



Assessment of Professional Judgements in Six Case Reviews Performed under Program Evaluation Report (PER)-017

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Background

- ◆ **April 1, 2013:** SC&A submitted its standard review of six cases reworked under OCAS-PER-017, “Evaluation of Incomplete Internal Dosimetry Records from Idaho, Argonne – East and Argonne – West National Laboratories,” revision 0 (“PER-017”), originally flagged due to incomplete internal dosimetry records.
- ◆ **December 5, 2024:** SC&A presented its review to the Advisory Board on Radiation and Worker Health. SC&A recommended that, to support the Dose Reconstruction Review Methods Work Group, the SPR should consider examining these cases for consistency in professional judgement decisions during dose reconstruction (DR).
- ◆ **January 28, 2026:** SPR tasked SC&A with examining consistency in professional judgement across these cases.
- ◆ **July 27, 2026:** SC&A submitted its professional judgement report to the SPR.

Key areas of professional judgement in dose reconstruction

- ◆ **Co-exposure dose assignment:** The choice of percentiles (50th or 95th) for dose distribution affects total dose estimates.
- ◆ **Addressing unmonitored employment periods:** Choosing adjacent monitored periods, environmental data, or co-exposure estimates to fill gaps affects dose estimates.
- ◆ **Skin cancer location in x-ray dose assignment:** Dose assignment varies by cancer site; incomplete records can introduce uncertainty.
- ◆ **Selection of bioassay data:** There is variability in using in vitro or in vivo data, sometimes favoring higher values or discarding them if deemed excessive.
- ◆ **Construction trade worker (CTW) status:** Assigning higher unmonitored doses to CTWs is often subjective and inconsistent.
- ◆ **Glovebox correction factor:** Criteria vary (such as extremity monitoring, documented glovebox work, or dose ratios), leading to inconsistent application.
- ◆ **Exposure area determination:** Reconstructors must resolve ambiguity due to insufficient documentation of work areas and job assignments.

Case A (Idaho National Laboratory (INL))

professional judgement decisions for external doses

Dose	Original DR (2005)	Reworked DR (2010)
Photon	Maximized 12 exchanges for each full and partial year of employment	Maximized 12 exchanges for each full and partial year of employment
Neutron	Maximized 12 exchanges for each full and partial year of employment	Not included Justified based on employment periods and work location
External onsite ambient	Included Assigned for each full and partial year of employment	Included Assigned for each full and partial year of employment

Case A (INL) professional judgement decisions for medical and internal doses

Dose	Original DR (2005)	Reworked DR (2010)
Occupational medical	Annual	Based on technical basis document (TBD) • 2 exams
Unmonitored internal	Hypothetical 28 radionuclides (ORAUT-OTIB-0002)	Environmental air concentrations
Monitored internal	Not applicable	1 whole body count (WBC) (less than minimum detectable activity (MDA)) • Missed (iodine-129 and iodine-131) Limiting air concentrations (ORAUT-OTIB-0018)

Case B (INL) professional judgement decisions for external doses

Dose	Original DR (2005)	Reworked DR (2007)
Photon	Maximized - Dose conversion factor (DCF) $\times 2$ - Maximizing badge exchanges for full and partial employment years	Maximized - Conservative >250 kiloelectron volt DCFs - Maximizing badge exchanges for full and partial employment years
Neutron	Maximized - DCF $\times 2$ - Maximizing badge exchanges for full and partial employment years	Not included Justified based on work location
External onsite ambient	Included Assigned for each full and partial year of employment	Included Assigned for each full and partial year of employment

Case B (INL) professional judgement decisions for medical and internal doses

Dose	Original DR (2005)	Reworked DR (2007)
Occupational medical	Annual	Annual
Unmonitored internal	Hypothetical 28 radionuclides (ORAUT-OTIB-0002)	Hypothetical 28 radionuclides (ORAUT-OTIB-0002)
Monitored internal	1 WBC (less than MDA) not used to calculated dose	1 WBC (less than MDA) not used to calculate dose

Case C (INL) professional judgement decisions for external doses

Dose	Original DR (2006)	Reworked DR (2008)
Photon	Maximized - Maximum badge exchanges for each full and partial employment year - Conservative DCF of 1.0	Not included
Neutron	Not included	Not included
External onsite ambient	Included Assigned for all years of employment	Not included

