ORAU Team **Dose Reconstruction Project for NIOSH** Application of Internal Doses Based on Claimant-Favorable Assumptions for Processing as Best Estimates	Document Number: ORAUT-OTIB-0033 Effective Date: 04/20/2005 Revision No.: 00 Controlled Copy No.: _____ Page 1 of 9
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RECORD OF ISSUE/REVISIONS

ISSUE AUTHORIZATION DATE	EFFECTIVE DATE	REV. NO.	DESCRIPTION
Draft	04/05/2005	00-A	New technical basis document to provide instructions on the application of overestimated internal doses for processing as best estimates. Initiated by Elizabeth M. Brackett.
Draft	04/12/2005	00-B	Incorporates internal review comments. Training required. Initiated by Elizabeth M. Brackett.
04/20/2005	04/20/2005	00	First approved issue. Initiated by Elizabeth M. Brackett.

1.0 PURPOSE

The purpose of this document is to provide a graded approach to the application of overestimated internal doses in Oak Ridge Associated Universities (ORAU) Team Technical Information Bulletin (OTIB) ORAUT-OTIB-0018, Internal Dose Overestimates for Facilities With Air Sampling Programs, for processing cases in the absence of complete information. ORAUT-OTIB-0018 was written to be applied as an overestimate for workers with no significant intakes of particulate radioactive material. Because it was intended to be used only as an overestimate, it did not consider additional factors that could limit the upper bound for certain types of workers.

These factors include:

- The period during which the energy employee worked,
- The processes conducted at the site at which the energy employee worked,
- The job category and work location of the energy employee, and
- The results of bioassay measurements for the energy employee.

These factors are addressed here to enable application of the values in ORAUT-OTIB-0018 in a graded manner as the best available estimate in the absence of specific site or individual information, when appropriate.

2.0 BACKGROUND

The final rule that describes the methods for dose reconstruction (42 CFR Part 82) allows the assumption of exposure conditions that maximize the internal dose to the organ where the cancer originated in cases where information in the energy employee's personal exposure records and the general site information gathered for the site are insufficient to determine specific internal radiation exposure conditions for the case. Use of a large dose estimate to complete the dose reconstruction is permissible. Information obtained through additional research would not result in a higher internal dose to the organ where the cancer originated, and would likely lower the dose.

This document applies to all workers covered under ORAUT-OTIB-0018; it does not extend the applicable periods specified in the OTIB.

ORAUT-OTIB-0018 does not apply to intakes of tritium. Because tritium bioassay analysis is easy and quick, it is assumed that an individual with a significant potential for intakes was monitored. An assessment of these results must be included in addition to the doses applied in the OTIB.

Radioiodines are not addressed in ORAUT-OTIB-0018; doses are generally significant only for thyroid cancers. For thyroid cancers, the OTIB may be applied if the resultant probability of causation (POC) is greater than 50% for the purposes of this document. For thyroid cancers with POCs less than 50%, radioiodines must be added separately if a significant intake potential exists.

This document does not replace or override ORAUT-OTIB-0014, and it does not supersede any information in a site profile if this document contradicts that information.

3.0 EXPOSURE CATEGORIES

Several categories are delineated for the purpose of applying a graded approach. The dose reconstructor must apply judgment when determining the appropriate categories for individual workers and take into account all information in the worker's file, (e.g., telephone interview information and

external doses). A worker's assigned category may change over time if the worker changed job titles or work locations.

3.1 EXPOSURE POTENTIAL

Three levels of potential exposure are applied. Attachment A provides guidance and examples on exposure potential specific to job and location. These are provided as guidance only; job titles could have had different usages at different sites.

Seldom Exposed Above Airborne Environmental Level
Individuals in jobs that seldom to never involved work with unsealed radioactive sources and who worked in locations with airborne activity levels no greater than the environmental background.

Intermittently Exposed Above Airborne Environmental Level
Individuals with jobs that could have involved work with unsealed sources on occasion but not routinely, or individuals who sometimes entered an area with a potential for airborne activity levels greater than the environmental background.

Routinely Exposed Above Airborne Environmental Level
Individuals with jobs that were likely to have routinely involved work with unsealed sources, or individuals who worked in areas likely to have airborne activity levels greater than the environmental background.

