



Dose Reconstruction Template Review for the Albuquerque Operations Office

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Review chronology of AOO dose reconstruction methodology and template

- ◆ No technical basis document (TBD) for Albuquerque Operations Office (AOO). Instead, NIOSH developed:
 - “Dose Reconstruction Methodology for the Albuquerque Operations Office” (“AOO DR methodology document”)
 - DR template with facility-specific data, assumptions, and references that provide basis for dose reconstruction
- ◆ **2/16/2023**: SC&A tasked to review DR template/methodology for AOO
- ◆ **10/25/2023**: SC&A submitted review of AOO DR methodology document and DR template “DR Draft RSET AOO 2.0.doc”

AOO facility description

- ◆ AOO is major defense program field organization in the U.S. Department of Energy (DOE)
- ◆ Originated during World War II as the Los Alamos “Z” division, the engineering branch of the project
- ◆ After establishment of the Atomic Energy Commission in 1946, it was called the Santa Fe Operations Office
- ◆ Office moved to Albuquerque in 1951 and in 1956, became the AOO
- ◆ AOO’s primary mission continues to be stewardship and maintenance of the nation’s nuclear weapons stockpile
- ◆ Operational period from 1942 through the present date

SC&A's evaluation of AOO facility description

- ◆ Neither AOO DR methodology document nor DR template give any references for the information provided in the facility description
- ◆ SC&A searched the SRDB, NIOSH website, and Sandia National Laboratories (SNL) and Los Alamos National Laboratory (LANL) TBDs and was unable to find any site description
- ◆ SC&A did find the exact same facility description on the [Energy Employee Claimant Assistance Project](#) website
- ◆ Although AOO history and location information was sparse, SC&A did not identify any contradictory information about the facility description
- ◆ No findings or observations

AOO dose reconstruction guidance

- ◆ Since site was in two locations during its history, DR methodology assesses doses for two time periods:
 - 1942 through 1951, when the facility is presumed to have been located on the LANL site
 - 1952 through the present date, when the office was relocated to Kirtland Air Force base in Albuquerque, NM
- ◆ Dosimetry records for AOO exist as a compendium of exposures from other sites
- ◆ No one received occupational internal or external exposures while working in the AOO
- ◆ Measured and missed internal and external exposures are assigned using the guidance of existing TBDs for the site where the worker received the exposure
- ◆ Only potential **environmental** exposure, **radon** exposure, and **x-ray** doses are addressed in AOO DR methodology document

SC&A's review of AOO dose reconstruction guidance

- ◆ SC&A found it appropriate to assign external and internal doses from other DOE sites where the energy employee (EE) may have been exposed
- ◆ For workers at the AOO site, it would be reasonable to assign potential environmental exposure, radon exposure, and occupational medical x-ray dose
- ◆ SC&A found it appropriate to assign environmental, radon, and occupational medical x-ray doses for 1942–1951 using LANL data and for 1952–present using SNL data

SC&A's review of external and internal doses using LANL data for 1942–1951

- ◆ SC&A reviewed recommendations in the DR methodology document for 1942–1951
- ◆ SC&A reviewed information in the DR template and compared it to the DR methodology document and LANL TBD
- ◆ SC&A had two findings and one observation

Finding 1

The DR template incorrectly states onsite ambient dose should be assigned for 1944–1951 rather than 1942–1951

- ◆ AOO DR methodology document lists operational period start date of 1942
- ◆ DOE-covered period is 1942 to the present for the AOO
- ◆ Contradiction: DR methodology document states to use LANL environmental exposures starting in 1942, but LANL TBD-2 states LANL was not established until 1943

Finding 2

Issue with AOO
template table 4B-1
reference

- ◆ Table 4B-1 is listed on page 71 of ORAUT-TKBS-0010-4, **revision 00**
- ◆ AOO DR template references ORAUT-TKBS-0010-4, **revision 01**, which does not contain table 4B-1 nor a table with the same intake values
- ◆ Issue could cause outdated, incorrect, or inconsistent environmental intake values to be used in AOO DRs

Observation 1

DR methodology document does not specify which sitewide ambient data are to be assigned

- ◆ Table 4-26 of the current LANL environmental dose TBD-4, revision 01, provides both a **sitewide maximum** and a **geometric mean** annual external dose
- ◆ AOO DR template specifies using the maximum sitewide value
- ◆ The DR methodology document does not specify which sitewide data are to be assigned and is therefore inconsistent with the DR template

SC&A's review of environmental external and internal doses using SNL data 1952 to present

