DCAS External Memorandum

Division of Compensation Analysis & Support

To: Kansas City Plant SEC Working Group

From: Peter Darnell, DCAS Health Physicist
Pat McCloskey, ORAU Team Health Physicist

Subject: SEC Issues Matrix Responses to 1, 7, 11, 12, 15 and 17

Date: June 11, 2015

The following update is provided for the Working Group. NIOSH received SC&A's Issue 13 (Mg-Th) comments on 5/12/15 and will respond separately. SC&A is planning a data capture trip to address Issue 18 (Incidents); therefore, NIOSH will wait for additional information from SC&A before responding. To address Issue 20 (Tritium), NIOSH has revised the white paper *Tritium and Ni-63 at KCP* and provided it to the Working Group.

Issue 1 - Data Completeness, Legibility, and Accuracy

At the January 20, 2015 Working Group meeting, NIOSH committed to provide the WG with a proposed sampling plan for how it intends to validate the electronic database with the raw records for both internal and external dose (external dose is also addressed in Issue #9). Following WG agreement, NIOSH would conduct the sampling review and provide results.

NIOSH response

The database (SRDB 111136) contains over 15000 external and 2810 internal monitoring records for 4500 workers, and spans the years from 1950 to 2010. The database has workers identified by Social Security and employee ID numbers. NIOSH used the database's monitoring data to build an internal coworker model from 1959 – 1971

urinalysis data, and an external coworker model from 1950 – 1990 data in the KCP Site Profile (SRDB 20217).

NIOSH plans to extract data from DOE-supplied dose records in the 691 NOCTS claims currently available. These NOCTS claims contain 223 external and 95 internal dosimetry records. NIOSH will compare this raw data to that in the database previously used for the coworker model. NIOSH will review each step of the data entry process to validate accuracy, and will perform a comparison of NOCTS and KCP raw records.

NIOSH will also compare database information to records in the SRDB such as REMS and incident reports where appropriate.

NIOSH responses to Issues 7, 15 and 17 of the memo "*SC&A's Evaluation of NIOSH's January 2015 Response to KCP SEC Matrix Issues 7, 15, 17, 18, and 20*" dated 4/20/15

Issue 7 – Radioactive Waste

In their memo, SC&A states the following: Interviews conducted at KCP in March 2015 indicated that unmonitored laborers collected the uranium and Mg-Th cuttings and chips from the lathe machines for placement in 55-gallon drums, which were then transported to the KCP central waste facility. These wastes were coated in lathe oil and were apparently collected from under the machine and from the floor, and loaded into the drums using a "pitchfork" implement. Laborers were neither badged nor bioassayed. It was also noted that while worker movement into and out of these radiological operating areas was restricted by security access badges until the late 1960s-early 1970s, this restriction was relaxed thereafter to anyone with a general "Q" clearance. While there was clearly an exposure potential, a remaining question is whether it can be considered comparable to the lathe operators, who were monitored.

SC&A recommends that NIOSH review the relative exposure potential of the custodial/laborers who routinely collected and drummed contaminated waste, as compared with the operators who conducted the machining of depleted uranium (DU) and Mg-Th, with an objective of informing the WG as to whether these exposures are comparable (or for the former, lower) and can therefore be adequately bounded using available monitoring data.

NIOSH response

NIOSH reviewed KCP job descriptions of custodians and laborers (e.g. SRDB 137737, 137790) from recently obtained documents. NIOSH also reviewed the notes from the SC&A referenced interviews, and the notes from past interviews of some of the same workers (SRDB 126958, 127876). SC&A referenced statements from four former workers and concluded that they were not monitored. NIOSH, however, reviewed the existing personnel monitoring database and found internal and external monitoring records for two of the four interviewees. NIOSH has also reviewed access lists and medical releases that authorized the interviewees to enter specific work areas (NOCTS 40995, 29761, 32283).

