This memorandum provides an abridged summary of the working NTS site profile matrix comments as well as SC&A's recommended status and current path forward (table 1). In compiling this summary document, SC&A considered previous versions of the NTS comment matrix (SC&A, 2016; NIOSH, 2015) as well as discussions held during the 2014 and 2017 meetings of the NTS Work Group (WG) (NTS WG, 2014, 2017).

DISCLAIMER: This is a working document provided by the Centers for Disease Control and Prevention (CDC) technical support contractor, SC&A, for use in discussions with the National Institute for Occupational Safety and Health (NIOSH) and the Advisory Board on Radiation and Worker Health (ABRWH), including its Working Groups or Subcommittees. Documents produced by SC&A, such as memorandum, white paper, draft or working documents are not final NIOSH or ABRWH products or positions, unless specifically marked as such. This document prepared by SC&A represents its preliminary evaluation on technical issues.

NOTICE: This document has been reviewed to identify and redact any information that is protected by the [Privacy Act 5 USC §552a](#) and has been cleared for distribution.

Table 1. Nevada Test Site – 2020 issues roadmap

Matrix comment #	Issue description	Status and/or SC&A recommended disposition
1	Some radionuclide lists are not complete. This is especially important for atmospheric testing and for early re-entry workers.	Comment 1 has been subsumed under comment 5 and was considered resolved during the December 3, 2014, WG meeting (NTS WG, 2014, p. 6). However, the comment does not appear to have been formally closed. SC&A recommends comment 1 be Closed by the NTS WG.
2	The TBD does not provide adequate guidance for dose estimation to gonads, skin, and gastro-intestinal (GI) tract for early reactor test re-entry personnel. Large hot-particle doses to skin and GI tract have not been evaluated. Naval Radiological Defense Laboratory (NRDL) documents and models have not been evaluated, though one document is referenced.	Comment 2 has been resolved pending revision of the occupational external dose TBD to include the dose reconstruction methods using NRDL data when applicable to the energy employee. The proposed use of the NRDL methods was outlined by NIOSH (2015). Although the occupational external dose TBD has not yet been revised, this issue was closed during the December 2014 WG meeting (NTS WG, 2014, p. 26). Comment 2 is Closed.
3	Doses from large (nonrespirable) particles to the GI tract and skin for workers in the early atmospheric test period have not been evaluated. These doses could be high. Hot-particle doses also need to be evaluated for early drillback and other early re-entry workers during underground testing periods.	Comment 3 has been resolved based on the discussion during the December 2014 WG meeting along with the text on page 58 of the NTS site profile occupational external dose TBD, rev. 03 (NIOSH, 2012). The generic oro-nasal breathing issue is pending on a complexwide basis. Comment 3 is Closed.
4	Ingestion of nonrespirable hot particles by reactor testing and nuclear weapons testing workers due to oro-nasal breathing needs to be evaluated.	Comment 4 has been thoroughly discussed and subsumed under comments 2 and 3. However, this issue has not been formally closed by the NTS WG. SC&A recommends comment 4 be Closed by the WG.

Matrix comment #	Issue description	Status and/or SC&A recommended disposition
5	Resuspension model and resuspension factor are not scientifically defensible or claimant favorable, due to a variety of factors. Doses may be underestimated by an order of magnitude or more. Mass-loading approach would be preferable for internal dose.	<p>Three main items resulted from 2017 WG discussions:</p> <ul style="list-style-type: none"> A. Period from July 1962 to December 31, 1962: SC&A accepts the NIOSH position and legal determination that environmental doses during this period are covered by the Special Exposure Cohort (SEC). Therefore, no internal environmental dose reconstructions can be performed for this period. SC&A considers this issue closed per the WG discussion in January 2017. B. SC&A accepts the use of the plutonium hotspot determined from available 1971–2001 data as the basis for environmental dose in the 1963–1992 period. However, SC&A recommends that the issue of correct evaluation of refractories and appropriate renormalization for use with the Hicks tables be undertaken. NIOSH is to provide the calculations to facilitate discussions related to the potential need for renormalization of the source term. In addition, NIOSH is to provide (1) specific information on how IMBA calculations were performed and (2) intermediate results. C. NIOSH is to provide a short memorandum on the appropriateness of using the Sedan event as a possible source term for environmental internal doses in the 1963–1992 period. <p>Since the 2017 WG meeting, NIOSH has transmitted the appropriate materials to SC&A. A technical teleconference was held with the WG on June 26, 2017, at which time the technical questions associated with Item 5B were resolved. However, Item 5C was not discussed during the 2017 technical call, and a memorandum from NIOSH concerning the applicability of the Sedan event has not yet been delivered.</p> <p>Finally, the recommended dose reconstruction procedure/instructions for assigning environmental intakes has not been included in the updated TBD. The dose reconstruction instructions were contained in the NIOSH white paper, “NIOSH Response to Inconsistency Issues Raised in Comment 8 of SC&A’s NTS Resuspension Issues Status Report,” which concluded that such instructions would be included in forthcoming TBD revisions (NIOSH, 2016).</p> <p>SC&A recommends comment 5 remain In Progress pending WG discussion.</p>
6	The use of the site average air concentration values when worker location is not known is not claimant favorable. Largest value consistent with job-type data should be used in such cases.	<p>Comment 6 has been thoroughly discussed and subsumed under comment 5. However, this issue has not been formally closed by the NTS WG.</p> <p>SC&A recommends comment 6 be Closed by the WG.</p>

