

NIOSH Response to Inconsistency Issues Raised in Comment 8 of SC&A's NTS Resuspension Issues Status Report

**White Paper
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PURPOSE

This white paper addresses the inconsistencies between guidance provided in the *Nevada Test Site Technical Basis Document – Occupational Environmental Dose* (ORAUT 2012a) and historical dose reconstructions performed for energy employees (EEs) at the Nevada Test Site. The inconsistencies were cited in Comment 8 and discussed in more detail in Section 6 of SC&A's *Status Report on Resuspension Issues at the Nevada Test Site* (SC&A 2015). This white paper will also discuss various approaches used in the past for reconstructing doses from environmental intakes of radioactive materials as well as the approaches recommended for the future.

BACKGROUND

Over the years of dose reconstruction for Nevada Test Site (NTS) employees, the methods used to account for possible environmental intakes have changed. In the early years when the active case backlog was large, the emphasis was on completing dose reconstructions as efficiently as possible while assuring that assigned doses were claimant favorable. To assist in producing claimant-favorable dose reconstructions in a timely fashion, a number of efficiency methods were approved which, in some cases, resulted in relatively large doses being assigned to non-compensable cases.

As the dose reconstruction project evolved and the active case backlog was lowered, the emphasis changed somewhat; dose reconstructions were expected to reflect more reasonable assigned doses for non-compensable claims while still maintaining claimant favorability. This change in emphasis precluded the use of some efficiency methods altogether while limiting the application of others. One such efficiency method is described in the *Technical Information Bulletin: Internal Dose Overestimates for Facilities with Air Sampling Programs* (ORAUT 2005). This technical information bulletin (OTIB-0018) provided a method for estimating intakes of radioactive particulate material and the resultant internal doses for use when overestimated doses are acceptable (i.e., non-compensable case when best estimates are not required). The method described in OTIB-0018 overestimates the internal dose by assuming 2,000-hour-per-year exposure at the limiting airborne concentration of various alpha- and beta-emitting radionuclides, as provided in various guidance documents (NBS 1953, NBS 1959, ICPR 1959, AEC 1968, and DOE 1988). In addition, rather than estimating radionuclide fractions, OTIB-0018 overestimates the internal dose by assigning 100% of the intake to the single radionuclide that produces the largest dose per unit intake to the organ of concern. Also, recognizing that the highest dose radionuclide could change over years of exposure, adjustments in the limiting radionuclides are made, as appropriate, on a year-by-year basis based on the highest dose radionuclide and absorption type, thus assuring the internal dose to the organ of interest is overestimated.

With regard to the NTS, the application of OTIB-0018 intakes are precluded during the period of atmospheric testing (i.e., prior to 1963). As stated in OTIB-0018 (ORAUT 2005, page 35):

These tests had the potential to create high airborne concentrations for relatively short periods. While it is possible that the continuous assumption made in this TIB will overestimate these intermittent exposures, further evaluation is necessary to verify this. Therefore, this TIB is not currently applicable to exposures at the Nevada Test Site prior to 1963.

SUMMARY OF THE ISSUES

Comment 8 in SC&A's Status Report on Resuspension Issues at the Nevada Test Site (SC&A 2015) reads:

8. A comparison of actual NIOSH dose reconstructions with the guidance provided in the TBD reveals that there are discrepancies and inconsistencies between the TBD guidance and the actual dose reconstructions. These inconsistencies need to be discussed with the WG.