NIOSH has reviewed safety procedures that span the years 1951-1975 (SRDB 128346, 14690, 14685, 128440 p. 35, 108264 p. 2 and 44, 128181 p. 2-7, 128443, 128433, 128155) that prescribe the use of PPE, medical surveillance, wet methods, and industrial hygiene best work practices. These procedures, corroborated by interviewees, were implemented by KCP to control the activities of anyone with access to the work area for waste handling.

The greatest potential for worker exposure at KCP was during the DU machining operations from 1958 to 1971. During these DU operations, KCP implemented an area and personal monitoring program. The monitoring data from this period indicate adequate work control and provide supporting evidence that the methods in the ER plausibly bound exposures during this period.

NIOSH reviewed SC&A's 2007 report "*A Focused Review of Operations and Thorium Exposures at the Dow Chemical Company Madison Plant"* (SRDB 53614), that describes dosimetric implications of working with the same Mg-Th Dow supplied to KCP. This report provides data from air samples collected in the breathing zone of workers that were "drumming" Mg-Th powder. The sample results for this drumming activity were given as 15 µg/m^3. Using the Th-232 specific activity (1.1E-7 Ci/g) yields an equivalent air concentration of 1.65 E-12 µCi/ml. NIOSH believes that this drumming activity represents a worst-case exposure scenario for waste handlers, and it is not likely that KCP waste handlers were exposed to a higher concentration on a 2000-hour time-weighted-average (TWA) basis.

The KCP ER has methods for bounding doses during operations in Section 7. Worker categories were presented in the ER to differentiate the varying exposure potential for machine operators, general laborers, supervisors and others. For example, NIOSH will assume that general laborers were exposed to an air concentration half that of the operators (0.5 * 3E-11 or 1.5E-11 µCi/ml).

NIOSH has reviewed the exposure potential of the custodial/laborers who collected and drummed contaminated waste, and believes some of the workers in this category were monitored, and will use that data where available to reconstruct doses.

Based on levels of Th observed during drumming operatons at Dow and KCP's Health and Safety procedures that included: 1) working with materials that were maintained wet and 2) the required use of KCP provided PPE and IH best practices, NIOSH concludes that the general laborer category of Mg-Th worker described in the ER, adequately bounds these exposures at an air concentration of 1.5 E-11 µCi/ml, and 2000 hours of exposure per year.

Issue 15 – Thorium oxide operations

In their memo, SC&A provides the following assessment:

> *"SC&A's review of KCP materials inventory data indicates that the listing of "unalloyed" thorium was apparently an artifact of the site's calculation of how much actual "pure" thorium made up the inventory of Mg-Th being processed. This was verified by comparing a sample of historic KCP inventory values from the 1970s, obtained and cleared by KCP, with those in the NMMSS database at DOE headquarters. Recorded values matched from both inventory ledgers. Other than Mg-Th, thorium being used at KCP was historically in gram quantities and of a laboratory scale, was handled under hoods, and did not present an exposure potential. SC&A recommends that this issue be closed by the WG."*

NIOSH concurs with SC&A's assessment.

Issue 17 – D&D activities

SC&A believes it is clear from the March 2015 onsite interviews with former workers, that at KCP, laborers had a substantial role in cleaning up floors, walls, and equipment, whether on a day-to-day basis, or in periodic room cleanups. A clear distinction was made between "laborers" who handled cleaning duties and various crafts responsible for moving, maintaining, and operating equipment, such as lathes. Some laborers wore external dosimeters (it was said to be mandatory in Mg-Th areas), but none of the former laborers interviewed indicated any routine bioassay. While the "KCP machine repair" was responsible for taking equipment apart, the laborers were responsible for cleaning the internal parts of that equipment, It is clear that non-bioassayed laborers had a substantial D&D role at KCP for the periodic room and equipment cleanups that took place at the plant; it is not clear whether their exposure potential was the same as the DU and Mg-Th machinists, themselves.