- ◆ DR methodology document indicates no external or internal ambient exposure from SNL could result in significant doses to employees at the AOO site located several miles away
- ◆ Maximum ambient external dose rate at SNL is 10 mrem per year
 - Considering dose would fall off as a function of 1 over the distance squared, SC&A determined the dose rate at the AOO site several miles away would not be dosimetrically significant (<1 mrem per year)
- ◆ Maximum annual intakes at SNL are relatively small
 - SC&A ran long-term SNL environmental intake exposure scenarios (1973–2000, 28 years) in the chronic annual dose tool for eight different organs with a 10-year latent period and found that the average annual dose was less than 1 mrem to most organs
- ◆ SC&A has no findings or observations on the guidance for not assigning occupational environmental doses after 1951

SC&A's review of occupational medical dose assignment 1952 to present

- ◆ DR methodology document recommends assigning an annual posterior-anterior (PA) x-ray exam using ORAUT-OTIB-0006, rev. 03 PC-1, "Dose Reconstruction from Occupationally Related Diagnostic X-Ray Procedures," for 1952–present
- ◆ This recommendation prompted observation 2

Observation 2

The AOO DR template and methodology documents utilize generic guidance in lieu of site-specific data for SNL medical dose

- ◆ Since the SNL TBD provides data needed to assign occupational medical doses for 1952 and later, SC&A questions why the SNL site-specific data are not recommended
- ◆ This approach is inconsistent with the period prior to 1952, which uses LANL site-specific occupational medical dose

SC&A's comparison of DR methodology document to DR template and overall review

- ◆ SC&A compared the DR methodology document to the DR template and identified observation 3 regarding the correct revision of LANL TBD to use
- ◆ Additionally, the overall review of guidance for AOO prompted observation 4 regarding the use of LANL and SNL environmental data

Observation 3

Different versions of the LANL site profile referenced

- ◆ **AOO DR template** referenced **revision 01** of the LANL occupational medical TBD and LANL occupational environment TBD
- ◆ **AOO DR methodology document** referenced **revision 00** of the LANL occupational medical TBD and LANL occupational environment TBD

Observation 4

Clarification is needed on what environmental doses are applicable given established SECs

- ◆ AOO DR methodology is unique in that it uses LANL and SNL site environmental data for AOO EEs
- ◆ SC&A questions whether, if a Special Exposure Cohort (SEC) were established at LANL and/or SNL for environmental doses during the EE's employment at AOO, would the EE qualify for inclusion in that site's SEC?



AOO case review

- ◆ SC&A reviewed one DR performed using AOO template
- ◆ DR completed by NIOSH in April 2014
- ◆ EE held a variety of job titles at LANL and AOO
- ◆ EE's total employment was more than 3 decades
- ◆ EE diagnosed with qualifying cancers after termination of employment

Monitoring records for AOO case

- ◆ EE was monitored periodically for photon, electron, and neutron exposures and bioassayed during the employment period at LANL
- ◆ EE was not monitored for external or internal exposures at AOO
- ◆ There were occupational medical x-ray examination records in the DOE files

SC&A's review of the LANL/AOO case

- ◆ Primary focus of DR review was to determine:
 - if the AOO DR template accurately follows information in the AOO DR methodology document
 - if the guidance was accurately applied for this DR
- ◆ For completeness, SC&A has briefly reviewed and summarized external and internal doses assignments associated with LANL employment

Recorded photon dose

- ◆ NIOSH used the EE's individual LANL dosimeter results to reconstruct the recorded photon dose
- ◆ SC&A reviewed EE's records and verified the dosimeter results
- ◆ SC&A verified NIOSH applied appropriate dose conversion factors for calculating dose to each cancer site
- ◆ SC&A also confirmed that the dose was appropriately assigned as 30–250 keV photons

Recorded electron dose

- ◆ NIOSH used the EE's individual LANL dosimeter results to assign shallow dose
- ◆ SC&A verified the shallow dosimeter result
- ◆ SC&A confirmed that NIOSH assigned the dose as >15 keV electrons, in accordance with LANL TBD

Recorded neutron dose

- ◆ NIOSH used the EE's individual LANL dosimeter results to assign neutron dose
- ◆ SC&A verified the neutron dosimeter results
- ◆ SC&A confirmed the correct ICRP Publication 60 neutron correction factor was applied
- ◆ SC&A agreed that no neutron-to-photon ratio was needed as the positive neutron dosimeters were after 1978
- ◆ SC&A verified that NIOSH assigned the doses as 100 keV–2 MeV neutrons, as specified in LANL TBD

Missed photon dose

- ◆ NIOSH assigned missed photon dose for dosimetry cycles that recorded a zero or less than half of the dosimeter's limit of detection (LOD)
- ◆ Missed photon dose was appropriately assigned as 30–250 keV photons
- ◆ SC&A confirmed the number of photon zeros and was able to match NIOSH's calculated doses using the appropriate LODs
- ◆ SC&A also confirmed that NIOSH followed the guidance in ORAUT-OTIB-0017, revision 01