Section 6.0 of that status report provided the results of SC&A's examination of claim files of energy employees (EEs) who were on-site after 1962 and had a probability of causation (POC) less than 50%. As stated in the report, these criteria were chosen to target the NTS claimants who were likely to have environmental doses assigned per the TBD. In addition, SC&A only considered cases evaluated after *Technical Basis Document for the Nevada Test Site – Occupational Environmental Dose* (ORAUT 2012a) was approved. A total of 241 claimants were identified and their dose reconstruction documentation examined. Table 5 of the SC&A status report provides a summary of observations concerning the assignment of ambient environmental internal doses to the NTS claims that were examined. Table 5 is reproduced below:

Table 5: Observations Concerning Ambient Environmental Dose Assignment to NTS Claimants

Observation	Description	Case Examples Provided
1a	OTIB-0018 was utilized instead of environmental intakes when the NTS employment period coincided with employment at another site (LLNL, LANL, SNL etc.).	7
1b	OTIB-0018 was applied instead of environmental intakes when employment was at NTS and not another site.	11
2a	Some employment periods after 1963 were not assigned environmental intakes, because there was no dosimeter assigned to the EE for those periods.	3
2b	Lack of a dosimeter during certain employment periods after 1963 was not always used to preclude the assignment of environmental intakes.	4
3	In some cases, OTIB-0018 was applied, but only for years after 1963.	9

Observation	Description	Case Examples Provided
4	Four cases assigned only 10% of the environmental intake values. Only one of the four cases specifically mentioned this in the DR Report. Two of the four cases had POC values that were less than 10%; the other two were above 45%.	4
5	Many cases did not evaluate ambient internal dose during NTS employment and cited the SEC and/or the lack of bioassay in the dose reconstruction report.	10
6	One case assigned full environmental intakes from 1966–1989, although the EE's covered employment was only for a single day in 1971 and 1982.	1
7	Several cases did not apply NTS environmental intakes and instead applied Tonopah Test Range (TTR) intake values, which are significantly lower than NTS intake rates (See Table 1). Not all of these observed cases had overlapping employment at NTS/TTR.	6
8	Both OTIB-0018 and environmental intakes were assigned to the same employment period in one case. However, the environmental intakes did not include plutonium (inhalation of ingestion) or americium (inhalation only).	1
9a	Some cases were not assigned environmental intakes, because the doses were deemed too low based on the short duration of covered employment.	5
9b	Some cases were assigned full years' worth of environmental intakes even though covered employment was of short duration.	5

NIOSH RESPONSE TO COMMENT 8

Historical Application of OTIB-0018 Intakes at the NTS

As previously stated, OTIB-0018 provided a method for estimating intakes of radioactive particulate material and the resultant internal doses for use when overestimated doses are acceptable (i.e., non-compensable case when best estimates are not required). The purpose of OTIB-0018 was to facilitate efficient processing of claims with bioassay results (*in vivo* and *in vitro*) that were less than the minimum level of detection (i.e., <MDA), or that had relatively-low positive results reported (see Tables 7-1 and 7-2 of ORAUT 2005).

Project guidance allowed the application of OTIB-0018 intakes at all sites that had air sampling programs in lieu of evaluating relatively-low positive bioassay results or results that were <MDA. In addition, project guidance allowed for OTIB-0018 intakes to also be applied at all sites that had air sampling programs in lieu of environmental intakes (Observation 1b in Table 5 above). These intakes were of such magnitude when compared to environmental intakes that it was deemed acceptable to apply OTIB-0018 intakes for one site (e.g., the NTS) in lieu of environmental intakes at other sites (e.g., LLNL, LANL, SNL, etc.) when employment at the other sites was relatively short compared to the site where the OTIB-0018 intakes were applied (e.g., the NTS [Observation 1a above]). However, for claimant favorability, project guidance did not preclude the assignment of environmental intakes when OTIB-0018 intakes were applied

(Observation 8 above). In some cases, alpha emitters (e.g., plutonium and americium) were omitted from the environmental intakes when OTIB-0018 intakes were applied because the OTIB-0018 intakes already considered their application and had either chosen them or had determined another alpha emitter resulted in a higher dose and had applied it instead of either americium or plutonium (Observation 8 above).

