



## ORAU TEAM Dose Reconstruction Project for NIOSH

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**PUBLICATION RECORD**

<b>EFFECTIVE DATE</b>	<b>REVISION NUMBER</b>	<b>DESCRIPTION</b>
09/09/2004	00	New technical basis document for the Mound Site – Introduction. First approved issue. Initiated by Jeffrey S. Vollmer.
03/13/2009	00 PC-1	<p>Approved page change initiated to remove information pertaining to Monsanto Chemical Company, the subject of a class of employees added to the Special Exposure Cohort. These changes occurred on pages 6 and 7. NIOSH required language was revised on page 5 in Section 1.0. Added references on pages 5, 6, and 7 and added the Reference Section on page 8. No changes occurred as a result of formal internal review. Incorporates formal NIOSH review comments. No sections were deleted. Training required: As determined by the Task Manager. Initiated by Donald N. Stewart.</p> <p><u>Signature on File</u> <span style="float: right;"><u>03/04/2009</u></span> Donald N. Stewart, Document Owner</p> <p><u>Signature on File</u> <span style="float: right;"><u>03/04/2009</u></span> John M. Byrne, Task 3 Manager</p> <p><u>Signature on File</u> <span style="float: right;"><u>03/04/2009</u></span> Edward F. Maher, Task 5 Manager</p> <p><u>Signature on File</u> <span style="float: right;"><u>03/11/2009</u></span> Kate Kimpan, Project Director</p> <p><u>Signature on File</u> <span style="float: right;"><u>03/13/2009</u></span> James W. Neton, Associate Director for Science</p>
03/28/2013	01	Revision initiated to revise Special Exposure Cohort and to add attribution and annotation information. Reorganized document to follow standard structure. Updated text in Section 1.1. No changes occurred as a result of formal internal review. Incorporates formal NIOSH review comments. Training required: As determined by the Objective Manager. Initiated by Donald N. Stewart.

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## ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DOL	U.S. Department of Labor
EEOICPA	Energy Employees Occupational Illness Compensation Program Act
IMBA	Integrated Modules for Bioassay Analysis (program)
IREP	Interactive RadioEpidemiological Program
NIOSH	National Institute for Occupational Safety and Health
ORAU	Oak Ridge Associated Universities
POC	probability of causation
SEC	Special Exposure Cohort
SRDB Ref ID	Site Research Database Reference Identification (number)
TBD	technical basis document
U.S.C.	United States Code
§	section or sections

## 1.1 INTRODUCTION

Technical basis documents and site profile documents are not official determinations made by the National Institute for Occupational Safety and Health (NIOSH) but are rather general working documents that provide historical background information and guidance to assist in the preparation of dose reconstructions at particular sites or categories of sites. They will be revised in the event additional relevant information is obtained about the affected site(s). These documents may be used to assist NIOSH staff in the completion of the individual work required for each dose reconstruction.

In this document the word “facility” is used as a general term for an area, building, or group of buildings that served a specific purpose at a site. It does not necessarily connote an “atomic weapons employer facility” or a “Department of Energy [DOE] facility” as defined in the Energy Employees Occupational Illness Compensation Program Act [EEOICPA; 42 U.S.C. § 7384l(5) and (12)]. EEOICPA defines a DOE facility as “any building, structure, or premise, including the grounds upon which such building, structure, or premise is located ... in which operations are, or have been, conducted by, or on behalf of, the Department of Energy (except for buildings, structures, premises, grounds, or operations ... pertaining to the Naval Nuclear Propulsion Program)” [42 U.S.C. § 7384l(12)]. Accordingly, except for the exclusion for the Naval Nuclear Propulsion Program noted above, any facility that performs or performed DOE operations of any nature whatsoever is a DOE facility encompassed by EEOICPA.

For employees of DOE or its contractors with cancer, the DOE facility definition only determines eligibility for a dose reconstruction, which is a prerequisite to a compensation decision (except for members of the Special Exposure Cohort). The compensation decision for cancer claimants is based on a section of the statute entitled “Exposure in the Performance of Duty.” That provision [42 U.S.C. § 7384n(b)] says that an individual with cancer “shall be determined to have sustained that cancer in the performance of duty for purposes of the compensation program if, and only if, the cancer ... was at least as likely as not related to employment at the facility [where the employee worked], as determined in accordance with the POC [probability of causation<sup>1</sup>] guidelines established under subsection (c) ...” [42 U.S.C. § 7384n(b)]. Neither the statute nor the probability of causation guidelines (nor the dose reconstruction regulation, 42 C.F.R. Pt. 82) restrict the “performance of duty” referred to in 42 U.S.C. § 7384n(b) to nuclear weapons work (NIOSH 2010).