Case C (INL) professional judgement decisions for medical and internal doses

Dose	Original DR (2006)	Reworked DR (2008)
Occupational medical	Pre-employment and annual	Not included
Unmonitored internal	Hypothetical 28 radionuclides (ORAUT-OTIB-0002)	Not included
Monitored internal	Not applicable	Compensated based on bioassay data (6 urinalyses and 2 WBCs) and minimizing assumptions

Case D (Argonne National Laboratory – West (ANL-W)) professional judgement decisions

Dose	Original DR (2004)	Reworked DR (2009)
Photon	Maximized Recorded and missed doses multiplied by 2	Maximized Maximum number of badge exchanges
Neutron	Not included	Maximized Maximum number of badge exchanges
External onsite ambient	Included Multiplied by 2	Included Based on TBD
Occupational medical	Annual Multiplied by 1.3	Based on U.S. Department of Energy (DOE) records
Unmonitored internal	Hypothetical 28 radionuclides (ORAUT-OTIB-0002)	Not applicable
Monitored internal	Not applicable	1 WBC (less than MDA); missed assuming cesium-137 Associated radionuclides using ratio in TBD

Case E (ANL-W) professional judgement decisions for external dose

Dose	Original DR (2006)	Reworked DR (2010)
Photon	Maximized 12 badge exchanges for each full and partial employment year	Maximized 12 badge exchanges for each full and partial employment year
Neutron	Maximized 12 badge exchanges for each full and partial employment year	Maximized 12 badge exchanges for each full and partial employment year
External onsite ambient	Included Annual assigned for each full or partial year of employment	Included Annual doses assigned for each full or partial year of employment

Case E (ANL-W) professional judgement decisions for medical and internal doses

Dose	Original DR (2006)	Reworked DR (2010)
Occupational medical	Annual Records indicate only 3 exams	Annual Records indicate only 3 exams
Unmonitored internal	Environmental air concentrations	Limiting air concentrations (ORAUT-OTIB-0018)
Monitored internal	Not applicable	9 WBCs (less than MDA) not used to calculated dose

Case F (Argonne National Laboratory – East (ANL-E)) professional judgement decisions for external doses

Dose	Original DR (2005)	Reworked DR (2008)
Photon	Maximized (ANL-E external TBD not published) - Recorded and missed doses multiplied by 2 - Conservative DCF of 1 50% co-exposure dose for unmonitored periods	Maximized (used ANL-E TBD) - Conservative DCF of 1 - Missed dose based on weekly, biweekly, monthly badge exchanges depending on monitoring period - Onsite ambient for unmonitored
Neutron	Not included based on: - All reported neutron doses were zero - External photon dose consistently low - Administrative practice to monitor for neutrons regardless of exposure risk	Maximized Badge exchanges maximized based on monitoring period
External onsite ambient	Not included	Included Assigned for all years of employment

Case F (ANL-E) professional judgement decisions for medical and internal doses

Dose	Original DR (2005)	Reworked DR (2008)
Occupational medical	Based on TBD	Annual
Unmonitored internal	Limiting air concentrations for 50% of employment	Onsite ambient
Monitored internal	Not applicable	Based on bioassay data: • Used 8 urinalysis results (less than MDA) • Assumed chronic intake for entire employment period • Claimant-favorable because involved higher estimates for both amount of intake and length of intake period

Summary: Professional judgement in external dose (original versus reworked DRs)

- ◆ External dose assumptions were largely aligned and generally used maximizing assumptions except for the compensated reworked DR (Case C)
- ◆ Neutron dose decisions diverged:
 - Two originals included neutrons that reworks omitted
 - Two reworks added neutrons where originals did not
- ◆ Unmonitored photon dose was generally addressed using onsite ambient dose:
 - Only one original DR assigned a 50% co-exposure dose
 - Rework based unmonitored dose on onsite ambient values

Summary: Professional judgement in medical and internal dose (original versus reworked DRs)

Occupational medical exams

- ◆ Original DRs:
 - Four cases used annual exam defaults (A, B, D, and E)
 - Case C included pre-employment plus annual
 - Case F applied TBD guidance
- ◆ Reworked DRs:
 - Three cases used annual exams (B, E, and F)
 - Case A used TBD guidance
 - Case D used DOE records
 - Compensated case (C) did not include medical exams

Internal dose assignments

- ◆ Original DRs:
 - Four cases used hypothetical intakes in ORAUT-OTIB-0002 (A, B, C, and D)
 - Case E assigned environmental air concentrations
 - Case F used limiting air concentrations in ORAUT-OTIB-0018 for 50% of employment
- ◆ Reworked DRs generally used the newly identified bioassay data, except:
 - One rework assigned hypothetical intakes consistent with original
 - One rework assigned limiting air concentrations while original used environmental dose data

