

Office of Compensation Analysis and Support (OCAS)	Document No. OCAS-IG-003 Effective Date: November 05, 2007 Revision No. 0
Radiation Exposures Covered for Dose Reconstructions under Part B of the Energy Employees Occupational Illness Compensation Program Act	Page 1 of 11
Approval: _____ Signature on file _____ Date: <u>11/05/2007</u> <i>J. W. Neton, Assoc. Dir. for Science</i> Concurrence: _____ Signature on file _____ Date: <u>11/05/2007</u> <i>L. J. Elliott, Director</i>	Supersedes: None

TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
1.0	Purpose and Scope.....	3
2.0	Covered Exposure at DOE Facilities.....	3
2.1	Occupational Environmental Exposure.....	4
2.2	Natural Background Exposure.....	5
2.3	Occupational Medical X-ray Exposure.....	5
3.0	Covered Exposure at AWE Facilities.....	5
3.1	During the Contract Period.....	6
	3.1.1 Occupational Environmental Exposure	
	3.1.2 Natural Background Exposure	
	3.1.3 Occupational Medical X-ray Exposure	
	3.1.4 Nuclear Navy Exposure	
3.2	During the Residual Contamination Period.....	8
	3.2.1 Occupational Environmental Exposure	
	3.2.2 Natural Background Exposure	
	3.2.3 Occupational Medical X-ray Exposure	

Effective Date: 11/05/2007	Revision No. 0	OCAS Document No. OCAS-IG-003	Page 2 of 11
-------------------------------	-------------------	----------------------------------	--------------

Record of Issue/Revisions

Issue Authorization Date	Effective Date	Revision No.	Description
11/05/2007	11/05/2007	0	Description of covered exposure under EEOICPA

Effective Date: 11/05/2007	Revision No. 0	OCAS Document No. OCAS-IG-003	Page 3 of 11
-------------------------------	-------------------	----------------------------------	--------------

1.0 PURPOSE AND SCOPE

The purpose of this document is to provide guidance as to which sources of radiation are to be included in dose reconstructions that are prepared by the National Institute for Occupational Safety and Health (NIOSH) under Part B of the Energy Employees Occupational Illness Compensation Program Act (EEOICPA). Specifically, descriptions are provided of the nature and type of occupationally-derived exposure that must be included in the dose reconstruction of work conducted by or for the U.S. Department of Energy (DOE) or its predecessor agencies (e.g., the Energy Research and Development Administration, the Atomic Energy Commission and the Manhattan Engineer District).¹ In accordance with the provisions of EEOICPA, these exposures must be evaluated for workers at one of two types of facilities, designated as either a DOE or an Atomic Weapons Employer facility. Because there are differences in the nature and the extent of the exposures that are included in these two facility types, this document provides a separate discussion for each.

2.0 COVERED EXPOSURE AT DOE FACILITIES

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 causation²] 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 CFR Part 82) define “performance of duty” for DOE employees with a covered cancer or restrict the “duty” to nuclear weapons work.

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

¹ For purposes of simplicity, all such agencies will be referred to collectively as “DOE” in the discussion that follows.

² The U.S. Department of Labor is ultimately responsible under the EEOICPA for determining the POC.

Effective Date: 11/05/2007	Revision No. 0	OCAS Document No. OCAS-IG-003	Page 4 of 11
-------------------------------	-------------------	----------------------------------	--------------

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.³ 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.

These exposures are assessed for each year from the date of initial radiation exposure at a covered DOE facility to the date of cancer diagnosis, which is established by the Department of Labor. In addition to the exposures associated with any radioactive material that was processed at the facility, any dose associated with radiation or radiation generating devices that were used at the DOE facility during the designated time period must also be reconstructed. This includes, but is not limited to, doses from: 1) non-destructive testing devices such as radiography units; 2) process or flow gauges that employ radioactive sources; 3) moisture or density gauges; 4) electrostatic eliminators; and, 5) radiation generating laboratory instruments, such as x-ray diffraction units.

2.1 Occupational Environmental Exposure

Environmental exposures due to elevated radiation background levels from DOE operations are included in dose reconstructions⁴. This includes the external exposure associated with environmentally deposited radioactivity, as well as the intake of radioactive materials due to: 1) the direct inhalation or ingestion of material released directly to the environment; or 2) the inhalation or ingestion of radioactive material that has been deposited on the ground and resuspended due to plant operations.

