



MEMO

TO: Kansas City Plant Work Group
FROM: Joyce Lipsztein, SC&A
SUBJECT: Review of NIOSH Response to SC&A's Review of Internal Exposures to Thorium and its Progeny at the KCP during Mg-Th Machining, July 7, 2015
DATE: August 14, 2015

The following comments and suggested clarifications are being provided as a follow-up to the Kansas City Plant (KCP) Work Group (WG) meeting on July 17, 2015. At that meeting, SC&A had tentatively agreed with NIOSH's conclusions pending further review and given the brevity of our review time. We have since had the opportunity to review the cited references provided in the Mg-Th white paper of July 7, 2015, and have remaining questions and issues regarding the basis of NIOSH's position.

Summary of Exchange Reports and White Papers between NIOSH and SC&A

In its Evaluation Report (ER) for the KCP Special Exposure Cohort (SEC) (NIOSH 2014), the National Institute for Occupational Safety and Health (NIOSH) proposes to use air concentration limits to bound internal exposures associated with Mg-Th operations at KCP from May 1, 1957, through April 30, 1979.

SC&A evaluated the assumptions used in the KCP ER in its August 2014 white paper, *Review of Internal Exposures to Thorium and Its Progeny at the Kansas City Plant during Mg-Th Machining Operations* (SC&A 2014).

In January 2015, NIOSH provided a response paper titled, *Internal Exposures to Thorium and its Progeny at the Kansas City Plant during Mg-Th Machining* (NIOSH 2015a), addressing SC&A's issues contained in SC&A 2014.

SC&A reviewed NIOSH's response paper and provided another response on May 12, 2015, titled, *Review of NIOSH's White Paper: Internal Exposures to Thorium and its Progeny at the Kansas City Plant during Mg-Th Machining* (SC&A 2015).

On July 7, 2015, NIOSH revised information available on KCP's Mg-Th machining and published a response paper titled, *Response to SC&A's Review of Internal Exposures to Thorium and its Progeny at the KCP during Mg-Th Machining* (NIOSH 2015b).

The last two white papers, SC&A (May 12, 2015) and NIOSH (July 7, 2015) were presented at the July 17th WG teleconference. This memo provides a formal response to the NIOSH July 7th paper (NIOSH 2015b).

SC&A's Recommendations Regarding the Application of Bounding Air Limit Concentration proposed by NIOSH, per time period, as described and justified in SC&A 2015

The recommendations and findings constituted the basis for the NIOSH response in its July 7th white paper (NIOSH 2015b). They are described in the following paragraphs.

SC&A agreed with NIOSH on the application of a bounding value of 3E-11 $\mu\text{Ci}/\text{mL}$ for thorium exposures in the machining work for the periods of time and locations where this limit was enforced. The application of this limit depends on NIOSH being able to corroborate for relevant operational time periods and locations that this limit was bounding of air concentrations to which Th-Mg machining workers were exposed.

SC&A agreed with NIOSH that Mg-Th machining operations began at KCP in August 1961, and those exposures from operations can be bounded with the ER's methodology through March 31, 1963.

For the period 1963–1966, SC&A requested information regarding the Mg-Th machining workload that was ongoing in concert with co-located depleted uranium (DU).

For the period 1966–1970, SC&A requested information regarding the location, specific timeframe, and workload for Mg-Th machining during this period. Department 20D (formerly Department 22), where the DU machining took place until 1966 [3/3/15 KCP worker interview – SRDB pending; NIOSH 2015a; SRDB 123895, pp. 131–134], started to be decontaminated in that year and was likely not used (in whole or part) for Mg-Th machining.

For the period 1970–1979, SC&A requested more information before applying the proposed bounding value of 3E-11 $\mu\text{Ci}/\text{mL}$ for exposures to thorium in the Mg-Th machining operations. The lone set of 1970 breathing zone (BZ) samples taken in Department 851 (Model Shop) are inadequate to demonstrate that the 3E-11 $\mu\text{Ci}/\text{mL}$ limit was bounding for 1970–1979. SC&A did not agree that air and surface monitoring results from Department 20D (formerly Department 22) during the 1962–August 1970 period can be used as an indication that in the period October 1970–1979, “KCP's control of work or in-plant environmental working conditions did not degrade in the years after the cessation of air monitoring,” as stated by NIOSH.

SC&A recommended that in the absence of such measurement data, NIOSH should validate its proposed 3E-11 $\mu\text{Ci}/\text{mL}$ air concentration limit through source term-based exposure modelling, followed by suitable sample dose reconstructions to demonstrate the feasibility of applying this limit for the various operational time periods in question (i.e., 1963–1966, 1966–1970, 1970–1979).

SC&A Analysis of NIOSH's Clarification Regarding Mg-Th Machining in the Period April 1963–August 28, 1970, in NIOSH 2015b

NIOSH has determined that Mg-Th operations were suspended beginning April 1, 1963, and did not begin again until after receiving approval from Health Services on August 28, 1970. The

cited reference SRDB 128433, PDF p. 2 refers to a letter dated August 28, 1970, about the processing of Mg-Th in the Model Shop.

NIOSH further states that the suspension of activities during the April 1963–August 28, 1970, period is corroborated by inventory information. The cited inventory references, SRDB 135987 and SRDB 137786, document the presence of Mg-Th beginning in 1971. Those documents do not cover the period 1963–first semester of 1969, which remains without information on Mg-Th machining.

