SC&A's Evaluation of ORAUT-OTIB-0075, Revision 01, "Use of Claimant Datasets for Coworker Modeling"

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ORAUT-OTIB-0075 timeline

- May 25, 2009: ORAUT-OTIB-0075, rev. 00, issued
- January 13, 2010: SC&A evaluated ORAUT-OTIB-0075, rev. 00, for use of claimant datasets for coworker modeling for construction workers at Savannah River Site
- ORAUT-OTIB-0075, rev. 01, issued June 17, 2016 ("OTIB-0075")
- October 9, 2017: SC&A review of OTIB-0075, rev. 01

OTIB-0075 purpose

- Presents the results of a study to determine if claimant datasets can be treated as random samples from the complete datasets from which they were drawn for the purpose of developing coworker models.
- Study consisted of taking sites where well-defined complete datasets are available and comparing these datasets with the claimant datasets.

Claimant and databases addressed in OTIB-0075

- National Security Complex (Y-12) uranium urine bioassay, 1950–1988
- Mound Laboratory (Mound) plutonium urine bioassay, 1960–1990
- Savannah River Site (SRS) tritium dose, 1991–2000

Terms used in OTIB-0075

- **Complete dataset –** Refers to all of monitoring records in database for the site relevant to the analysis. Note that the term “complete” does not necessarily indicate that all workers were monitored at the site.
- **Claimant dataset –** Refers to claimants’ monitoring records in the database obtained from NIOSH Claims Tracking System (NOCTS) relevant to the analysis.

OTIB-0075 analysis of datasets

- NIOSH constructed tables showing:
  - Number of workers monitored in the complete dataset
  - Number of workers monitored in the claimant dataset
  - Ratio of the number of claimants to number of workers
  - Number of samples from the complete dataset
  - Number of samples from the claimant dataset
  - Ratio of number of samples from claimants to number of samples from complete dataset

Modeling of data to determine 50th and 84th percentile values

- NIOSH used the methodology in ORAUT-RPRT-0053, "Analysis of Stratified Coworker Datasets," rev. 02, to create a lognormal probability plot of uranium in urine versus Z-Score probability on an annual basis from the results of analysis of each dataset (section 4.0 of OTIB-0075, rev. 01)
- NIOSH derived:
  - 50th percentile (geometric mean)
  - geometric standard deviation
  - 84th percentile (geometric mean multiplied by geometric standard deviation)

Random sample

- To ensure that claimant dataset is useful for estimating slopes and intercepts of the complete dataset, it must be shown that claimant dataset can be treated as if it were a random sample
- Section 5.0 of OTIB-0075 gives the process of selecting and analyzing random samples and then comparing them to results from the claimant and complete datasets

NIOSH's conclusions

- At the three sites analyzed, only a total of 4 out of 80 years had coworker model parameters outside of the respective 95% confidence ellipses
- This result is in excellent agreement with what would be expected if the NOCTS datasets were random draws from the complete datasets
- This proof-of-principle technique was used to show that the claimant datasets from Y-12, Mound, and SRS can, in general, be used as if they were random samples
- This exercise can be used as a technical justification for applying the assumption that claimant datasets can be used as if they were random samples for other sites for which complete datasets are not available

SC&A's evaluation of NIOSH's approach

- SC&A analyzed NIOSH's approach used in OTIB-0075, rev. 01
- Did not identify any issues with NOISH's general approach to compare claimant datasets to complete datasets

NIOSH used the guide "Draft criteria for the evaluation and use of coworker datasets"

- NIOSH issued "Draft Criteria for the Evaluation and Use of Coworker Datasets", rev. 4, on February 26, 2015 ("Draft Criteria")
- In the Draft Criteria, NIOSH recommended four areas that should be addressed when considering a dataset for use in constructing a coworker model:
    1. Data adequacy
    2. Data completeness
    3. Review and analysis of monitoring program data
    4. Evaluation of stratification

NIOSH's analysis of claimant data in OTIB-0075

- Used claimant data from NOCTS database in place of using complete dataset for constructing a coworker model
- Concluded that claimant datasets can be used for a site where the complete datasets are not available
- Main areas in the Draft Criteria applicable to OTIB-0075 were:
  - Evaluation of the adequacy of available data for assigning dose to unmonitored workers
  - Stratification according to job/title, area, time, radionuclides, etc.

