



### PUBLICATION RECORD

EFFECTIVE DATE	REVISION NUMBER	DESCRIPTION
12/01/2004	00	New document to provide direction for assignment of organ dose from medical X-ray exams based on TBD information. Incorporates formal internal and NIOSH review comments. First approved issue. Initiated by Steven E. Merwin.
07/21/2006	01	Revised to include additional sites with approved TBDs, new guidance on X-rays for locations of the skin, and additional X-ray procedures. Incorporates formal internal and NIOSH review comments. Constitutes a total rewrite of the document. Incorporates additional NIOSH review comment. Training is required. Initiated by Robert C. Winslow.
01/02/2008	02	Revised to update Attachment C to include approved Request for Direction or Operational Change for X-Ray dose assignment to the face and to include updates based on current TBD revisions. Constitutes a total rewrite of the document. Revised to incorporate internal comments and to include recently approved TBDs, change column headings, and alignment of x-ray procedures to align with new headings in Attachment A. Incorporates second formal internal review comments. Revised to address OCAS comments. Training is required. Initiated by Robert C. Winslow.
03/03/2010	03	Revised to remove the LAT chest doses for Ames Laboratory in Notes to Table A-1 which are now included in a revised Ames Site Profile; to add guidance for skin dose for PA and LAT chest for post 1970; to better define dose to various areas of skin from PFG, PA and LAT chest pre-1970 and lumbar spine procedures; to remove Table A-1, the quick reference table, and Table B-1, the records availability table, and move them to shared space on the O drive so that they can be kept up to date as Site Profiles are revised; to move the responsibilities of the "subject expert - external dosimetry" to the "dose reconstruction group managers". Incorporates formal internal and NIOSH review comments. Constitutes a total rewrite of the document. Training is required. Initiated by Elyse M. Thomas.
06/06/2017	04	Revision initiated to ensure consistency with ORAUT-OTIB-0006. Appendix C on the calculation of skin dose deleted as duplicate of ORAUT-OTIB-0006 content. Incorporates formal internal review comments. Constitutes a total rewrite of the document. Training is required. Initiated by Elyse M. Thomas.

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## 1.0 **PURPOSE**

The purpose of this procedure is to provide direction on reconstruction of doses from occupational medical X-rays for the Oak Ridge Associated Universities (ORAU) Team Dose Reconstruction Project for the National Institute for Occupational Safety and Health (NIOSH). The Energy Employees Occupational Illness Compensation Program Act of 2000 (EEOICPA) requires the assignment of external dose from medical X-ray examinations that were performed for occupational health screening at covered facilities and required as a condition of employment. This procedure relies on information in Site Profiles and supersedes some of the instructions for X-ray dose reconstruction in ORAUT-PROC-0006, *External Dose Reconstruction*. ORAUT-OTIB-0079 reviews the data for sites that might have performed these occupational X-ray screenings at off site, non-covered facilities.

## 2.0 **SCOPE**

This procedure applies to Project Employees who perform or supervise dose reconstructions for employees who are covered under EEOICPA.

## 3.0 **REFERENCES**

OCAS-IG-001, *External Dose Reconstruction Implementation Guideline*

DCAS-IG-003, *Radiation Exposures Covered for Dose Reconstructions under Part B of the Energy Employees Occupational Illness Compensation Program Act*

ORAUT-OTIB-0006, *Dose Reconstruction from Occupational Medical X-Ray Procedures*

ORAUT-OTIB-0079, *Guidance on Assigning Occupational X-Ray Dose Under EEOICPA for X-Rays Administered Off Site*

ORAUT-PROC-0006, *External Dose Reconstruction*

ORAUT-PROC-0106, *Roadmap to Reconstructing Dose*

## 4.0 **RESPONSIBILITIES**

Principal Medical Dosimetrist – Initiates revisions to medical dose information in Site Profiles, ORAU Team Technical Information Bulletins (OTIBs), and procedures when necessary. Provides guidance on issues and answers technical questions that arise in the course of dose reconstruction. Calculates organ doses, including skin doses, based on technical information. Provides interpretation of claim files or Site Profile information when necessary. Provides direction for the revision of this procedure based on revised or new information in Site Profiles or on feedback from Dose Reconstructors. Keeps Table A-1, Quick-Reference Table for X-Ray Dose Assignments, and Table B-1, X-Ray Records Availability for AWE/DOE Sites, up to date as Site Profiles are revised. The tables are on the Project Q drive in folder \\Obj\_3DR\DR Information\PROC-0061 (x-ray) Table A-1 and Table B-2 updates.