The statute also includes a definition of a DOE facility that excludes “buildings, structures, premises, grounds, or operations covered by Executive Order No. 12344, dated February 1, 1982 (42 U.S.C. 7158 note), pertaining to the Naval Nuclear Propulsion Program” [42 U.S.C. § 7384l(12)]. While this definition excludes Naval Nuclear Propulsion Facilities from being covered under the Act, the section of EEOICPA that deals with the compensation decision for covered employees with cancer [i.e., 42 U.S.C. § 7384n(b), entitled “Exposure in the Performance of Duty”] does not contain such an exclusion. Therefore, the statute requires NIOSH to include all occupationally-derived radiation exposures at covered facilities in its dose reconstructions for employees at DOE facilities, including radiation exposures related to the Naval Nuclear Propulsion Program. As a result, all internal and external occupational radiation exposures are considered valid for inclusion in a dose reconstruction. No efforts are made to determine the eligibility of any fraction of total measured exposure for inclusion in dose reconstruction. NIOSH, however, does not consider the following exposures to be occupationally derived (NIOSH 2010):

- Background radiation, including radiation from naturally occurring radon present in conventional structures
- Radiation from X-rays received in the diagnosis of injuries or illnesses or for therapeutic reasons

<sup>1</sup> The U.S. Department of Labor (DOL) is ultimately responsible under the EEOICPA for determining the POC.

### 1.1.1 Purpose

This site profile supports the Oak Ridge Associated Universities (ORAU) Team documentation of historic practices at the Mound Laboratory site in Miamisburg, Ohio. It is an evaluation of internal and external dosimetry data, site monitoring, and other pertinent data for unmonitored and monitored workers for use as a supplement to individual monitoring data. This site profile provides technical basis information to be used to evaluate the total occupational dose for EEOICPA claimants.

### 1.1.2 Scope

In 1943, the Manhattan Engineer District began the Dayton Project to investigate the chemistry and metallurgy of polonium. Between 1943 and 1948, this work was performed at locations around Dayton, all of which turned out to be too small for the job. As such, the Mound Plant was constructed in 1947 in Miamisburg, Ohio to replace these earlier laboratories. Mound was first occupied in May 1948 and became operational February 1949. The site's role grew to include nuclear weapons component development and production, and such secondary missions as radioactive waste management and recovery, the use of radioactive materials for nonweapons purposes, and the purification of nonradioactive isotopes for scientific and commercial research. This site profile contains supporting documentation to assist in the evaluation of worker dose from these processes at the Mound Laboratory, using the methodology in NIOSH implementation guides (NIOSH 2002 and 2007).

Methods and concepts of measuring radiation exposure to workers have evolved since the beginning of Mound operations in 1949. This site profile provides supporting technical data to evaluate the total Mound occupational dose that can reasonably be associated with the worker's radiation exposure. This dose includes occupational internal and external exposures, occupationally required diagnostic X-ray examinations, and onsite exposure to site environmental releases. Consistent with NIOSH implementation guidance (NIOSH 2002 and 2007), this site profile identifies how to adjust the historic occupational dose to account for current scientific methods and protection factors.

In addition, this site profile presents technical basis methods used to prepare the Mound worker dose records for input to the NIOSH Interactive RadioEpidemiological Program (IREP) and the Integrated Modules for Bioassay Analysis (IMBA) computer codes used to evaluate worker dose. Because information on measurement uncertainties is an integral component of the NIOSH approach, this site profile describes how the uncertainty is evaluated for the Mound exposure and dose records.

This site profile describes Mound facilities and processes and historic information related to worker internal and external exposures. Attachments contain critical data and tables required by dose reconstructors to suffice as a standalone document.

This site profile also supplies supporting technical data used in the evaluation of the occupational dose that may be reasonably associated with a Mound Laboratory worker's claim. The source of exposure may have resulted from external and internal radiation sources, required medical X-rays and to onsite releases and ambient exposure. Doses that may have occurred to unmonitored workers or that may have been missed by monitoring are included in this evaluation. Over time, improvements to monitoring devices and techniques as well as new protection standards have been developed. This site profile also captures these historical changes.

The doses are evaluated using the NIOSH IMBA and the IREP computer programs. As part of these evaluations, uncertainties associated with the assessment are an integral part of the NIOSH process. Therefore uncertainty analysis of Mound Laboratory exposure is also an essential part of this site profile.

This site profile consists of the latest versions of six major parts called technical basis documents (TBDs): this Introduction, Site Description, Occupational Medical Dose, Occupational Environmental Dose, Occupational Internal Dose, and Occupational External Dose. Each TBD has attachments as appropriate with relevant data that can be used by the dose reconstructor to evaluate claims. Sections 1.2 through 1.6 describe the TBDs.

### **1.1.3 Special Exposure Cohort Petition Information for the Mound Plant**

#### **Classes Added to the SEC**

*Employees of the Department of Energy (DOE), its predecessor agencies, and DOE contractors or subcontractors who worked in any areas at the Mound Plant site from October 1, 1949, through February 28, 1959, for a number of work days aggregating at least 250 work days or in combination with work days within the parameters established for one or more other classes of employees in the SEC (SEC-0090; Leavitt 2008).*

*All employees of the Department of Energy (DOE), its predecessor agencies, and its contractors and subcontractors who had at least one tritium bioassay sample and worked at the Mound Plant in Miamisburg, Ohio from March 1, 1959 through March 5, 1980, for a number of work days aggregating at least 250 work days, occurring either solely under this employment, or in combination with work days within the parameters established for one or more other classes of employees in the Special Exposure Cohort (SEC-00171; Sebelius 2010).*