SC&A's 2010 review of rev. 00 of OTIB-0075

- SC&A's 2010 review identified 13 findings concerning the Y-12, Mound, and SRS databases and concluded:
  - The NOCTS claimant dataset is inadequate for dose reconstruction with sufficient accuracy for SRS construction workers
  - A more complete compilation of the data and analyses by area, radionuclide, and job type are necessary to determine whether dose reconstruction with sufficient accuracy is feasible for SRS construction workers (i.e., stratification tests need to be performed)
- Summarized in Appendix A of SC&A's 2017 review of rev. 01

SC&A's 2017 review of OTIB-0075, rev. 01

- Rev. 01 is very much like rev. 00, with the following changes in the number of monitored workers:
  - Y-12 claimant dataset increased from 731 to 1,585
  - Mound claimant dataset increased from 225 to 301
  - SRS claimant dataset increased from 451 to 920
- Data used in the analysis in rev. 01 were time-weighted-one-person-one-statistic
- Methodology used for analyses and the number of workers in the complete dataset remained essentially the same as in rev. 00

SC&A's analysis of OTIB-0075, rev. 01

- SC&A analyzed the 13 original 2010 SC&A findings and found:
  - Findings 2 and 6 are the only ones that may be influenced by the additional claimant data in OTIB-0075, rev. 01
  - All other findings (except Findings 1 and 3, which SC&A concurred with) were concerned with stratification issues that were not addressed in either rev. 00 or rev. 01 to OTIB-0075; these findings remain open

SC&A's review of Finding 2

- Finding 2:

  "At the Mound Laboratory, the complete (all-worker) and claimant datasets for plutonium in urine from 1960 to 1990 show significant differences at the annual level of aggregation. This finding raises questions concerning the conclusions reached in OTIB-0075 for plutonium at the Mound Laboratory."

- In view of the additional claimant data in OTIB-0075, rev. 01, SC&A:
  - Reran the analysis for the Mound 1960–1990 plutonium bioassay data using the new data from tables 6-1 and 6-2 of OTIB-0075, rev. 01
  - Found that the additional claimant data indicate that the claimant dataset was similar to the complete dataset
  - Appendix B to SC&A's 2017 review provides additional figures and a summary table supporting this conclusion

SC&A's review of Finding 6

- Finding 6:

  "At Y-12, only 37% of all claimants (3 out of 8) have data in the 'complete' Y-12 uranium urine bioassay coworker database for 1950 to 1988. This subset of 731 claimants with uranium bioassay data had a total of approximately 70,000 bioassays."

- SC&A found:
  - OTIB-0075, rev. 00, page 10, footnote 7, states that out of 1,971 claimants, 731 claimants had bioassay records in the complete dataset, which is 37%
  - OTIB-0075, rev. 01, page 8, states that a total of 1,585 claimants submitted 119,044 uranium urine samples; however, there was no indication in the text or footnotes of how many total claimants there were
  - Therefore, with the present information, SC&A could not determine the fraction of the number of claimants who were monitored (i.e., had bioassay records in the complete dataset) compared to the total number of claimants in the dataset
  - Therefore, SC&A recommends that Finding 6 remain open

Original concerns not addressed

- Increasing the number of workers in claimant datasets may have improved the statistics for a claimant dataset but, except for Finding 2, did little to address SC&A's original concerns in our 2010 review of OTIB-0075, rev. 00:
  - Adequacy of the data in the claimant datasets in NOCTS to represent unmonitored workers (who were subjected to a wide variety of exposure potentials)
  - In rev. 01 to OTIB-0075, there was no indication in the text or footnotes of how many total claimants there were to compare to the 1,585 claimants who submitted uranium urine samples
  - Therefore, there is no way to calculate the percent of all Y-12 claimants in rev. 01 to compare with the percent of all claimants in rev. 00 to address the original Finding 6

Status of original findings

- Datasets may need to be tested to determine if stratification is needed concerning areas, time, radionuclide, construction versus non-construction workers, subcontractors versus prime, etc.
- Therefore, SC&A recommends that Findings 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13 remain open

Evaluation of documentation in OTIB-0075, revision 01

- Observation 1: Tables 4-1, 5-1, 6-2, and 7-2 should have the units of disintegration per day in the column headings as appropriate.
- Observation 2: The data for 2001 were included in Table 7-1, Table 7-2, Figure 7-3, and Figure 7-4 in rev. 00 to OTIB-0075. However, the year 2001 was not included in these tables and figures in rev. 01.

Summary and conclusions

- SC&A found the approach NIOSH used to be reasonable and without technical errors.
- SC&A generally found the statistical methods used by NIOSH to be acceptable.
- However, the increase in the number of workers in the claimant datasets only served to improve the statistics of claimant datasets.
- Except for Finding 2, the increase did little to address SC&A's original concerns as expressed in our 2010 evaluation of OTIB-0075, rev. 00, regarding the need to test for stratification of data (i.e., Findings 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13).
- Rev. 01 to OTIB-0075 did not indicate how many total claimants there were to compare to the 1,585 claimants who submitted uranium urine samples. Therefore, there is no way to calculate the percent of all Y-12 claimants in rev. 01 to compare with the percent of all claimants in rev. 00 to address the original Finding 6.

Questions?