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**ADVISORY BOARD ON  
RADIATION AND WORKER HEALTH**

*National Institute for Occupational Safety and Health*

**A REVIEW OF NIOSH'S PROGRAM EVALUATION REPORT  
DCAS-PER-062, "ORAUT-OTIB-0052"**

**Contract No. 211-2014-58081  
SCA-TR-2018-PR002, Revision 0**

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**SC&A, INC.:**

***Technical Support for the Advisory Board on Radiation and Worker Health Review of NIOSH Dose Reconstruction Program***

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## ABBREVIATIONS AND ACRONYMS

Advisory Board or

ABRWH	Advisory Board on Radiation and Worker Health
AMW	all monitored workers
CPWR	Center to Protect Workers' Rights
CTW	construction trade worker
DCAS	Department of Compensation Analysis and Support
DOE	U.S. Department of Energy
DR	dose reconstruction
EE	energy employee
HPAREH	Health Protection Annual Radiation Exposure History
INL	Idaho National Laboratory
MUD	Master Update Dump
NIOSH	National Institute for Occupational Safety and Health
NOCTS	NIOSH OCAS Claimant Tracking System
OCAS	Office of Compensation Analysis and Support
ORAUT	Oak Ridge Associated Universities Team
OTIB	ORAUT technical information bulletin
PER	program evaluation report
POC	probability of causation
REX	Radiological Exposure (database)
SRS	Savannah River Site
TIB	technical information bulletin

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## 1 STATEMENT OF PURPOSE

To support dose reconstruction (DR), the National Institute for Occupational Safety and Health (NIOSH) and the Oak Ridge Associated Universities Team (ORAUT) have assembled a large body of guidance documents, workbooks, computer codes, and tools. In recognition of the fact that all of these supporting elements in DR may be subject to revisions, provisions exist for evaluating the effect of such programmatic revisions on the outcome of previously completed DRs. Such revisions may be prompted by document revisions due to new information, misinterpretation of guidance, changes in policy, and/or programmatic improvements.

The process for evaluating potential effects of programmatic changes on previously completed DRs has been proceduralized in OCAS-PR-008, Revision 2, *Preparation of Program Evaluation Reports and Program Evaluation Plans*, dated December 6, 2006 (NIOSH 2006b). This procedure describes the format and methodology to be employed in preparing a program evaluation report (PER) and a program evaluation plan.

A PER provides a critical evaluation of the effects that a given issue or programmatic change may have on previously completed DRs. This includes a qualitative and quantitative assessment of potential effects. Most important in this assessment is the potential effect on the probability of causation (POC) of previously completed DRs with POCs <50%.

During an Advisory Board on Radiation and Worker Health meeting on December 14, 2017, the Advisory Board tasked SC&A to conduct reviews of several PERs. Included among these PERs is DCAS-PER-062, *ORAUT-OTIB-0052* (NIOSH 2017; hereafter “PER-062”). In conducting a PER review, SC&A is committed to perform the following five subtasks, each of which is discussed in this report:

- Subtask 1: Assess NIOSH’s evaluation and characterization of the “issue” and its potential effects on DR. Our assessment intends to ensure that the issue was fully understood and characterized in the PER.
- Subtask 2: Assess NIOSH’s specific methods for corrective action. In instances where the PER involves a technical issue that is supported by documents (e.g., white papers, technical information bulletins [TIBs], procedures) that have not yet been subjected to a formal SC&A review, Subtask 2 will include a review of the scientific basis and/or sources of information to ensure the credibility of the corrective action and its consistency with current/consensus science. Conversely, if such technical documentation has been formalized and previously subjected to a review by SC&A, Subtask 2 will simply provide a brief summary conclusion of this review process.
- Subtask 3: Evaluate the PER’s stated **approach** for identifying the universe of potentially affected DRs, and assess the **criteria** by which a subset of potentially affected DRs was selected for reevaluation. The second step may have important implications in instances where the universe of previously denied DRs is very large and, for reasons of practicality, NIOSH’s reevaluation is confined to a subset of DRs that, based on their scientific judgment, have the potential to be significantly affected by the PER. In behalf of Subtask 3, SC&A will also evaluate the timeliness of the completion of the PER.

