MEMO

TO: Dose Reconstruction Subcommittee

FROM: Ron Buchanan, SC&A

SUBJECT: Major Differences in the three Dose Reconstruction Methods and their Resolution or Course of Action regarding Rocky Flats Plant Case #[Redact]

DATE: June 16, 2015

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. A summary of the doses assigned and probability of causation (POC) values are listed in the following table:

Table 1. Comparison of Original Total External and Internal Dose Estimates and Resulting POC Values for the Lung

Total Lung Doses	NIOSH (rem)	SC&A-Method A (rem)	SC&A-Method B (rem)
External Doses:			
- Photons <30 keV	0.030	0.019	0.030
- Photons 30–250 keV	1.562	1.488	2.254
- Neutrons <10 keV	0.118	0.129	0.171
- Neutrons 10–100 keV	0.036	0.027	0.036
- Neutrons 0.1–2 MeV	1.037	0.882	1.157
- Neutrons 2–20 MeV	0.457	0.400	0.524
Occupational Medical Dose	0.084	0.294	0.294
Internal Doses: Alpha	46.033	38.676	67.414
Total Lung Dose	**49.357**	**41.915**	**71.880**
POC	**47.51%**	**56.71%**	**55.71%**

The major areas of differences in the three DR methods, and their resolution or course of action, are as follows:

1. **Occupational Medical X-ray Frequency** – Both of SC&A's Method A and B assigned annual doses from medical x-rays exams, as per ORAUT-TKBS-0011-3. NIOSH assigned doses for the two medical x-ray exams as listed in the DOE records. SC&A pointed out that ORAUT-TKBS-0011-3, Table 3-1, page 8, indicates that it is claimant favorable to assign annual x-ray doses because the RFP DOE records NIOSH receives may not be complete concerning medical x-rays. NIOSH indicated that there is an RFP guideline that recommends x-ray exam doses be assigned according to the DOE records received. **Status:** *This difference in DR protocol needs to be resolved.*

2. **SC&A-Method A Missed Internal Dose Distribution** – SC&A Method A assigned missed plutonium and americium doses into the IREP table as a geometric mean (GM) value of a lognormal distribution with a geometric standard deviation (GSD) of 3.0. However, NIOSH

pointed out that ORAUT-OTIB-0060, page 15, states that it should be assigned using a triangular distribution with a minimum of 0, mode of annual dose, and maximum of 2 × mode. When SC&A used this distribution for the internal doses in this case (with total dose of 41.915 rem) a POC value of 41.09% was derived. This is compatible with NIOSH's POC value of 47.51% when a total dose of 49.357 rem was assigned. **Status:** *This issue has been resolved and SC&A will use triangular distributions for missed internal dose in future DRs.*

3. **SC&A-Method B Internal Doses** –

- **DU:** SC&A Method B assigned depleted uranium (DU) dose because the EE's DOE bioassay records included a listing of analysis for uranium as well as plutonium. However, it was concluded that the EE worked in only the plutonium area and not in both the plutonium and uranium areas; therefore, assignment of uranium intakes/doses in this case would be an overestimate.

- **Missed Internal Dose Distribution:** SC&A Method B assigned missed plutonium and americium doses into the IREP table as a GM value of a lognormal distribution with a GSD of 3.0. However, NIOSH pointed out that ORAUT-OTIB-0060, page 15, states that it should be assigned using a triangular distribution with a minimum of 0, mode of annual dose, and maximum of 2 × mode.

- **Plutonium/Americium:** SC&A Method B assigned plutonium intakes/doses based on the Am-241 chest count data. However, during the April 14, 2015, DRSC meeting, it was found that the IMBA program that SC&A has available does not contain the "Add-on" feature #10 that compensates for Am-241 ingrowth; this lack of adjustment results in the plutonium intake/dose results being greater than the values assigned by NIOSH. NIOSH indicated that the SC&A intake/dose values would need to be multiplied by approximately 55% to obtain the correct values.

- **SC&A-Method B Revised Doses and POC:** SC&A revised the doses and POC values by (1) eliminating the DU doses, (2) assigning the missed internal doses with a triangular distribution, and (3) multiplying the derived plutonium doses by 55%. This resulted in a total dose assignment of 36.538 rem with a resulting POC of 38.15%. This is now in line with NIOSH's DR and SC&A's Method A results.

Status: *SC&A needs to have the current version/add-ons, and associated training, for the IMBA program to be able to meaningfully compare DR methods and results.*

The following is a revised summary table after incorporating the above modifications:

Table 2. Comparison of Revised Total External and Internal Dose Estimates and Resulting POC Values for the Lung

Total Lung Doses	NIOSH (rem)	SC&A-Method A (rem)	SC&A-Method B (rem)
External Doses:			
- Photons <30 keV	0.030	0.019	0.030
- Photons 30–250 keV	1.562	1.488	2.254
- Neutrons <10 keV	0.118	0.129	0.171
- Neutrons 10–100 keV	0.036	0.027	0.036
- Neutrons 0.1–2 MeV	1.037	0.882	1.157
- Neutrons 2–20 MeV	0.457	0.400	0.524
Occupational Medical Dose	0.084	0.294	0.294
Internal Doses: Alpha	46.033	38.676	32.072
Total Lung Dose	**49.357**	**41.915**	**36.538**
POC	**47.51%**	***41.09%***	**38.15%**