SC&A recommends that NIOSH review the relative exposure potential of the custodial/laborers who routinely cleaned contaminated equipment and areas, as compared with machinists who did the machining of DU and Mg-Th, with an objective of informing the WG as to whether these exposures are comparable (or for the former, lower) and can therefore be adequately bounded using available monitoring data.

NIOSH response

NIOSH has reviewed the notes from the referenced interviews and the notes from past interviews of some of the same workers. SC&A referenced statements from four former workers and stated that they were not internally monitored. NIOSH, however, reviewed the existing personnel monitoring database and found internal monitoring records for two of the four interviewees. NIOSH has also reviewed access lists and medical releases that authorized these interviewees to enter specific work areas.

NIOSH has reviewed safety procedures that KCP implemented to control the activities of anyone with access to the work area, and documents that describe KCP's decontamination procedures. These procedures corroborate the interviewee's recollection of, among other things; radioactive materials maintained wet and the use of respirators while performing decontamination work. (Same SRDB references listed above)

The greatest potential for worker exposure at KCP was the DU machining operations from 1958 to 1971. During these DU operations, KCP implemented a robust area and personal monitoring program. The monitoring data from this period indicates adequate work control and validates the bounding methods in the ER.

NIOSH reviewed SC&A's 2007 report "A Focused Review of Operations and Thorium Exposures at the Dow Chemical Company Madison Plant" (SRDB 53614), that describes dosimetric implications of working with the same Mg-Th Dow supplied to KCP. This report provides data from air samples collected in the breathing zone of workers performing aggressive activities with Mg-Th that would have likely exceeded the airborne generating capacity of KCP's decontamination work. These vigorous activities included open-wheel surface grinding, air-operated vibration sanding and buffing. For comparison, the highest observed air concentration in the workers' breathing zone while performing these airborne generating activities at Dow was 3.9 E-12 µCi/ml. NIOSH believes that this Dow work represents a worst-case exposure scenario for D&D type work, and it is not likely that KCP workers were exposed to a higher concentration on a 2000-hour TWA basis.

The KCP ER has methods for bounding doses during operations in Section 7. Worker categories were presented in the ER to differentiate the varying exposure potential for machine operators, laborers, supervisors and others. NIOSH has reviewed the exposure potential of the custodial/laborers who cleaned contaminated equipment and areas, and believe some of the workers in this category were monitored, and will use that data where appropriate to reconstruct doses.

Based on levels of Th observed during grinding/sanding operatons at Dow and KCP's Health and Safety procedures that included: 1) working with materials that were maintained wet and 2) the required use of KCP provided PPE and IH best practices, NIOSH concludes that the general laborer category of Mg-Th worker described in the ER, adequately bounds these exposures at an air concentration of 1.5 E-11 µCi/ml, and 2000 hours of exposure per year.

Additionally, NIOSH has reviewed a KCP procedure used for the decontamination of equipment contaminated with beryllium or radioactive material (SRDB 137215 p. 23) which may contain the controls for the work described by one March 2015 interviewee.

NIOSH response to the memo "*SC&A's Evaluation and Closure of KCP SEC Matrix Issues 11 and 12; Neutron Dose*" dated 4/21/15

In this memo, SC&A documented their review of the NIOSH Issues Matrix response, and independently evaluated the supporting KCP dosimetry data. In conclusion SC&A states:

> *"In view of this analysis, SC&A found that NIOSH's use of a neutron dose of 0.154 rem/year for KCP workers that may have been exposed to neutrons is reasonable and claimant favorable. SC&A considers the present KCP SEC neutron dose-related issues addressed and the issues have been closed by the Advisory Board."*

NIOSH concurs with SC&A's conclusion.

Reviewed and Concurred by:

[Signature on File]

_____ **Date: 06/19/2015**

Peter Darnell, CHP, RRPT
Division of Compensation Analysis and Support