Prior to 2010, OTIB-0018 intakes were routinely applied after 1962 to eligible cases (non-compensable case when best estimates are not required) in lieu of evaluating bioassay results (*in vivo* and *in vitro*) that were <MDA or had relatively low positive results reported. Because of the SEC (Leavitt 2006) in place, no internal dose was assigned prior to 1963 in the absence of bioassay results. With the approval of the second SEC (Sebelius 2010), because OTIB-0018 intakes were not specifically allowed by the SEC, OTIB-0018 intakes were no longer applied from 1963 through to the end of the second SEC in 1992. Because the second SEC ended in 1992, OTIB-0018 intakes are allowed from 1993 through to the present day (Observation 3 above).

Historical Application of Ambient Environmental Intakes at the NTS

With the 2004 publication of the *Technical Basis Document for the Nevada Test Site – Occupational Environmental Dose* (ORAUT-TKBS-0008-4), ambient environmental intakes were defined for assignment beginning in 1963 to the present day. In the early years of dose reconstruction for NTS workers, environmental intakes were assigned for claims in the absence of bioassay data, and in the event that OTIB-0018 intakes were not assigned. If bioassay data were available and evaluated by assuming chronic intakes (either positive or missed) over the worker's entire employment period, environmental intakes were typically not assigned. However, once the environmental intakes had been incorporated into the chronic intake tool (CAD tool), the environmental intakes were assigned in addition to bioassay-based chronic intakes for claimant favorability (Observation 9a above). Because there is currently no approved method to prorate intakes for partial years of employment, the environmental intakes assigned by the CAD tool are assumed to occur for the entire year. This assumption also applied to short employment periods (Observations 6 and 9b above). However, for very short visits to the NTS (typically less than several weeks), environmental intakes were sometimes omitted because the resultant dose was less than 0.001 rem and deemed unimportant to overall dose (Observation 9a above). It should be noted that, even with the assignment of multiple years of environmental intakes, the resultant dose to a non-presumptive cancer's organ would typically be less than 0.005 rem.

The assignment of ambient environmental intakes ceased with the approval of the second SEC in 2010. The interpretation of this SEC was that it precluded the assignment of all internal dose in the absence of bioassay data, including the internal dose resulting from the assignment of environmental intakes (Observation 2b and 5 above). However, in 2012, project guidance provided an updated interpretation of the limitations of the SEC (Sebelius 2010), that allowed assignment of environmental internal dose because approved methods (ORAUT 2010) had been developed allowing for the derivation of environmental intakes and their resultant doses.

An additional reason for not assigning environmental intakes was the absence of dosimeter badging. On April 1, 1957, the NTS issue card system came on line. All persons entering NTS had to have a film badge with the correct monthly color-coding on the badge exterior. An individual working in a radiation exclusion area could have many more than 12 badges for the year because, if the pocket dosimeter indicated a possible exposure on the work shift, the film dosimeter was pulled and replaced. From April 1957 through the end of testing in 1992, all NTS personnel had dosimeters. The front gate security officer would check to make sure each badge had the proper color. If it did not, it was necessary to go to the Badge Office in Building 1000 at the gate to get a current badge (ORAUT 2012a). With these checks in place, it was not possible to pass the NTS boundary without a dosimeter. Therefore, the absence of dosimeter data from April 1, 1957 through to the end of 1992 is interpreted as evidence that the worker was not on-site, but probably, at the operations office in Las Vegas (if NTS employment was indicated by the DOL). Thus, environmental intakes derived for individuals not on-site are not assigned for these periods (Observations 2a and 2b above).

Lastly, for the Tonopah Test Range (TTR), ambient environmental intakes for Pu-238, Pu-239, and Am-241 have been evaluated and documented (ORAUT 2013). These intakes represent a small fraction of the intakes of these radionuclides compared to intakes of similar radionuclides at the NTS. Because the TTR borders the NTS, most TTR workers also had employment at the NTS. For claimant favorability, when employment at the two sites overlapped, the NTS intakes are typically applied. If only employment at the TTR is verified, only the TTR intakes should be applied. However, for cases where a best estimate is not required, the NTS environmental intakes may be applied (Observation 7 above). This will result in a reasonable overestimate of ambient environmental internal dose.