Comparison of professional judgement decisions in the original DRs

Case (DR year)	Photon dose	Neutron dose	Onsite ambient	Occupational medical	Unmonitored internal	Monitored internal
A (2005)	Maximized	Maximized	Included	Annual	Hypothetical 28 radionuclides	Not applicable
B (2005)	Maximized	Maximized	Included	Annual	Hypothetical 28 radionuclides	WBC data not used to calculate dose
C (2006)	Maximized	Not applicable	Included	Pre-employment and annual	Hypothetical 28 radionuclides	Not applicable
D (2004)	Maximized	Maximized ($\times 2$)	Included	Annual ($\times 1.3$)	Hypothetical 28 radionuclides	Not applicable
E (2006)	Maximized	Maximized	Included	Annual	Environmental air concentrations	Not applicable
F (2005)	Maximized	Not included	Not included	Based on TBD	Limited air concentrations for 50% employment	Not applicable

Summary of professional judgements in the original DRs

- ◆ **External dose:** Assumptions were maximized in all cases, except that Case F omitted neutron and onsite ambient doses
- ◆ **Occupational medical doses:** All cases assigned annual, with Case C including a pre-employment exam
- ◆ **Internal dose:** Assuming bioassay monitoring was not available:
 - Four cases (A, B, C, and D) assigned dose based on hypothetical intakes of 28 radionuclides
 - One case (E) estimated internal dose based on environmental air concentration data from site TBD
 - One case (F) used limiting air concentrations to estimate internal doses for 50% of the energy employee's employment period

Comparison of professional judgement decisions in the reworked DRs

Case (DR year)	Photon dose	Neutron dose	Onsite ambient	Occupational medical	Unmonitored internal	Monitored internal
A (2010)	Maximized	Not included	Included	Based on TBD (2 exams)	Environmental air concentrations	WBC results, max. air concentration
B (2007)	Maximized	Not included	Included	Annual	Hypothetical 28 radionuclides	WBC not used
C (2008)	Not included	Not applicable	Not included	Not included	Not included	Compensated using bioassay data
D (2009)	Maximized	Maximized	Included	Based on DOE records	Not applicable	Based on WBC data
E (2010)	Maximized	Maximized	Included	Annual	Limiting air concentrations (ORAUT-OTIB-0018)	WBC not used
F (2008)	Maximized	Maximized	Included	Annual	Onsite ambient	Based on urinalysis data

Summary of professional judgements in external and medical reworked DRs

Photon dose:

- ◆ Most cases (A, B, D, E, and F) applied maximizing assumptions
- ◆ Case C did not include photon dose

Neutron dose:

- ◆ Cases A, B, and C did not include neutron dose
- ◆ Cases D, E, and F maximized neutron dose

External onsite ambient:

- ◆ Included in all cases except Case C, where it was not considered

Occupational medical approaches varied:

- ◆ Case A used TBD guidance for exams
- ◆ Cases B, E, and F relied on annual exams
- ◆ Case D referenced DOE records
- ◆ Case C did not include medical exams

Summary of professional judgements in internal reworked DRs

Unmonitored internal dose

Methods were diverse:

- ◆ Case A used environmental air concentrations
- ◆ Case B assigned hypothetical radionuclide intakes (ORAUT-OTIB-0002)
- ◆ Case C did not include
- ◆ Case D marked as not applicable
- ◆ Case E used limiting air concentrations (ORAUT-OTIB-0018)
- ◆ Case F used onsite ambient

Monitored internal dose

Data use differed:

- ◆ Case A referenced WBC results and maximum air concentration
- ◆ Cases B and E had WBC data but did not use it
- ◆ Case C compensated using bioassay data
- ◆ Case D based decisions on WBC data
- ◆ Case F relied on urinalysis results

Professional judgement and dose estimation consistency

- ◆ Variability often stems from differing efficiency strategies (such as using intakes from hypothetical 28 radionuclides versus using limiting air concentrations) applied across cases.
- ◆ Changes in guidance and timing (such as retirement of ORAUT-OTIB-0002) alter available methods and influence results.
- ◆ Best estimate approaches tend to amplify inconsistency compared with deliberately conservative or bounding methods.
- ◆ Standardized decision criteria are essential to reduce variability and improve transparency and reproducibility.



Questions?