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- Subtask 4: Conduct audits of DRs affected by the PER under review. The number of DRs selected for audit for a given PER will vary. (It is assumed that the selection of the DRs and the total number of DR audits for each PER will be made by the Advisory Board.)
- Subtask 5: Prepare a written report that contains the results of the Subtask 4 DR audit, along with our review conclusions.

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## **2 SUBTASK 1: IDENTIFY THE CIRCUMSTANCES THAT NECESSITATED DCAS-PER-062, “ORAUT-OTIB-0052”**

Construction trade workers (CTWs) who worked on new facility construction were not monitored because no radioactive materials were present before the facility was completed and had become operational. Thereafter, facility modifications and/or maintenance of major systems that now contained radioactive materials/contamination may have exposed CTWs, some of whom were not monitored for external and/or internal exposure. CTWs include (but are not limited to) laborers, mechanics, masons, carpenters, electricians, painters, pipefitters, boilermakers, millwrights, sheet-metal workers, ironworkers, insulators, etc.

To address the fact that some CTWs at various U.S. Department of Energy (DOE) sites were unmonitored, NIOSH issued ORAUT-OTIB-0052, Revision 00, *Parameters to Consider When Processing Claims for Construction Trade Workers*, on August 31, 2006 (NIOSH 2006a). The purpose of this TIB was to provide guidance for the reconstruction of exposure by means of “adjusted” site-specific coworker data to those CTWs who were either unmonitored or inadequately monitored. Guidance for the reconstruction of external penetrating dose for unmonitored CTWs involves the use of a 1.4 adjustment factor (i.e., multiplier) and the 95th percentile of site-specific coworker dose, which was derived using dose data that compared CTW to all monitored workers (AMW) doses for six DOE sites.

### **2.1 CHRONOLOGY OF EVENTS**

ORAUT-OTIB-0052, Revision 00 PC-1: On January 16, 2007, Sections 8.2 (guidance on the determination of penetrating dose for unmonitored CTWs), 8.3 (guidance on the determination of nonpenetrating dose for unmonitored CTWs), and 8.4 (guidance on the determination of internal dose) were revised to provide consistent guidance for DR (NIOSH 2007a).

SC&A Draft Review of ORAUT-OTIB-0052, Revision 00: At the September 19–21, 2006, Advisory Board meeting, SC&A was tasked with performing a review of ORAUT-OTIB-0052. SC&A’s review was submitted July 3, 2007 (SC&A 2007). As a result of this review, SC&A identified the following 16 findings (SC&A 2011):

- Finding 1: ORAUT-OTIB-0052 does not address differences in doses received by different construction occupations.
- Finding 2: The dose databases used are lacking significant data for the early operational years.
- Finding 3: The dose databases do not always identify who were CTWs, and for CTWs, what were their occupations.
- Finding 4: NIOSH did not make modifications to the internal dose calculation methodology as they indicated to the Center to Protect Workers’ Rights (CPWR) that they would.

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- Finding 5: Plutonium and/or uranium were used to compare internal CTW to AMW doses. What about other radionuclides?
- Finding 6: ORAUT-OTIB-0052 does not address how to determine CTW doses at sites that do not have a coworker model.
- Finding 7: ORAUT-OTIB-0052 does not address how to determine neutron CTW doses.
- Finding 8: All Savannah River Site (SRS) external doses are from the Health Protection Annual Radiation Exposure History (HPAREH). There needs to be an evaluation of other dose databases, e.g., Fayerweather, SRS-ABST.
- Finding 9: Evaluation is based on DOE annual exposure report. Needs to address the Master Update Dump (MUD) dose database for Idaho National Laboratory (INL).
- Finding 10: For post-1974, the ratio of penetrating doses experienced by CTWs to other workers in ORAUT-OTIB-0052 does not agree with the INL epidemiologic study (NIOSH 2005), which indicates a correction factor closer to 2, and perhaps greater for some job types.
- Finding 11: The claimant favorability of the ORAUT-OTIB-0052 approach for INL early period internal dose (to 1965) cannot be determined.
- Finding 12: The Radiological Exposure (REX) dose database was not used. NIOSH needs to compare results based on the REX database to those given in ORAUT-OTIB-0052.
- Finding 13: The CTW doses need to be compared consistently to either AMW or non-CTWs. Currently, different sections perform different comparisons.
- Finding 14: The handling of “missing dose” needs to be consistent. Currently, some sections include “missing dose” while others do not.
- Finding 15: ORAUT-OTIB-0052 does not give instructions for what to do if high or low cumulative exposures are suspected.
- Finding 16: Some construction occupations (e.g., pipefitters) receive exposures larger than the average CTW exposure. The average member of such groups may consistently receive external exposures above the 95th percentile, but possibly not by much. Occupational details in the data are not plentiful enough to define percentile value.