3.2 PERIOD

With the implementation of U.S. Department of Energy (DOE) Order 5480.11, Radiation Protection For Occupational Workers, in 1989 and the subsequent codification of requirements (10 CFR 835, Occupational Radiation Protection) a few years later, monitoring programs became more robust and personnel who had a modest exposure potential were likely to have been monitored. Respiratory protection was generally required for radiological areas that had levels greater than 10% of the derived air concentration, on which ORAUT-OTIB-0018 is based. Before that time, bioassay monitoring is likely to have been less organized and proceduralized, with routine monitoring at some sites or at particular facilities within a site but with sporadic or as-needed sampling at other sites and locations. Records of some of the earlier monitoring may be unavailable.

3.3 BIOASSAY

Application of this approach is divided into monitored and unmonitored individuals because the use of individual monitoring results takes priority over estimated values when it will make a difference to the compensation decision. Coworker data also takes precedence over estimated values.

Note: The unmonitored category includes those who had only a baseline or a termination measurement, or both.

4.0 APPLICATION OF DOSE

Tables 1 and 2 show the doses to be applied for several category combinations. Table 1 applies to unmonitored workers, and Table 2 applies to monitored workers.

Table 1: Unmonitored Personnel

Category	Exposure Potential	Period	Application of Dose
1	Seldom	All	ORAUT-OTIB-0014
2	Intermittent	Before 1989	50% ORAUT-OTIB-0018
3	Intermittent	1989 and later	5% ORAUT-OTIB-0018
4	Routine	Before 1989	1. Coworker data 2. ORAUT-OTIB-0018
5	Routine	1989 and later	1. Coworker data 2. 10% ORAUT-OTIB-0018

Unmonitored categories 2 and 3: The application of 50% of the corresponding "routine" category value is based on the assumption that an individual in category 2 or 3 is intermittently exposed. Because the occupancy factor is assumed to be uniformly distributed from 0 to 1, a mean value of 0.5 is applied to the ORAUT-OTIB-0018 value (or to the 10% value in 1989 or later, resulting in a total of 5% of the ORAUT-OTIB-0018 value). The geometric standard deviation remains the same.

Unmonitored categories 4 and 5: Coworker data are applied if available; otherwise ORAUT-OTIB-0018 (or applicable fraction) is acceptable.

Table 2: Monitored Personnel

Category	Exposure Potential	Period	Bioassay	Application of Dose
1	All	All	All results < MDA[a]	1. Coworker data 2. Missed dose determination 3. ORAUT-OTIB-0018
2	All	All	Incidents and/or results > MDA	1. IMBA application for all internal dose 2. ORAUT-OTIB-0018 + assessment of positive results

a. MDA = minimum detectable amount or activity; results less than those given in Table 7-1 of ORAUT-OTIB-0018 may be considered in the < MDA category.

Monitored category 1: Coworker data are considered to be the best estimate for this case. ORAUT-OTIB-0018 may be applied as an overestimate to the systemic organs in the absence of coworker data but, if it yields a POC greater than 47%, a missed dose calculation must be performed if adequate information is available. The OTIB might not be an overestimate of non-systemic organ (respiratory and gastrointestinal tract) doses, so if it yields a POC less than 50%, coworker data or missed dose must be applied.

Monitored category 2: If the application of ORAUT-OTIB-0018 plus the dose from assessment of the positive results yields a POC greater than 47%, an assessment based on the worker's bioassay must be performed if adequate information is available.

REFERENCES

DOE (U.S. Department of Energy), 1988, "Radiation Protection For Occupational Workers," Order 5480.11, Washington, D.C., December 21.

ORAU (Oak Ridge Associated Universities), 2004, Assignment of Environmental Internal Doses for Employees Not Exposed to Airborne Radionuclides in the Workplace, ORAUT-OTIB-0014, Oak Ridge, Tennessee.

ORAU (Oak Ridge Associated Universities), 2005, Internal Dose Overestimates for Facilities With Air Sampling Programs, ORAUT-OTIB-0018, Oak Ridge, Tennessee.

