Draft White Paper

SC&A'S EVALUATION OF NIOSH'S APRIL 2012 MOUND LABORATORY Th-232 WHITE PAPER

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Record of Revisions

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1.0 INTRODUCTION

On April 2, 2012, the National Institute for Occupational Safety and Health (NIOSH) provided a white paper titled, *Retrospective Dose Reconstruction for Thorium-232 Activities at the Mound Laboratory* (NIOSH 2012), to the Mound Laboratory (ML) Work Group (WG).

A ML WG meeting was held on April 10, 2012, in which the issue of Th-232 bioassay monitoring and dose assignments was discussed.

The following is a summary of SC&A's evaluation of NIOSH's white paper concerning Th-232 monitoring and dose assignments at the ML.

2.0 SC&A'S EVALUATION OF NIOSH'S WHITE PAPER

SC&A evaluated NIOSH's white paper and found that it does demonstrate that thorium is an important consideration for some Mound works, and in general, concurs with the NIOSH method of dose reconstruction (DR) from potential thorium intakes (the purpose of this evaluation was not to analyze the DR process for thorium). However, there are still some issues concerning who was monitored and had their samples analyzed for thorium, and how often and under what circumstances this was performed. Some of these issues were discussed on a preliminary basis during the April 10, 2012, ML WG meeting, but are included in this summary for completeness and so that they can be documented.

Item #1 – Control of Access to Thorium Material
In evaluating the assignment of thorium dose to ML workers, it is important to determine if access to the thorium-containing materials was controlled, or if persons not directly associated with the materials also could have been inadvertently exposed. This brings up the following questions or issues:

a. Was access to, and working with, the thorium-containing materials controlled by physical barriers and/or procedural requirements?

b. Were only persons directly involved with handling the material allowed in the area, or could there have been other personnel, such as craft workers, maintenance workers, grounds keeper, etc., that may have worked around the material, but were not considered part of the thorium-handling crew? Exposures could have occurred not only during the periods the material was being handled, but also during dormant periods when no specific activity was taking place, and no health physics oversight was in place; thorium bioassays would not have been available for these types of workers under those circumstances.

c. What situation or procedure triggered the need to obtain urine samples and have them analyzed for thorium and the results recorded?

d. Was a list of personnel working with or around thorium-containing materials maintained? Relying on recorded thorium bioassays and/or applying a coworker model can only be used if it can reasonably be assured that the potentially thorium-exposed workers were bioassayed or identifiable for coworker dose application, unless the coworker dose is applied to all unmonitored workers.

Item #2 – Thorium Bioassay Records

SC&A reviewed some of the ML workers' DOE files and ORAUT-TKBS-0016-5 (ORAUT 2009) to assess the validity of the thorium bioassay records. ORAUT-TKBS-0016-5 states:

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> *Primary ^{230}Th bioassay records consisted of a logbook, and apparently duplicate records in a brown notebook. Count data were typically recorded on Form O-318 followed by an "I" or "Io." Secondary ^{230}Th results started as weekly reports on March 17, 1958. Weekly reports included Name, Isotope, and Result. Prior to 1958, secondary ^{230}Th results were reported on Form O-634 including Name, Badge Number, Date, Type of Analysis, Isotope, and Result. However, some secondary documents have problems with reporting units. Some results are reported to be cph* [counts per hour] *per 24-hour sample when primary records indicate that they are actually cpm* [counts per minute] *per aliquot. The ORAU database should therefore be considered a secondary record extracted from primary records.*

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> *Thorium-232 records are diverse due to programs conducted for many years. Primary ^{232}Th bioassay data were entered into a small brown spiral notebook marked "Radium-Thorium" and "Radium-Thorium Separation from 8/15/1955 to 2/2/1959 (Meyer 1992). Additional primary ^{232}Th bioassay data were recorded in a large hardcover record book. However, the first 38 pages from this record book were removed from 7/6/59 to 1/9/61, 7/13/64 to 11/15/64 and 5/30/65 to 6/6/65. These record books apparently do not contain true primary data, but calculated results such as cpm excreted per day. Secondary records in weekly reports contained ^{232}Th results as cpm/24-hr samples beginning March 17, 1958. In August 1959, secondary results were reported on form O-756. The ORAU database is a record of secondary ^{232}Th bioassay data extracted from other primary records (ORAU 2003e).* [Emphasis added.]

From this information, it is not apparent that the dose reconstructor has access to copies of all the original data sheets, or where they are located. SC&A's scan of some of the DOE files located several of these forms with thorium bioassay data recorded. However, there does not appear to be much assurance that all the primary data are available to the dose reconstructor.

Item #3 – Thorium-Containing Materials at the ML during All Periods

In addition to the drummed material from United Lead Corporation (ULC), Mound also received thorium-containing materials from the St. Louis Airport, according to page 15 of ORAUT-TKBS-0016-2 (ORAUT 2004):

> *SW building was used in the Cotter Concentrate (St. Louis Airport Cake) starting in the early 1970s and terminated late in that decade. Pilot plant operations in SW were to recover Th-230 and Pa-231.*

The Cotter concentrate contained 99.9 g/drum of Th-232 and 11.1 g/drum of Th-230, according to page 16. Additionally, thorium was used in other areas at Mound as stated on page 12 of ORAUT-TKBS-0016:

> *Thorium-232 was often substituted for ^{238}Pu compounds for modeling purposes in research and development, because this isotope was less expensive and less hazardous, and had physical characteristics similar to ^{238}Pu. It is possible, therefore, to find ^{232}Th compounds identical to the ^{238}Pu compounds.*

These were not included in the paper that SC&A could find, and most likely not in the cleanup date of September 1975 as stated on page 20 of the paper. Although the drummed material from ULC most likely presented the greatest exposure potential, the issue of thorium exposure/monitoring did not go completely away in mid-1975. These other sources of thorium, and thorium contamination present during decontamination and decommissioning (D&D), are sources that could also result in personnel exposures and require bioassay data for DR.

3.0 SUMMARY

SC&A found that NIOSH's white paper demonstrated that thorium intakes and doses are important considerations during DR for some Mound works; however, identifying all the Mound workers potentially exposed to thorium, and determining if all primary thorium bioassay records are available for these workers, is not as apparent and has not been adequately addressed.

4.0 REFERENCES

Meyer, H.E., 1992. *History of Mound Bioassay Programs*, MLM-MV-93-93-0003, EG&G Mound Applied Technologies, Miamisburg, Ohio. [SRDB Ref ID: 1962]

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