Matrix comment #	Issue description	Status and/or SC&A recommended disposition
7	Resuspension doses to monitored workers, especially early re-entry workers, may be underestimated, due to the presence of short-lived radionuclides and higher resuspension expected in the days and months after a test (including safety tests). TBD does not specify procedures for estimating environmental internal doses in such cases.	Comment 7 has been thoroughly discussed and subsumed under comment 5. However, this issue has not been formally closed by the NTS WG. SC&A recommends comment 7 be Closed by the WG.
8	Use of 1967 external dose data for 1963–1966 is not claimant favorable. There was no test in 1967 with measurable offsite fallout. Relatively short-lived radionuclides, which were likely present in 1963–1966, would have substantially decayed away by 1967.	Comment 8 was closed by the WG during the December 3, 2014, meeting (NTS WG, 2014, p. 84). Comment 8 is Closed.
9	Lack of environmental external dose data for 1968–1976 is puzzling. TBD has not specified an approach to estimating external environmental dose for this period. Venting in the 1968–1970 period likely made external dose in that period (and possibly beyond) higher than 1967.	Comment 9 was closed by the WG during the December 3, 2014, meeting (NTS WG, 2014, p. 84). Comment 9 is Closed.
10	The TBD does not provide any guidance for pre-1963 external environmental dose. Issues relating to unmonitored workers, as well as time of entry into contaminated areas, could be important.	Comment 10 has been resolved pending revision of the occupational external dose TBD to include external co-exposure doses modified to include an evaluation of missed dose. SC&A recommends comment 10 remain In Abeyance pending revision to the occupational external dose TBD.
11	Correction factors for external environmental dose due to geometry of organ relative to badge, and angular dependence of the dose conversion factor need to be developed.	SC&A produced a memorandum in May 2017 (SC&A, 2017a) documenting its main concerns regarding methods for reconstructing beta dose using a beta/gamma ratio. In November 2017, NIOSH produced a white paper (NIOSH, 2017) detailing new methods to address the reconstruction of extremity doses for workers in direct handling occupations (e.g., device assembly) as well as the lack of external dosimetry measurements for beta particles prior to 1966. SC&A reviewed the new methods outlined by NIOSH (2017) in a white paper response dated June 11, 2018 (SC&A, 2018). Neither the newly proposed methods presented by NIOSH (2017) nor SC&A's (2018) review of those methods have been discussed by the NTS WG. SC&A recommends comment 11 remain In Progress pending WG discussion.

Matrix comment #	Issue description	Status and/or SC&A recommended disposition
12	Radon doses in G-Tunnel are not claimant favorable. Gravel Gertie radon doses are not discussed and could be substantial. (Site status of gravel gertie workers needs clarification.)	<p>Following the January 2017 WG meeting, NIOSH was to provide updated methodology and guidance for identifying workers who potentially entered the Gravel Gerties and thus should be assigned radon and thoron exposure.</p> <p>Section 4.4.4 of revision 04 of the environmental dose TBD (NIOSH, 2020) gives revised guidance for workers who were potentially exposed to radon, thoron, and their associated progeny. The NIOSH (2020) guidance continues to state that workers who have spent significant time in the gravel gerties may be identified through dosimetry records or telephone interviews (Note: the guidance on identifying gravel gertie workers remains unchanged from revision 03).</p> <p>No specific list of job titles or examples of relevant job titles are included in the updated guidance as was discussed and agreed upon during the January 2017 WG meeting (NTS WG, 2017, pp. 208–213). Therefore, SC&A believes this issue should remain In Abeyance as indicated during the NTS WG meeting in 2017 (NTS WG, 2017, p. 213).</p> <p>SC&A recommends comment 12 remain In Abeyance pending WG discussion.</p>
13	Environmental doses due to iodine-131 venting need to be taken into account for nonmonitored workers	<p>Comment 13 was closed by the WG during the January 2017 WG meeting (NTS WG, 2017, p. 94)</p> <p>Comment 13 is Closed.</p>
14	There are no internal monitoring data until late 1955 or 1956; some plutonium (Pu) from then on; some tritium from 1958; Pu, tritium, and mixed fission products from 1961; and full radionuclide coverage established in about 1967. The TBD does not provide significant guidance for estimating internal dose for the pre-1967 periods for many radionuclides	<p>This issue was closed during the December 2014 WG meeting due to the designation of an SEC from the beginning of operations through September 30, 1992 (NTS WG, 2014, p. 143).</p> <p>Comment 14 is Closed.</p>
15	Resuspension of radionuclides by the blast wave, fractionation of relatively nonvolatile radionuclides, and the variability of cesium-137 to strontium-90 ratios need to be taken into account in internal dose estimation.	<p>Comment 15 has been thoroughly discussed and subsumed under comment 5. However, this issue has not been formally closed by the NTS WG.</p> <p>SC&A recommends comment 15 be Closed by the WG.</p>
16	Use of photon dose, as done by Defense Threat Reduction Agency, as the basis for estimating internal dose during periods when there are no data or scattered internal monitoring data has significant uncertainties. These uncertainties are compounded by the data integrity issue associated with NTS (refer to comment 20 below).	<p>Comment 16 was closed during the December 2014 WG meeting due to the designation of an SEC from the beginning of operations through September 30, 1992 (NTS WG, 2014, p. 143).</p> <p>Comment 16 is Closed.</p>