OCAS-PER-014, Revision 0: NIOSH issued OCAS-PER-014, Revision 0, *Construction Trades Workers*, on November 28, 2007 (NIOSH 2007b), to evaluate CTW claims that had been adjudicated at DOE sites with existing external coworker studies prior to the issuance of ORAUT-OTIB-0052. As a result of this PER, 977 potentially affected claims were identified, which were reviewed to determine if they were affected by ORAUT-OTIB-0052 guidance.

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ORAUT-OTIB-0052, Revision 01: On February 17, 2011, NIOSH issued Revision 01 of ORAUT-OTIB-0052 (NIOSH 2011) to address five of the findings from SC&A’s review of Revision 00 PC-1. These changes provided clarification for the basis of certain assumptions and cautions regarding limitations of the data.

SC&A’s Draft Review of ORAUT-OTIB-0052, Revision 01: SC&A’s review of ORAUT-OTIB-0052, Revision 01, was issued on July 11, 2011 (SC&A 2011). As a result of many Subcommittee for Procedure Reviews meetings, 6 of the 16 findings identified in the review of ORAUT-OTIB-0052, Revision 00, were closed, 3 findings were transferred to the ORAUT-OTIB-0020 review, 1 finding was in abeyance, and 6 findings remained in progress. The purpose of the report was to determine which of SC&A’s findings were addressed by ORAUT-OTIB-0052, Revision 01, and to provide recommendations to the Subcommittee on the status of the remaining findings.

SC&A’s Draft Review of OCAS-PER-014, Revision 0: On March 16, 2012, SC&A issued its review of OCAS-PER-014 (SC&A 2012). The review of OCAS-PER-014 resulted in the identification of six findings. Three of the findings were identified as “conditional” because SC&A was unable to confirm data due to the lack of or restrictive access to information. One finding identified NIOSH’s failure to proceed with the evaluation of the 977 potentially affected claims, and two findings related to unresolved issues from SC&A’s review of ORAUT-OTIB-0052, Revision 00 (SC&A 2007).

ORAUT-OTIB-0052, Revision 02: NIOSH issued Revision 02 of ORAUT-OTIB-0052 on July 24, 2014, to add language to the Purpose, Scope, Section 7.0, and Section 8.0 to clarify applicability of the TIB to CTWs who could have worked for prime Management and Operations contractors and DOE sites (NIOSH 2014).

DCAS-PER-062, Revision 0: NIOSH issued PER-062 on November 2, 2017 (NIOSH 2017), in response to the issuance of Revisions 01 and 02 of ORAUT-OTIB-0052 (NIOSH 2011, 2014). Both revisions to ORAUT-OTIB-0052 added language to clarify guidance for the DR of CTWs, hence the need for this PER.

## 2.2 SC&A COMMENTS

SC&A reviewed each of the documents leading up to changes incorporated in Revision 01 and Revision 02 of ORAUT-OTIB-0052 (NIOSH 2011, 2014). Although no values were changed in the two revisions to ORAUT-OTIB-0052, guidance was added to clarify assumptions and provide more detail about who qualified as a CTW, as well as to add information about limitations of the data. SC&A agrees with NIOSH regarding these changes and their effects on CTWs that mandate the need for PER-062 (NIOSH 2017).

**There are no findings pertaining to Subtask 1.**

### 3 SUBTASK 2: ASSESS NIOSH’S SPECIFIC METHODS FOR CORRECTIVE ACTION

NIOSH’s plan for corrective action involved a two-step process, which included the identification of applicable sites and the assessment of the total population of potentially applicable cases, as discussed below.