Dose Reconstruction Group Manager – Informs the Principal Medical Dosimetrist of issues or problems with implementation of this procedure. Provides additional guidance to Dose Reconstructors as needed.

Dose Reconstruction Production Manager – A dose reconstruction team leader responsible for ensuring e-mail requests are sent to InitialQC@oraucoc.org about any noted discrepancies between

NOCTS and the DOL or DOE files, or if the Dose Reconstructor needs supplemental data to perform the DRR.

Claims Processing Support Group Manager – Submits additional requests for X-ray records at the request of Dose Reconstructors.

Dose Reconstructor – Informs the Dose Reconstruction Group Manager of issues with implementation of this procedure. Applies published dose values and requests assistance from the Dose Reconstruction Group Manager and Principal Medical Dosimetrist when published values do not exist, need to be developed, or both.

## **5.0 GENERAL**

As described in OCAS-IG-001, *External Dose Reconstruction Implementation Guideline*, and DCAS-IG-003, *Radiation Exposures Covered for Dose Reconstructions under Part B of the Energy Employees Occupational Illness Compensation Program Act*, doses from occupational medical X-ray procedures that are performed on Energy Employees for occupational health screening and as a condition of employment must be included in dose reconstructions. This requirement is complicated by the fact that the doses from these procedures were not typically measured and were not considered or included by the site as a part of the Energy Employee's overall occupational exposure. Because these exposures were not monitored, reconstruction of doses must rely on information in the claim files, OTIBs, Site Profiles, and the medical and health physics literature. Dose from medical X-ray screening procedures is assigned for the Energy Employee's verified employment period, including a remedial period if applicable, but is not assigned for a residual contamination period.

Typical X-ray procedures eligible for inclusion in dose reconstruction under EEOICPA are (1) Photofluorography (PFG); Posterior-Anterior (PA) and Lateral (LAT) 14- by 17-in. chest X-rays to screen for tuberculosis, lung cancer, or other lung diseases; (2) Anterior-Posterior (AP) and LAT lumbar spine X-rays (and sometimes AP and LAT spot projections) to screen for back anomalies, particularly for Energy Employees who performed heavy lifting; and (3) AP pelvis, thoracic spine, or cervical spine X-rays to screen for fluorosis in Energy Employees who were exposed to fluoride. Most other procedures (such as extremities) were performed in cases of work-related injuries, which excludes them from the screening category and, therefore, should not be included in dose reconstruction. Additional projections (such as oblique or lordotic chest projections) that are requested to better visualize suspicious areas on a radiograph are also not generally screening procedures (i.e., performed on all workers regardless of history, symptoms, or complaint) and therefore generally excluded from dose reconstruction. However, there are some exceptions in which additional projections were part of the screening protocol (for example, oblique chest projections might have been part of the screening protocol for asbestos workers). Site Profiles provide descriptions of the screening procedures for each site when they are available.

All occupational X-ray doses are assigned in the Interactive RadioEpidemiological Program (IREP) as follows:

Exposure rate: Acute  
Radiation type: Photons E = 30 to 250 keV

Section 6.0 of this procedure provides direction for assignment of occupational X-ray doses for Energy Employees from specific sites based on approved Site Profiles. If the relevant Site Profile has not been issued, the Dose Reconstructors should review ORAUT-OTIB-0006, *Dose Reconstruction from Occupational Medical X-Ray Procedures*, and report and request assistance or needed dose information to their Dose Reconstruction Group Manager and the Principal Medical Dosimetrist.

Section 6.0 describes a procedure for three general dose reconstruction approaches for calculating the probability of causation (POC): overestimate, best estimate, and underestimate. The following sections describe the conditions under which to use each approach:

### **5.1 Overestimate**

- 5.1.1 The general philosophy for an overestimate is to assign dose from all eligible X-ray procedures under EEOICPA for each site where the Energy Employee worked.
- 5.1.2 An overestimate is typically applied to claims with a POC that will clearly be less than 45% in the judgement of the Dose Reconstructor.
- 5.1.3 There is no need to request claim-specific X-ray records for the Energy Employee if those were not initially provided by the site.
- 5.1.4 The overestimate in Table A-1, while based on information in Site Profiles, might include higher frequencies than those in the Site Profiles to ensure that the approach is, in fact, an overestimate.