NIOSH uses reference SRDB 137860 to corroborate the suspension of Mg-Th operations in April 1963:

The Weekly Activities reports also corroborate the suspension of Mg-Th operations. They document a very small staff (consisting of five personnel) working one shift, and D&D in Department 22 (the area where this work would have been done) beginning in May 1964, and by August 1964, half of the machines were removed from the area, and the staff were reduced to two, part-time personnel (SRDB 137860).

Reference 137860 reports do not refer specifically to Mg-Th work; they only refer to the workload in Department 22. On the other hand, several other references include Department 22/20 as a radiation area [on October 1, 1965, Department 22 changed its name to Department 20D (SRDB 123895, pages 154, 156)]. Reference SRDB 123895 contains a memo on page 155 dated June 24, 1965, citing machining of radioactive material, including classified radioactive material. The same reference SRDB 123895 reports the cleaning of Department 20 in 1966 (pp. 132, 133). Reference SRDB 128373 contains uranium air sample results in Department 20/22 for the years 1962–1969. Reference SRDB 108264, page 8, from 1971, cites Department 20D as a controlled radiation area.

SC&A is concerned that there is no substantial evidence of the suspension of work with radioactive material in Department 22/20 during the entire April 1963 to August 1970 period. For the period 1963–1970, information remains lacking regarding the location, specific timeframe, and workload for Mg-Th machining.

SC&A's Analysis of NIOSH's Clarification Regarding Mg-Th Machining in the Period 1970–1979

NIOSH indicates that Mg-Th machining at KCP ended in 1977.

Reference SRDB 128420, given by NIOSH, cites that between 1970 and 1977 the Engineering Shop fabricated products made from mag/thorium. NIOSH cites 1977 as the year Mg-Th machining ended, based on references SRDB 135987 and SRDB 137786. Reference SRDB 135987 is from March 1978 and thus should not be used to prove that there were no Mg-Th activities in 1978 and 1979. Reference SRDB 137786 indicates no inventory of Mg-Th after 1977.

SC&A agrees with NIOSH that all reports indicate Mg-Th work was a wet process. SC&A analyzed the references provided by NIOSH, and concurs that given that the material was wet, it is not plausible that KCP machinists would generate a significant amount of dust higher than the proposed bounding limit.

NIOSH, following SC&A's suggestion, validated its proposed $3E-11$ $\mu\text{Ci}/\text{ml}$ air concentration limit through source term-based exposure modeling. NIOSH used the largest inventory for 1973, which totaled 42 kg of thorium during the year (SRDB 135987). NIOSH applied NUREG-1400 to calculate the yearly intake using conservative values for the release and confinement fractions and for the dispersibility factor. The source-term calculation showed an intake rate much smaller (156 times) than that based on the ER's bounding exposure concentration. SC&A agrees with NIOSH's conclusion.

Remaining Issues

NIOSH should specify for which periods of time the bounding air concentration limit of $3E-11$ $\mu\text{Ci}/\text{mL}$ will be applied. It is not clear if the bounding limit is going to be applied to the periods April 1, 1963, to August 28, 1970. SC&A recommends the application of the limit for this period of time, as the references show conflicting information on the period that Department 20/22 was considered a radiation area. Concerns remain on the lack of documentation to substantiate either the work or the interruption of work during those two periods of time.

NIOSH did not define how the workers' committed equivalent organ doses are going to be calculated. SC&A recommends that NIOSH should do suitable sample dose reconstructions to illustrate the application of $3E-11$ $\mu\text{Ci}/\text{mL}$ air concentration limit in a claimant-favorable scenario.

References

NIOSH 2014. *SEC Petition Evaluation Report*, Rev. #0. National Institute for Occupational Safety and Health, Cincinnati, Ohio. January 7, 2014.

NIOSH 2015a. *Response Paper, Internal Exposures to Thorium and its Progeny at the Kansas City Plant during Mg-Th Machining*, National Institute for Occupational Safety and Health, Cincinnati, Ohio. January 2015.

NIOSH 2015b. *Response to SC&A's Review of Internal Exposures to Thorium and its Progeny at the KCP during Mg-Th Machining*, National Institute for Occupational Safety and Health, Cincinnati, Ohio. July 7, 2015.

SC&A 2014. *Review of Internal Exposures to Thorium and Its Progeny at the Kansas City Plant during Mg-Th Machining Operations*, SC&A, Inc., Vienna, Virginia, and Saliant, Inc., Jefferson, Maryland. August 15, 2014.

SC&A 2015. *Review of NIOSH's White Paper: Internal Exposures to Thorium and its Progeny at the Kansas City Plant during Mg-Th Machining*, Rev. 1. SC&A, Inc., Vienna, Virginia, and Saliant, Inc., Jefferson, Maryland. May 12, 2015.

SRDB pending: 3/3/15 KCP Worker Interview

SRDB 108264, PDF p. 8: January 5, 1971, memorandum from Robert T. Foster to V.J. Smeltzer, titled "Development Support Project Using Magnesium-Thorium Alloy."

SRDB 123895: pp. 131–134; pp. 154 and 156; pg. 155; pp. 132 and 133

SRDB 128373: Air Sample Results by Location, 1962–1969

SRDB 128420, *D/823 Radioactive Materials Usage*

SRDB 128433, PDF p. 2, *Development Support Project Using Magnesium-Thorium Alloy*

SRDB 135987, *Statements of Measurement Methods/Balance Report/Inventory*

SRDB 137786, *Handwritten Inventory Notes*

SRDB 137860, *Weekly Activities Reports*