Establishing a List of Applicable Sites: NIOSH first identified a list of sites for which coworker data had been developed using monitored site workers (see Table 3-1). Those sites where a site-specific PER is planned or where a PER had already been issued were excluded from consideration in PER-062. Sites that were included in this PER are identified as “Yes” in column 2 of Table 3-1.

**Table 3-1. NIOSH Applicable Site List**

<b>Site</b>	<b>Included in PER-062</b>
Ames Laboratory	PER forthcoming
Albany Research Center	PER forthcoming
Area IV – Santa Susana Field Laboratory	PER forthcoming
Bridgeport Brass Company	PER-061
Brookhaven National Laboratory	PER forthcoming
Canoga Avenue Facility	PER forthcoming
Clinton Engineering Works	Yes
De Soto Avenue Facility	PER forthcoming
Downey Facility	PER forthcoming
Electro Metallurgical Company	PER-068
Energy Technology Engineering Center (ETEC)	PER forthcoming
Feed Materials Production Center (Fernald)	PER forthcoming
Hanford	PER forthcoming
K-25 (Oak Ridge Gaseous Diffusion Plant)	PER forthcoming
Kansas City Plant	Yes
Lake Ontario Ordnance Works	Yes
Los Alamos National Laboratory	PER forthcoming
X-10 (Oak Ridge National Laboratory)	PER forthcoming
Paducah Gaseous Diffusion Plant	PER-049
Portsmouth Gaseous Diffusion Plant	PER forthcoming
Rocky Flats Plant	PER forthcoming
Sandia National Laboratories – Albuquerque, NM	Yes
Savannah River Site	PER forthcoming
Y-12 Plant	PER forthcoming
Extrusion Plant	Yes
Nevada Test Site (1945-1957)	Yes
Pacific Proving Grounds	Yes
Pantex Plant	PER forthcoming
Pinellas Plant	PER forthcoming
United Nuclear Corp.	PER forthcoming
Weldon Spring Plant	Yes

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Determination of the Population of Claims: As shown in Table 3-1, eight sites were evaluated under PER-062. An assessment of claims from these eight sites resulted in NIOSH identifying a total of 2,486 cases that potentially required reevaluation using ORAUT-OTIB-052, Revision 02, guidance.

### 3.1 SC&A'S COMMENTS AND FINDINGS

SC&A's assessment of NIOSH's methods for corrective action included a process to verify (1) all sites that have coworker models, (2) the total number of cases associated with the eight sites that are the subject of PER-062, and (3) the PERs listed in Table 3-1 were issued after Revision 02 of ORAUT-OTIB-0052 and included reevaluation of all claims less than 50% POC.

Coworker Models: SC&A reviewed the entire list of sites with covered employment under the Energy Employees Occupational Illness Compensation Program Act of 2000 to determine if a coworker model had been developed for the site. The SC&A-developed list was compared to those sites identified in Table 3-1. SC&A determined that NIOSH accurately captured all sites where coworker models have been developed using site-specific data. However, SC&A does have one observation regarding Table 3-1.

**Observation 1:** SC&A could not find documentation indicating that a coworker model is being developed or that a PER is forthcoming for Albany Research Center, which is listed in Table 3-1.

Total Number of Cases: Using the NIOSH OCAS Claimant Tracking System (NOCTS), SC&A was able to approximate NIOSH's 2,486 total number of cases associated with the eight sites that are being reevaluated under PER-062.

PERs: SC&A reviewed the three PERs associated with Bridgeport Brass Company, Electro Metallurgical Company, and Paducah Gaseous Diffusion Plant listed in Table 3-1. Our review confirmed that the PERs had been issued after the ORAUT-OTIB-0052, Revision 02, effective date of July 24, 2014. Since the three PERs required the reevaluation of all cases with POCs <50%, the reworks would have included the most current ORAUT-OTIB-0052 guidance. However, since SC&A cannot presently assess the forthcoming PERs for sites listed in Table 3-1, we recommend a follow-up action, as discussed in Observation 2.

