**MEMO**

TO: Dose Reconstruction Subcommittee

FROM: Doug Farver, SC&A

SUBJECT: Differences in the Dose Reconstruction Methods for the Occupational Medical and Internal Doses regarding Feed Materials Production Center (FMPC) Case #[Redact]

DATE: June 23, 2015

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The dose reconstruction (DR) by NIOSH and the blind DRs by SC&A-Method A, and SC&A-Method B were discussed during the April 14, 2015, DRSC meeting. The major areas of differences between the NIOSH and SC&A occupational medical and internal doses are as follows:

1. **Occupational Medical Doses.** Both NIOSH and SC&A-Method A used the same number and type of x-ray examination for their calculations; 8 PA exams, 1 LAT exam. SC&A-Method B assumed 6 PA exams from 1982–1993. NIOSH used the dose values shown in Tables 3-7 and 3-8 of ORAUT-TKBS-0017-3, Rev. 01. SC&A-Method A used the dose values given in Table A-9 of ORAUT-OTIB-0006 and Method B used the dose values in Tables 3-14 through 3-16 of ORAUT-TKBS-0017-3, Rev. 00. Table 1-1 shows a comparison of the occupational medical doses.

**Table 1-1. Occupational Medical Dose Comparison**

| SC&A-Method A | | | | | SC&A-Method B | | NIOSH | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| #1 SCC Chest (rem) | #2 BCC Nose (rem) | #3 BCC Ear (rem) | #4 SCC Scalp (rem) | #5 SCC Forehead (rem) | Chest (rem) | Nose, Ear, Scalp, Forehead (rem) | #1 SCC Chest (rem) | #2 BCC Nose (rem) | #3 BCC Ear (rem) | #4 SCC Scalp (rem) | #5 SCC Forehead (rem) |
| 0.065 | 0.049 | 0.041 | 0.081 | 0.081 | 0.131 | 0.131 | 0.010 | 0.009 | 0.024 | 0.024 | 0.012 |

NIOSH completed the DR for the five skin cancers on July 31, 2012 (Version 2). The case was revised by NIOSH (Version 3) with [redact] on August 12, 2014. The SC&A blind DR of the 5 cancers was completed January 13, 2014. The effective dates of the references cited above are as follows:

- ORAUT-TKBS-0017-3, Rev. 00, Effective date of February 11, 2004
- ORAUT-TKBS-0017-3, Rev. 01, Effective date of January 2, 2014
- ORAUT-OTIB-0006, Rev. 04, Effective date of June 20, 2011

Although it appears NIOSH used dose values from ORAUT-TKBS-0017-3, Rev. 01, 2 years before it became effective, the dose values in Tables 3-7 and 3-8 of that report appear to be derived using the skin dose guidance in Attachment C of ORAUT-PROC-

0061, Rev. 03 (March 3, 2010) and the x-ray beam parameters in Table 3-10 of ORAUT-TKBS-0017-3, Rev. 00.

2. **Internal Doses.** NIOSH assigned internal doses from uranium with recycled uranium contaminants and from thorium. SC&A assigned internal doses from uranium with recycled uranium contaminants. Table 2-1 shows a comparison of the internal doses.

**Table 2-1. Internal Dose Comparison**

| | SC&A-Method A | | | | | SC&A-Method B | | NIOSH | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | #1 SCC Chest (rem) | #2 BCC Nose (rem) | #3 BCC Ear (rem) | #4 SCC Scalp (rem) | #5 SCC Forehead (rem) | Chest (rem) | Nose, Ear, Scalp, Forehead (rem) | #1 SCC Chest (rem) | #2 BCC Nose (rem) | #3 BCC Ear (rem) | #4 SCC Scalp (rem) | #5 SCC Forehead (rem) |
| Uranium/RU Contaminants | 0.033 | 0.034 | 0.037 | 0.037 | 0.037 | 0.238 | 0.293 | 0.019 | 0.020 | 0.022 | 0.022 | 0.022 |
| Thorium | – | – | – | – | – | – | – | 0.188 | 0.214 | 0.280 | 0.280 | 0.280 |

**Thorium Doses.** The energy employee (EE) submitted a baseline fecal sample [redact], 1994, that was analyzed for thorium. The EE also had several chest counts from 1985–1997, which were evaluated for uranium and thorium. All results indicated activity levels below the minimum detectable activity (MDA) for thorium-232. NIOSH calculated a missed thorium dose based on the MDA value of 0.4 nCi from the EE's last chest count in 1997, and then used IMBA to calculate a chronic inhalation intake from the date of the fecal sample until the last chest count in 1997.

**Uranium/Recycled Contaminant Doses.** Both NIOSH and SC&A-Method A assessed acute intakes from fitting the elevated bioassay data. NIOSH calculated fitted intakes from a bioassay result on [redact], 1985, of 18 µg/L, and another at the MDL (i.e., 14 µg/L) on [redact], 1987. SC&A-Method A calculated a fitted intake from the 18 µg/L result. Both NIOSH and SC&A-Method A calculated a missed uranium internal dose using one-half the MDL value and the chronic intake period from [redact], 1982, to [redact], 1997. Based in these intakes, both NIOSH and SC&A assessed intakes from recycled uranium contaminants. NIOSH choose Type M uranium, while SC&A-Method A selected Type S.

SC&A-Method B assessed a missed uranium dose (Type S) assuming a chronic intake from 1983 to1997.

The key difference between the NIOSH and SC&A-Method A dose calculations is in the selection of the radiation weighting factors, and the remainder organ selection and rules. NIOSH used ICRP 68 weighting factors and remainder rules. SC&A used 10 CFR 835 weighting factors and remainder rules. IMBA allows the user to select either ICRP default values or CFR default values. The IMBA technical documentation states:

> *NOTE for Users in the United States: Radiation protection requirements for Licensees of the U.S. Nuclear Regulatory Commission (USNRC) and U.S. Department of Energy (DOE) and DOE-contractor employees are given in*

*DOE's Occupational Radiation Protection, Title 10, Code of Federal Regulations, Part 835 - referred to here as "10 CFR 835." The requirements under 10 CFR 835 (DOE 1999) differ from the ICRP's current recommendations in respect of (1) tissue weighting factors; (2) remainder tissues, and; (3) remainder tissue rules. In compliance with 10 CFR 835, IMBA Professional provides the User with the appropriate "10 CFR 835 Default" weighting factors and rules for calculation of committed effective dose. This software also provides the "option" of substituting ICRP's currently recommended weighting factors and rules - for purposes only of comparison and investigation.*

For example, recalculating the SC&A-Method A uranium/recycled contaminant #3 BCC Ear dose from Table 2-1 using IMBA with the ICRP default values reduces the dose from 0.037 rem to 0.017 rem.