ATTACHMENT A
EXPOSURE POTENTIALS
(Page 1 of 3)

Job Categories

Likely *low* potential for work with unsealed sources

Administrator
Assistant
Business systems specialist
Cafeteria worker
Checker
Clerk
Computer specialist
Dispatcher
Draftsman
Groundskeeper
Instructor
Manager
Medical technician
Office supervisor
Planner
Quality assurance specialist
Program analyst
Programmer
Radio operator
Recruiter
Scheduler
Secretary
Telephone operator

Possible *some* potential for work with unsealed sources, depending on job specifics

Biologist
Boilermaker
Bricklayer
Carpenter
Construction worker
Driver
Electrician
Electronics technician
Engineer
Equipment operator
Firefighter
Foreman
Foundry worker
Heavy equipment operator
HP analyst
Instrument mechanic
Insulator
Ironworker
Janitor
Laborer
Mechanic
Painter
Patrolman
Photographer
Scientist
Security guard
Specialist
Storekeeper
Supervisor
Surveyor
Technician

Likely *high* potential for work with unsealed sources

Analytical chemist
Assembly worker
Chemical operator
Fabricator
Glovebox worker
Health physics technician
Machinist
Material handler
Metallurgist
Millwright
Pipefitter
Plumber
Processor
Production worker
Radiation monitor
Radiochemist
Reactor operator
Steamfitter
Ventilation and balance operator
Waste handler
Welder

ATTACHMENT A
EXPOSURE POTENTIALS
(Page 2 of 3)

Example Work Locations

High Potential for Airborne Activity (alpha, beta/gamma, and/or uranium)

- Uranium refining – Fernald and Weldon Spring (natural, depleted, and enriched uranium reactor fuel and targets); Oak Ridge National Laboratory (weapons parts and highly enriched reactor fuel); K-25, Paducah, and Portsmouth Gaseous Diffusion Plants (production of UF_6 feed)

- Fuel and target fabrication – Highly enriched uranium: Savannah River Site 300 M Area; Hanford 300 Area

- Chemical separations facility – Weapons plutonium: Hanford 200 East and West Areas (PUREX, REDOX, T and B Plants, 231-Z Plant); Savannah River Site (F Canyon complex) Uranium recycling: Hanford (UO_3 Plant, U Plant); Savannah River Site (H Canyon complex); Idaho National Engineering Laboratory (Idaho Chemical Processing Plant)

- Weapons component fabrication facility – Plutonium: Rocky Flats; Hanford 234-5 Plutonium Finishing Plant; Los Alamos (TA-21 and TA-55)

- Weapons component fabrication facility – Plutonium recycling: Rocky Flats; Hanford 234-5 Plutonium Finishing Plant; Los Alamos (TA-55) Highly enriched uranium; Y-12; Rocky Flats

- Isotope separation – Uranium: K-25, Paducah, and Portsmouth Gaseous Diffusion Plants

- Reactor operations – Hanford (B, D, F, H, DR, C, KW, KE, and N Reactors); Savannah River Site (R, P, K, L, and C Reactors)

- Weapons testing – Test sites: Nevada Test Site; Bikini and Enewetak Atolls; Christmas and Johnston Islands; Amchitka Island; Tonopah Test Range; Salton Sea Test Base

- Weapons research and development: Los Alamos; Lawrence Livermore; Sandia (New Mexico and California)

- Uranium ore sampling – Fernald and Middlesex

- Other facilities with the potential for airborne uranium or plutonium

Low Potential for Airborne Activity (alpha, beta/gamma, and/or uranium)

- Chemical separations facility – Tritium: Savannah River Site

- Weapons component fabrication facility – Tritium including recovery and recycling: Mound; Savannah River Site (Tritium Facility), Lithium-6 deuteride including recovery and recycling: Oak Ridge Y-12

- Weapons operations – Assembly and dismantlement: Sandia; Pantex; Burlington

ATTACHMENT A
EXPOSURE POTENTIALS
(Page 3 of 3)

- Weapons operations – Modifications and maintenance: Pantex; Burlington; Sandia; Clarksville; Medina Modification Centers
- Isotope separation – Lithium: Y-12 COLEX and ELEX Plants
- Isotope separation – Heavy water: Savannah River Site Heavy Water Plant; Dana Heavy Water Plant
- Fuel and target fabrication – Enriched Lithium: Y-12; Savannah River Site M Area
- Administrative and Support Facilities or other non-radiological facility