Missed neutron dose

NIOSH

- ◆ For early employment years, NIOSH assigned missed neutron dose by multiplying the LANL assigned missed photon dose with the 95th percentile neutron-to-photon ratio for “Other Operations”
- ◆ For remaining years of employment:
 - NIOSH used actual number of zero neutron dosimeters
 - Missed neutron dose was calculated using applicable neutron LOD and the ICRP correction factor

SC&A’s review

- ◆ SC&A confirmed:
 - the number of neutron zeros
 - the neutron-to-photon ratio
 - the ICRP 60 correction factor
- ◆ SC&A was able to match NIOSH’s calculated missed neutron dose
- ◆ SC&A also verified that doses were assigned as 100 keV–2 MeV neutrons in accordance with LANL TBD

Onsite ambient dose at LANL

- ◆ EE was not continuously monitored during employment period at LANL
- ◆ For unmonitored years, NIOSH assigned the maximum ambient doses listed in LANL TBD
- ◆ Prorated doses for partial years of employment
- ◆ SC&A reviewed the EE's records and confirmed that NIOSH applied the correct ambient doses for unmonitored periods of LANL employment

Onsite ambient dose at AOO

- ◆ No radiological work has been performed at the current location of AOO
- ◆ Since the nearest DOE radiological site is SNL (several miles away), no onsite ambient dose was assigned for AOO
- ◆ It was noted that radon levels are less than background at SNL; therefore, no radon intakes are assigned for SNL or AOO employees
- ◆ SC&A reviewed the AOO DR template document and confirmed that the text regarding onsite ambient doses at AOO in the DR report is consistent with template text
- ◆ SC&A also confirmed that the text is consistent with the information in the AOO DR methodology document regarding onsite ambient doses after 1951

Occupational medical dose at LANL

- ◆ NIOSH assumed the EE received a yearly PA x-ray during employment at LANL
- ◆ NIOSH assumed the EE also received a lateral x-ray examination
- ◆ SC&A confirmed the x-ray doses assigned by NIOSH were appropriate based on LANL TBD guidance

Occupational medical dose at AOO

- ◆ NIOSH assumed the EE received a yearly PA x-ray during employment at AOO
- ◆ SC&A confirmed the x-ray doses assigned were according to ORAUT-OTIB-0006 and were consistent with AOO DR methodology document
- ◆ SC&A confirmed that doses were entered in IREP as a normal distribution with GSD of 30 percent
- ◆ SC&A reviewed the AOO DR template document and confirmed that the text regarding occupational medical doses at AOO in the DR report matches the text in the template
- ◆ SC&A also confirmed that the AOO DR template text is consistent with occupational medical dose information in the AOO DR methodology document

SC&A's conclusions about assignment of external doses

- ◆ SC&A determined that the AOO DR template is mostly consistent with information in the AOO DR methodology document for external dose, except for findings and observations identified in the detailed review of these documents, as previously presented
- ◆ SC&A found that NIOSH appropriately applied the stated guidance for calculating external dose in this DR

Internal monitored dose

- ◆ EE had several plutonium urinalysis samples during employment at LANL, all of which were below minimum detectable activity (MDA)
- ◆ NIOSH assigned missed plutonium internal dose using one half of the plutonium-239 MDA and assumed a mixture of radionuclides based on weapons-grade plutonium
- ◆ SC&A reviewed bioassay data and confirmed all sample results were less than MDA
- ◆ SC&A confirmed NIOSH correctly modeled the intake from start date for the period of employment through the date of the EE's last bioassay

Internal environmental dose

- ◆ NIOSH also assigned internal environmental dose for EE's employment at LANL
- ◆ SC&A confirmed the intakes used by NIOSH to assign LANL environmental dose were in accordance with LANL TBD guidance
- ◆ Since the nearest DOE radiological site is SNL, which is several miles away, no onsite internal environmental dose was assigned for AOO
- ◆ SC&A reviewed the AOO DR template document and confirmed that the text regarding onsite internal environmental intakes at AOO in the DR report matches the text in the template
- ◆ SC&A also confirmed that the text is consistent with the information in the AOO DR methodology document regarding onsite environmental intakes after 1951

SC&A's conclusions about assignment of internal doses

- ◆ SC&A found that NIOSH's internal dose calculations were performed appropriately and in accordance with the LANL TBD guidance
- ◆ SC&A determined that the AOO DR template is mostly consistent with information in the AOO DR methodology document for internal dose, except for the findings and observations identified in the detailed review of these documents, as previously presented



Questions?