**Observation 2:** To ensure that appropriate ORAUT-OTIB-0052 guidance is applied to all cases evaluated under planned PERs for the 20 sites listed in Table 3-1, SC&A should (1) maintain a list of these sites, (2) be informed when the PER is issued, and (3) review the PER to assess whether the selection of reworked cases will adequately capture all potential CTWs.

**SC&A has no findings about the methodology used by NIOSH for corrective action. However, our review of NIOSH's corrective actions did identify two observations.**

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#### **4 SUBTASK 3: EVALUATE THE PER'S STATED APPROACH FOR IDENTIFYING THE NUMBER OF DOSE RECONSTRUCTIONS REQUIRING REEVALUATION OF DOSE**

As discussed in Subtask 2, NIOSH calculated a total population of 2,486 cases associated with eight sites. To determine if the energy employee (EE) from that population should have been classified as a CTW, NIOSH developed the following list of keywords: craft, iron, teamster, plast, maint, crane, boil, skill, pipe f, equip, engineer, radiographer, asbestos, rigger, sheet, metal, linem, ship, plumb, construction, machinist, insulator, weld, mason, tile, black, millw, heavy, electric, operating, cement, truck, paint, brick, laborer, pipef, and carp. NIOSH used these keywords to query the DR Reports and the NOCTS database to identify cases where any of the keywords were found. This process resulted in the identification of 1,438 cases that met the search criteria.

In addition, NIOSH conducted a text search on the DR Reports for all cases from all sites, except those already reworked under a separate PER as identified in Table 3-1, to determine if the site names for any the eight sites considered under PER-062 were mentioned. This search identified an additional 754 cases. Using the keywords above, NIOSH conducted a query on these 754 cases. This query eliminated 223 cases, which brought the total population of CTW cases potentially requiring additional evaluation to 1,969 (1,438 + 531).

Additional Reductions to the Population of CTW Claims: NIOSH then considered the following factors, which further reduced the number of CTW cases:

- Duplicate cases (EE was listed at one site but another site on the list was mentioned) = 169 cases
- POC greater than 50% = 260 cases
- Cases in the process of a DR, which would use the current version of ORAUT-OTIB-0052 = 23 cases
- Cases compensated under a Special Exposure Cohort = 163 cases
- Nevada Test Site cases with employment starting after 1957 = 267 cases
- Clinton Engineering Works employment that did not include years 1948 or 1949 = 22 cases

Considering these factors, the CTW population of 1,969 was reduced by 970 cases, leaving a total of 1,006 cases remaining that needed further evaluation.

#### **4.2 SC&A'S COMMENTS AND FINDINGS**

SC&A reviewed the list of keywords used to define an EE as a CTW. SC&A determined that this list was thorough and adequately served to identify workers as CTWs.

SC&A does not have the ability to perform queries on the DR Reports. Based on personal communications with David Allen of NIOSH, these queries were performed by the NIOSH

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Information Technology Group and required 3 days to complete. Therefore, SC&A is not able to verify the final total number of cases that were subject to dose reevaluation.

Therefore, SC&A's assessment is limited to the methodology and criteria employed by NIOSH to identify those cases that are or were potentially affected by PER-062. Based on this restrictive assessment, SC&A concludes that the screening criteria used to identify potentially affected claims are scientifically sound.

**SC&A has no findings pertaining to the identification of claims that were affected by PER-062.**

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## **5 SUBTASK 4: CONDUCT AUDITS OF A SAMPLE SET OF DOSE RECONSTRUCTIONS AFFECTED BY DCAS-PER-062**

NIOSH evaluated the 1,006 cases to determine (1) if coworker doses were assigned, and (2) if so, whether the EE should have been considered a CTW. For those cases meeting both of these criteria, the DR was reviewed to assess whether the ORAUT-OTIB-0052 external dose correction factor 1.4 had been applied. If not, the dose was recalculated using Revision 02 of ORAUT-OTIB-0052, as well as other current revision of applicable documents.

Of the 1,006 cases, 1 case resulted in a recalculated POC greater than 52%, 992 had POCs below 45% or no change, and 1 case resulted in a POC between 45% and 50%. Among the pool of 1,006 DRs that are subject to audit, SC&A recommends the selection of the one case that resulted in a POC between 45% and 50% to satisfy its commitment under Subtask 4.

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