Matrix comment #	Issue description	Status and/or SC&A recommended disposition
17	Ingestion doses need to be better evaluated.	<p>Comment 17 has been thoroughly discussed and subsumed under comment 5. However, this issue has not been formally closed by the NTS WG.</p> <p>SC&A recommends comment 17 be Closed by the WG.</p>
18	<p>Recommended use of ORAUT-OTIB-0002 for post-1971 tunnel re-entry workers is contrary to guidance in that document, and its scientific validity has not been established. Its use may not be satisfactory even with restrictions, for instance, for reactor testing early re-entry workers.</p>	<p>Comment 18 was closed by the WG during the December 3, 2014, meeting (NTS WG, 2014, p. 144).</p> <p>Comment 18 is Closed.</p>
19	<p>There are no beta dose data until 1966; the TBD does not specify a procedure for estimating pre-1966 beta dose. When the approach is developed, the large hot-particle issue will need to be taken into account.</p>	<p>This issue has been subsumed under comment 11; however, the issue has not been formally closed out by the NTS WG.</p> <p>SC&A recommends comment 19 be Closed by the WG.</p>
20	<p>There appears to have been intentional non-use of badges in some circumstances to avoid approaching or exceeding operational dose limits. The practice may have occurred until the mid-1960s or even extended into the 1970s. NIOSH has not investigated this problem, which raises questions about the integrity of the external dose record possibly into the 1970s, which need to be explicitly addressed.</p>	<p>Comment 20 was closed by the WG during the December 3, 2014, meeting (NTS WG, 2014, p. 146).</p> <p>Comment 20 is Closed.</p>
21	<p>The TBD does not contain information about extremity dosimetry. Site status of bomb assembly workers is unclear.</p>	<p>Following the January 2017 meeting, NIOSH was to provide generic guidance on the reconstruction of cancers that appear on the extremities. NIOSH produced a white paper (NIOSH, 2017) detailing new methods to address the reconstruction of extremity doses for workers in direct handling occupations (e.g., device assembly).</p> <p>SC&A reviewed the new methods outlined by NIOSH (2017) in a white paper response dated June 11, 2018 (SC&A, 2018). Neither the newly proposed methods presented by NIOSH (2017) nor SC&A's (2018) review of those methods have been discussed by the NTS WG.</p> <p>SC&A recommends comment 21 remain In Progress pending WG discussion.</p>
22	<p>There are no neutron dose data until 1966, and partial data until 1979.</p> <p>TBD assertion that neutron doses during atmospheric testing were negligible has not been substantiated and may be in error for some workers.</p>	<p>Per discussion during the January 2017 meeting, NIOSH proposes to use neutron co-exposure models developed for the Pantex site. SC&A concurs with this approach, which is dependent on revision of the occupational external dose TBD.</p> <p>SC&A recommends comment 22 be put In Abeyance pending revision of the occupational external dose TBD.</p>