### **5.2 Best Estimate**

- 5.2.1 The general philosophy for a best estimate is to assign dose from all eligible X-ray procedures under EEOICPA for each site where the Energy Employee worked. However, some X-rays should be excluded from a best estimate. For example, prehire and rehire procedures more than 1 year before U.S. Department of Labor (DOL)-verified employment should not be included. However, if records provide documented extenuating circumstances for a delay in the start of employment, X-ray procedures up to 2 years before DOL-verified employment may be considered. Based on the possibility of physical changes over time, it is expected that prehire and rehire X-ray procedures more than 1 or 2 years before DOL-verified employment would have had to have been redone to verify the physical condition of the potential Energy Employee. If records indicate such additional X-ray procedures, all of the prehire and rehire procedures should be included in the dose reconstruction.
- 5.2.2 A best estimate is typically applied to claims in which the POC is between 45% and 52% if the X-ray dose is maximized or to claims in which a best estimate can be obtained with minimal effort.
- 5.2.3 All available X-ray records for the individual Energy Employee should be requested from the site (if not already provided) if the compensability decision could be affected.

### **5.3 Underestimate**

- 5.3.1 The underestimate for the assignment of dose from eligible X-ray procedures under EEOICPA may only be used when the POC for the claim is greater than 52%. The general philosophy is to assign dose from eligible X-ray procedures in the most efficient manner possible to achieve a POC greater than 52%. In other words, if the POC is greater than 52% without including dose from X-ray procedures, the X-ray doses should not be included.
- 5.3.2 Only claim-specific X-ray records may be used.

## **6.0 PROCEDURE**

### **6.1 Determining the Approach**

#### **Dose Reconstructor**

- 6.1.1 Reviews all of the information in the claim file as a whole (internal dose, external dose, environmental dose, and medical dose).
- 6.1.2 Determines the approach (overestimate, best estimate, or underestimate) in accordance with Section 5.0.
- 6.1.3 For an overestimate proceeds to Section 6.2, for a best estimate proceeds to Section 6.3, for an underestimate proceeds to Section 6.4.

### **6.2 Applying an Overestimate**

#### **Dose Reconstructor**

**NOTE: As a general rule, overestimates should not require claim-specific X-ray records if they were not included in the DOE submittal.**

- 6.2.1 Reviews the X-ray records in the claim file to determine the frequencies and types of X-rays for the Energy Employee.
- 6.2.2 If the records indicate there are more or different types of X-ray procedures eligible under EEOICPA that could result in higher organ doses in comparison with the doses based on the overestimate in Table A-1, includes doses from the additional procedures and notifies the Dose Reconstruction Group Manager and Principal Medical Dosimetrist of these differences.
- 6.2.3 If the Dose Reconstructor suspects the records could be necessary to ensure results favorable to the claimant, notifies his/her Dose Reconstruction Production Manager, who sends a request to InitialQC@oraucoc.org (the Claim Processing Support Group Manager) to request them from the site. If the Dose Reconstruction Production Manager is not available, then the Dose Reconstructor sends the request to InitialQC@oraucoc.org directly so as not to cause delay. Otherwise proceeds to step 6.2.6.

#### **Claims Processing Support Group Manager**

- 6.2.4 Requests the occupational medical records.
- 6.2.5 Notifies the Dose Reconstructor when those records are available or if there are no available records.

#### **Dose Reconstructor**

- 6.2.6 If the records are not available, makes appropriate judgments based on the available information, including information from interviews, to assign dose.
- 6.2.7 Uses the Project dose reconstruction tools to calculate the X-ray doses.
- 6.2.8 Assigns the doses in IREP with a normal distribution in IREP Parameter 1 and an uncertainty of the dose multiplied by 0.3 in Parameter 2.

### 6.3 Applying a Best Estimate

**NOTE:** A best estimate must be conducted with:

- A published Site Profile or a NIOSH-approved dose reconstruction method for sites for which a Site Profile will not be written.
- X-ray records in the DOE submittal. The only exception is the Y-12 National Security Complex, because Y-12 does not provide X-ray records.

#### **Dose Reconstructor**

6.3.1 If the claim file does not include the X-ray records, and the site is not the Y-12 Plant, notifies the Claims Processing Support Group Manager to request them from the site. Otherwise proceeds to step 6.3.5.

**NOTE:** The requested records could include information that is not typically provided by the sites in response to bulk requests. Table B-1, X-Ray Records Availability for AWE/DOE Sites, contains details on the types of information that are normally included in the DOE submittals for sites that are listed in Table A-1.

