DCAS-PER-049 Subtask 4 – Internal Dose Issue

Ron Buchanan, PhD, CHP

Advisory Board on Radiation and Worker Health,
Subcommittee for Procedure Reviews

November 16, 2023

Introduction

- **2005:** NIOSH's dose reconstruction (DR) assigned a total internal dose of 18.330 rem using ORAUT-OTIB-0002 (ORAUT, 2004) hypothetical model to derive intakes for a Paducah Gaseous Diffusion Plant (PGDP) case.
- **2016:** Under DCAS-PER-049, NIOSH's reworked DR assigned a total internal dose of 33.244 rem using bioassay data and overestimating methods to derive intakes.
  - **Issue:** This raised the concern that the hypothetical model may not provide an adequate overestimate of the intakes and resulting doses.
- **2023:** Issue was addressed by NIOSH reworking the case using bioassay data and more reasonable, but claimant-favorable, DR methods.
  - **Results:** NIOSH's 2023 DR resulted in a lower total internal dose and probability of causation (POC) than the two previous DRs.

SC&A's review of DCAS-PER-049

- **2012:** NIOSH revised sections 3, 4, and 6 of the PGDP site profile.
- **August 5, 2016**: NIOSH issued DCAS-PER-049 (NIOSH, 2016) to address changes in the PGDP site profile that could affect DR.
- **March 2, 2018:** SC&A submitted its review of one case under subtask 4 (SC&A, 2018).

2018 correspondence re internal dose issue

- **March 6, 2018:** Designated Federal Official (DFO) sent an email to SC&A inquiring why the hypothetical intakes resulted in internal doses that were about half of the internal doses estimated using the energy employee's bioassay records.
- **March 6, 2018:** SC&A responded that there appeared to be a contradiction between the DRs concerning the results from the two internal dose methods (hypothetical and bioassay) that could use NIOSH's clarification.
- **March 7, 2018:** The DFO requested that NIOSH clarify the different internal doses. SC&A was not informed of the outcome or whether NIOSH provided a followup.
- **October 31, 2018:** SC&A presented its subtask 4 review of PER-049 to the SPR. There were no findings, and the SPR closed the review.

2022–2023 discussions concerning internal dose issue

- **August 18, 2022:** SC&A gave a presentation on the status of PER-049 subtask 4 and mentioned the internal dose issue to the Board. The Board ask SC&A to evaluate the internal dose in more detail and report its findings to the SPR.
- **September 9, 2022:** SC&A provided a memorandum to the SPR on the status of the internal dose issue (SC&A, 2022).
- **February 16, 2023:** SC&A presented the internal dose memo to the SPR. The SPR discussed the issue and requested that NIOSH provide SC&A with the details of the DRs.

Previous NIOSH DRs

- **2005:** NIOSH performed the original overestimating DR using hypothetical intakes and assigned a total internal dose of 18.330 rem with a POC of 39.40%.
- **March 2016:** NIOSH reworked DR
  - NIOSH input bioassay data in the Integrated Modules for Bioassay Analysis program (IMBA):
    - Used seven acute and three chronic intakes, as an efficiency method
    - Resulted in an overestimate of intakes and projected organ internal doses
  - This rework resulted in a relatively large total internal dose of 33.244 rem with a POC of 45.43%.

NIOSH's 2023 DR

- **February 17, 2023:** NIOSH reworked the case using bioassay data in IMBA and reasonable estimating methods:
  - Analyzed the bioassay data and assumed nine acute and one chronic intakes.
  - Resulted in a more uniform fit of the potential intakes.
  - Derived a smaller total internal dose and a smaller POC.
- **February 21, 2023:** NIOSH provided SC&A with the general results of the reworked DR. SC&A requested more detailed information and calculation files.
- **May 2023:** NIOSH provided SC&A with the detailed data and associated files.

SC&A's analysis of NIOSH's 2023 DR

- **August 2023:** SC&A performed an analysis of NIOSH's 2023 reworked DR as follows:
  - Reran the IMBA program.
  - Derived the uranium intakes.
  - Derived the associated radionuclide intakes using the PGDP site profile ratio values.
  - Derived the resulting annual and total internal doses (14.544 rem).
  - Ran the Interactive RadioEpidemiological Program (IREP).
  - Derived a POC of 33.86%.
- **Results:** SC&A's total internal dose and POC value matched those derived by NIOSH for the reworked case.

Summary

- SC&A found that the 2016 DR, which was performed using bioassay data, employed overestimating methods.
- This resulted in the internal dose and POC being greater than the original 2005 DR that used hypothetical intakes.
- NIOSH's 2023 DR, which used bioassay data and reasonable estimating methods, but still claimant-favorable, resulted in a smaller internal dose and POC than either of the former DRs.
- SC&A did not have any findings or observations concerning NIOSH's 2023 reworked DR, assigned dose, or final POC.

Conclusions

- It appears that the original case was not a good candidate and did not meet all requirements for using the ORAUT-OTIB-0002 hypothetical internal intakes.
- The 2016 rework of this case used overestimating methods in assessing the bioassay data.
- SC&A concluded that it is unlikely the hypothetical intake model would result in an underestimate of dose, if more reasonable estimating methods were used to fit the bioassay data.
- SC&A has concluded that it is improbable this issue would impact other cases and recommends closing the issue.

Questions?

References

National Institute for Occupational Safety and Health. (2016). *Paducah Gaseous Diffusion Plant* (DCAS-PER-049, rev. 0). https://www.cdc.gov/niosh/ocas/pdfs/pers/dc-per49-r0.pdf

Oak Ridge Associated Universities Team. (2004). *Technical information bulletin – Maximum internal dose estimates for certain DOE Complex claims* (ORAUT-OTIB-0002, rev. 01 PC-2). https://www.cdc.gov/niosh/ocas/pdfs/arch/tibs/or-t2-r1-p2.pdf

SC&A, Inc. (2018). *DCAS-PER-049, subtask 4: Review of an Advisory Board selected case reworked for the evaluation of Paducah Gaseous Diffusion Plant technical basis document revisions* (SCA-TR-2018-PER049-ST4, rev. 0).

SC&A, Inc. (2022, September 9). *DCAS-PER-049 subtask 4 – Internal dose followup* [Memorandum]. https://www.cdc.gov/niosh/ocas/pdfs/abrwh/scarpts/sca-per49-090922-508.pdf