Matrix comment #	Issue description	Status and/or SC&A recommended disposition
23	Adequacy of soil data for estimating resuspension doses needs to be evaluated, for instance, in relation to hot spot detection and Pu soil data.	Comment 23 has been subsumed under comment 5 and was closed during the January 2017 WG meeting (NTS WG, 2017, p. 236). Comment 23 is Closed.
24	The presence of high-fired oxides resulting from atmospheric weapons testing and reactor testing needs to be investigated.	Comment 24 was closed by the WG during the December 3, 2014, meeting (NTS WG, 2014, p. 164). Comment 24 is Closed.
25	NIOSH documentation of site expert interviews is inadequate, and crucial site expert interviews have not been performed or performed in an incomplete manner. Potentially critical archives and documents have not been reviewed, including the NRDL.	Comment 25 was closed by the WG during the December 3, 2014, meeting (NTS WG, 2014, p. 165). Comment 25 is Closed.
26	A number of issues in relation to waste handling, decommissioning, and other post-1992 site activities were reviewed by SC&A in SC&A (2005) or during the SEC review.	Following discussions during the January 2017 meeting, SC&A was tasked with reviewing post-1992 issues involving waste disposal in relation to the pertinent sections of the TBD and other documents provided by NIOSH. SC&A provided its review on June 12, 2017, in its white paper, "Nevada Test Site: Review of Site Profile Comment 26" (SC&A, 2017b). This review has not been yet been discussed by the NTS WG. SC&A recommends comment 26 remain In Progress pending WG discussion.

References

National Institute for Occupational Safety and Health (NIOSH). (2012). *Nevada Test Site – Occupational external dose* (ORAUT-TKBS-0008-6, rev. 03).
<https://www.cdc.gov/niosh/ocas/pdfs/tbd/nts6-r3.pdf>

National Institute for Occupational Safety and Health (NIOSH). (2015). Privacy Act Protected-- NIOSH response to the 121412 SCA Update of the NTS Resolution Matrix - response to action items from 12-3-14 NTS WG Mtg- FINAL - 4-21-15 [Microsoft Word file].

National Institute for Occupational Safety and Health (NIOSH). (2016). *NIOSH response to inconsistency issues raised in comment 8 of SC&A's NTS resuspension issues status report* (rev. 0) [White paper]. <https://www.cdc.gov/niosh/ocas/pdfs/dps/dc-ntscmt8-060616.pdf>

National Institute for Occupational Safety and Health (NIOSH). (2017). *Determination of NTS beta-to-photon ratio and beta dose for 1963–1966, and determination of an extremity to whole-body ratio using quantile regression and imputation methods*.
<https://www.cdc.gov/niosh/ocas/pdfs/dps/dc-ntsbetphot-111417-508.pdf>

National Institute for Occupational Safety and Health (NIOSH). (2020). *Nevada Test Site – Occupational environmental dose* (ORAUT-TKBS-0008-4, rev. 04).
<https://www.cdc.gov/niosh/ocas/pdfs/tbd/nts4-r4-508.pdf>

Nevada Test Site Work Group (NTS WG). (2014). *Advisory Board on Radiation and Worker Health Work Group on Nevada Test Site Wednesday, December 3, 2014* [Transcript]. Hebron, KY. <https://www.cdc.gov/niosh/ocas/pdfs/abrwh/2014/wgtr120314.pdf>

Nevada Test Site Work Group (NTS WG). (2017). *Advisory Board on Radiation and Worker Health Nevada Test Site Work Group Thursday January 5, 2017* [Transcript]. Hebron, KY. <https://www.cdc.gov/niosh/ocas/pdfs/abrwh/2017/wgtr010517.pdf>

SC&A, Inc. (2005). *Review of the NIOSH site profile for the Nevada Test Site* (SCA-TR-TASK1-0006, rev. 0). <https://www.cdc.gov/niosh/ocas/pdfs/abrwh/scarpts/sca-ntssp-r0.pdf>

SC&A, Inc. (2016). *NTS site profile matrix comments and December 2016 update by SC&A* [Memorandum]. <https://www.cdc.gov/niosh/ocas/pdfs/abrwh/scarpts/sca-ntsspirm-122916.pdf>

SC&A, Inc. (2017a). *SC&A concerns regarding the use of a beta/gamma ratio to determine external dose* [Memorandum]. <https://www.cdc.gov/niosh/ocas/pdfs/abrwh/scarpts/sca-ntsbetgam-050917.pdf>

SC&A, Inc. (2017b). *Nevada Test Site: Review of site profile comment 26* (SCA-TR-2017-SP003, rev. 0). SRDB upload pending

SC&A, Inc. (2018). *Comments on NIOSH's "Determination of NTS beta-to-photon ratio and beta dose for 1963–1966, and determination of an extremity to whole-body ratio using quantile regression and imputation methods" (2017)* (SCA-TR-2018-SP002, rev. 0 PC-1).
<https://www.cdc.gov/niosh/ocas/pdfs/abrwh/scarpts/sca-ntsbetaextremity-r0-pc1-508.pdf>