*All employees of the Department of Energy (DOE), its predecessor agencies, and their contractors and subcontractors who worked at the Mound Plant in Miamisburg, Ohio, from September 1, 1972 through December 31, 1972, or from January 1, 1975 through December 31, 1976, for a number of work days aggregating at least 250 work days, occurring either solely under this employment or in combination with work days within the parameters established for one or more other classes of employees included in the Special Exposure Cohort (SEC-00207; Sebelius 2012).*

Dose reconstruction guidance in this document for periods before March 6, 1980, is presented to provide a technical basis for partial dose reconstructions for claims not covered in the SEC class through March 5, 1980. Although NIOSH found that it is not possible to completely reconstruct radiation doses for the SEC classes above, NIOSH intends to use any internal and external monitoring data that may become available for an individual claim (and that can be interpreted using existing NIOSH dose reconstruction processes or procedures). Therefore, dose reconstructions for employees who worked in any areas of the Mound Plant during the periods from October 1, 1949 through February 28, 1959, or September 1, 1972 through December 31, 1972, or January 1, 1975 through December 31, 1976; or who worked in R or SW Buildings (as indicated by tritium bioassay) during the period from March 1, 1959 through March 5, 1980, but who do not qualify for inclusion in the SEC, may be performed using these data as appropriate.

## **1.2 SITE DESCRIPTION**

Part 2 describes facilities and processes and potential radiation sources utilized during the history of the Mound Laboratory. The tables showing radionuclides of concern and operational histories of the different facilities and sites are presented in this part. This document provides processes, radioisotope forms, and other information that might be useful in the completion of dose reconstructions. The dose reconstructor would use these data when monitoring data or other methods of evaluating dose are inadequate (ORAUT 2009a).

### **1.3 OCCUPATIONAL MEDICAL DOSE**

Part 3 presents information for evaluation of dose due to occupational medical procedures. This includes radiation doses due to medical X-rays that were required for preemployment, annual, and other prescribed examinations. Any changes to techniques or equipment that were used at Mound Laboratory are also presented in this TBD. This TBD presents the pertinent details to help assist dose reconstructors in determining doses from occupational medical procedures at Mound Laboratory (ORAUT 2013).

### **1.4 OCCUPATIONAL ENVIRONMENTAL DOSE**

Part 4 presents information for use in reconstructing radiation doses to unmonitored workers. The releases of radionuclides from buildings at Mound Laboratory are related to the methods used to calculate doses to unmonitored workers. Potential internal exposures are presented that might have resulted from air dispersion of radionuclides from the buildings, ground-level releases during construction or deconstruction activities, and resuspension of radioactive contaminated soil. External radiation sources from various site facilities are evaluated for their contribution to this environmental dose. Methodology and equipment for estimating these doses over the years have changed, and these changes are taken into account in evaluating doses to unmonitored workers. Part 4 presents the details necessary for calculation of occupational environmental doses to unmonitored workers at Mound Laboratory (ORAUT 2009b).

### **1.5 OCCUPATIONAL INTERNAL DOSIMETRY**

Part 5 presents information about occupational internal doses. The most significant radionuclides are presented in this TBD. This TBD also describes historical changes in monitoring methods and equipment. These changes are presented to aid the dose reconstructors in evaluating internal dosimetry records. Tables showing minimum detectable activities and other pertinent monitoring details are presented for both *in vitro* and *in vivo* bioassay techniques that might have been used. This TBD presents information that will aid the dose reconstructor in calculating doses to monitored and unmonitored workers (ORAUT 2010).

### **1.6 OCCUPATIONAL EXTERNAL DOSIMETRY**

Part 6 outlines the details of the occupational external dosimetry that will aid the dose reconstructor in evaluating external exposure to monitored and unmonitored workers at Mound Laboratory. Historical techniques and practices are presented and discussed in this TBD as well as radiation protection standards and practices that could have affected the dosimetry program. Tables are included that list historical exchange frequencies, techniques, exposure levels, and other details that will aid the dose reconstructor in evaluating external exposure. The pertinent information that can be utilized by dose reconstructors in evaluating occupational external dose is in this TBD (ORAUT 2004).

### **1.7 ATTRIBUTIONS AND ANNOTATIONS**

All information requiring identification was addressed via references integrated into the reference section of this document.



## REFERENCES

- Leavitt, M. O. 2008, *HHS Designation of Additional Members of the Special Exposure Cohort under the Energy Employees Occupational Illness Compensation Program Act of 2000, Designating a Class of Employees from Mound Plant, Miamisburg, Ohio*, U.S. Department of Health and Human Services, Office of the Secretary, Washington, D.C., March 3. [SRDB Ref ID: 80513]
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- Sebelius, K., 2012, *HHS Designation of Additional Members of the Special Exposure Cohort under the Energy Employees Occupational Illness Compensation Program Act of 2000, Designating a Class of Employees from the Mound Plant, Dayton, Ohio*, U.S. Department of Health and Human Services, Office of the Secretary, Washington, D.C., December 7.