#### **Claims Processing Support Group Manager**

6.3.2 Requests the occupational medical records.

6.3.3 Notifies the Dose Reconstructor when those records are available or if there are no available records.

#### **Dose Reconstructor**

6.3.4 If the Energy Employee's X-ray records are not available, and if the information could affect the claim compensability, places the claim on Hold and requests additional information from the Claims Processing Support Group Manager.

6.3.5 If the Energy Employee's X-ray records are available, reviews the X-ray records to determine the frequencies and types of X-rays for the Energy Employee.

6.3.6 Uses the following hierarchy of information to assign dose from X-rays:

6.3.6.1 Energy Employee records showing X-ray procedures: Does not add dose for years for which there are no records.

6.3.6.2 Telephone interview summary, especially if site records of X-ray procedures are not available after requesting the information in step 6.3.1.

6.3.6.3 Information in the Site Profile about historical X-ray procedure frequencies if they cannot be determined from records or telephone interviews.

6.3.7 Uses the Project dose reconstruction tools to calculate the X-ray doses.

6.3.8 Assigns the doses in IREP with a normal distribution in Parameter 1 and an uncertainty of the dose multiplied by 0.3 in Parameter 2.

6.3.9 Uses assumptions favorable to the claimant when necessitated by a lack of reliable information.

## **6.4 Applying an Underestimate**

### **Dose Reconstructor**

6.4.1 If X-ray records are not available and the inclusion of X-ray dose could raise the calculated POC to 50% or greater, uses a best estimate using the Site Profile and other available information (see Section 6.3).

6.4.2 When using as an underestimate, assigns dose only for X-rays in the Energy Employee's records.

6.4.3 Uses the Project dose reconstruction tools to calculate the X-ray doses.

6.4.4 Assigns the doses in IREP with a normal distribution in Parameter 1 and an uncertainty of the dose multiplied by 0.3 in Parameter 2.

**NOTE: A combination of an underestimate and a best estimate is acceptable because the overall goal is to arrive at the correct compensability decision in the most efficient manner possible, provided an adequate basis exists for the dose assignments.**

## **7.0 RECORDS**

The following records are generated as applicable:

None.

## **8.0 APPLICABLE DOCUMENTS**

### **8.1 Drivers**

Contract No. 200-2014-57820, "Dose Reconstruction and Related Activities to Support NIOSH's Responsibilities Under the EEOICPA"

ORAUT-PLAN-0028, *Quality Assurance Program Plan*

ORAUT-PLAN-0029, *Project Management Plan*

### **8.2 Forms**

None.

## **9.0 DEFINITIONS AND ACRONYMS**

AP – Anterior-Posterior.

DCAS – Division of Compensation and Analysis Support.

DOE – U.S. Department of Energy.

DOL – U.S. Department of Labor.

EEOICPA – Energy Employees Occupational Illness Compensation Program Act of 2000 (42 U.S.C. § 7384 et seq.).

in. – Inch.

IREP – Interactive RadioEpidemiological Program.

LAT – Lateral.

NIOSH – National Institute for Occupational Safety and Health.

OCAS – Office of Compensation and Analysis Support (now DCAS).

ORAU – Oak Ridge Associated Universities.

OTIB – ORAU Team Technical Information Bulletin.

PA – Posterior-Anterior.

PFG – Photofluorography.

POC – Probability of Causation.

Screening – Screening X-rays are systematic examinations performed on asymptomatic people, without history, complaint, physical findings, or physician evaluation.

Site Profile – (1) The combination of five Technical Basis Documents (TBDs), each written to describe a specific technical area related to a covered site or sites, along with an introduction. (2) One TBD covering all technical areas related to a covered site or sites.

Technical Basis Document (TBD) – Document that provides the rationale and background information for an approach for dose reconstruction related to a particular type of radiation at a particular site that participated in the manufacture/assembly of nuclear weapons or their components.

U.S.C. – United States Code.

§ – Section or Sections.

**ATTACHMENT A**  
**QUICK-REFERENCE TABLE FOR X-RAY DOSE ASSIGNMENTS**

The Table A-1 Quick Reference Table for X-Ray Dose Assignment document can be found at the following location: Q:\DR Information\PROC-0061 (x-ray) Table A-1, Quick Reference Table for X-ray Dose Assignments updates, so it can be kept up to date with Site Profile revisions.

**ATTACHMENT B**  
**X-RAY RECORDS AVAILABILITY FOR DOE SITES**

The Table B-1 Records Availability for DOE Sites document can be found at the following location:  
Q:\DR Information\PROC-0061 (x-ray) Table B-1, Records Availability for DOE sites, so it can be kept  
up to date with Site Profile revisions.