Path Forward for Application of OTIB-0018 Intakes at the NTS

Current guidance allows for the assignment of OTIB-0018 intakes after 1992 in lieu of evaluating relatively-low positive bioassay results, or results that were <MDA for eligible claims (i.e., non-compensable case when best estimates are not required). In addition, when OTIB-0018 intakes are assigned, environmental intakes do not need to be assigned. However, for claimant favorability, assignment of environmental intakes in addition to OTIB-0018 intakes is allowed (Observations 3 and 8 above)

Path forward for the Application of Ambient Environmental Intakes at the NTS

Generally, ambient environmental intakes are being applied to all cases starting in 1963. Exceptions are those cases and time periods for which OTIB-0018 intakes have been applied (after 1992), and cases for which OTIB-0018 intakes have not been applied but the calculated probability of causation (POC) is greater than 52 percent. However, for claimant favorability, the assignment of environmental intakes for these cases is not precluded. The resultant doses will be applied as a constant since the intakes given in Tables 4-7 and 4-11 of the NTS environmental dose TBD are considered bounding (ORAUT 2012a).

For cases for which a best estimate is required, 10 percent of the Table 4-7 and 4-11 intakes will be applied (Observation 4 above) and the resultant doses will be applied as lognormal distributions with a geometric standard distribution of 3.0, per the site profile and TBD development procedure (ORAUT 2012b).

For short duration employment/visits to the NTS (typically less than a single month in any given year), in which the assignment of environmental intakes would result in internal dose of less than 0.001 rem, the environmental intakes do not need to be evaluated, because these doses would not affect the overall dose to the organ(s), or significantly affect the probability of causation.

CONCLUSIONS AND RECOMMENDATIONS

NIOSH agrees that, over the years, the lack of detailed instructions and the evolution of project- and NTS-specific guidance has resulted in inconsistencies in the manner in which OTIB-0018 and environmental intakes are assigned and the resultant doses evaluated. However, these inconsistencies have not resulted in any discernible effect on case decisions.

Going forward, to assure consistency, revisions will be made to Section § 4.5.2 of the NTS environmental TBD (ORAUT 2012a) to contain the following instructions to DRs:

- Assign environmental intakes for all employees who were issued dosimetry at NTS between 1963 and 1992 and to all employees after 1993.
- Beginning in 1993, OTIB-0018 can be applied in lieu of environmental intakes as an overestimating technique for cases that do not require a best estimate.
- Beginning in 1993, OTIB-0018 intakes may be applied in lieu of evaluating claims that had bioassay results (*in vivo* and *in vitro*) that were less than the minimum level of detection (i.e., <MDA), or had relatively-low positive results reported (see Tables 7-1 and 7-2 of ORAUT 2005).
- When OTIB-0018 intakes are assigned, environmental intakes do not need to be assigned but may be assigned for claimant favorability.
- If the EE's employment periods for the Tonopah Test Range (TTR) and the NTS overlap for less than a year, the NTS environmental intakes may be assigned for the entire employment periods for claimant favorability.
- For short duration employment/visits to the NTS (typically less than a single month in any given year), in which the assignment of environmental intakes would result in internal dose of less than 0.001 rem, the environmental intakes do not need to be evaluated, because these doses would not affect the overall dose to the organ(s).
- If there was only employment at the TTR, or employment at the TTR for more than a year that did not overlap with employment at the NTS, the TTR environmental intakes should be assigned.
- Prior to 1993, for periods greater than a year, if no external dosimeter data are available, the assumption should be made that the EE was not on-site at the NTS and environmental intakes should not be assigned. However, for these periods, environmental intakes may be assigned for claimant favorability for cases that do not require a best estimate.

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