For workers who have been monitored for internal and external exposure via bioassay samples and personal dosimeter badges, their exposure to environmental sources is included in these measurements. As such, a separate assessment of this mode of exposure is not necessary in these cases.

Intakes attributable to globally distributed fallout from the above ground testing of nuclear weapons are not included in EEOICPA dose reconstructions (see attachment A), except at sites where individuals participated in weapons testing as part of their work assignment (e.g., the Pacific Proving ground or the Nevada Test Site). At weapons testing sites, if baseline measurements of workers are

³ Occupationally-derived exposure, defined as that exposure incurred during the performance of duty at a DOE facility, does not include certain sources of radiation exposure that are described later in this document.

⁴ Exposures due to increased natural background radiation, a subset of environmental exposure, are discussed in section 2.2.

Effective Date: 11/05/2007	Revision No. 0	OCAS Document No. OCAS-IG-003	Page 5 of 11
-------------------------------	-------------------	----------------------------------	--------------

available to definitively identify intakes of fallout that occurred prior to employment at the site, these intakes are not considered occupationally-derived exposure at the site and are not included in the dose reconstruction.

2.2 Natural Background Exposure

Exposure to internal or external natural background radiation is not included in dose reconstructions, unless there is evidence that the natural background was increased due to a DOE activity (see attachment A). This is what is known as Technologically Enhanced Naturally Occurring Radioactive Material (TENORM). Exposure to radon in the workplace would only be considered in a dose reconstruction if there was an increase in natural radon levels due to the presence of a DOE refined material that included ^{226}Ra . In addition, increased radon levels due to the existence of structures or tunnels that were required to safely test nuclear weapons or components (e.g., tunnels at the Nevada Test Site, gravel gerties at IAAP) would be included in a dose reconstruction, while increased levels of radon in ordinary sub-surface structures (e.g., basements used for office or storage space), not related to the safe testing of nuclear weapons, would not be included.

For bioassay samples that have been collected from site workers and analyzed for radionuclides that are naturally present in excreta (e.g., natural uranium in urine, natural thorium in feces), the amount of radioactivity naturally present in the sample is not considered in the assessment of the dose from site operations. If, however, the information is not available to subtract the contribution of the natural background component from the sample result, it is an acceptable practice, which is favorable to the claimant, to consider the background as part of the occupationally-derived exposure.

2.3 Occupational Medical X-ray Exposure

At many DOE facilities, physical examinations were required as a condition of employment. Some of these examinations included the use of medical screening x-rays. In accordance with 42 C.F.R. pt. 81, external doses received from occupational x-ray screening procedures, which were provided to the energy employee as a condition of employment, are included in dose reconstructions. X-rays performed for diagnostic or therapeutic reasons, however, are excluded. Screening x-rays are systematic examinations performed on asymptomatic people without history, complaint, physical findings, or physician evaluation. Diagnostic x-rays are examinations of people who already have suspicious signs or symptoms of a potential condition performed after physician evaluation.

3.0 COVERED EXPOSURE AT AWE FACILITIES

Under EEOICPA, employment at an AWE facility is categorized as either (1) during the DOE contract period (i.e., when the AWE was processing or producing material that emitted radiation and was used in the production of an atomic

Effective Date: 11/05/2007	Revision No. 0	OCAS Document No. OCAS-IG-003	Page 6 of 11
-------------------------------	-------------------	----------------------------------	--------------

weapon), or (2) during the residual contamination period (i.e., periods that NIOSH has determined there is the potential for significant residual nuclear weapons-related contamination after the period in which weapons-related production occurred).⁵ The exposures to be included in a dose reconstruction during each of these time periods are not necessarily the same.⁶ Specifically, exposures incurred during the residual contamination period are less inclusive (i.e., they do not include commercial sources of exposure if the commercial sources are distinguishable from the non-commercial sources) than those incurred during the DOE contract period. The types of exposures that NIOSH is required to include in dose reconstructions during these two defined time periods are described below.

3.1 During the Contract Period

For exposures that were incurred during the designated DOE contract period, all occupationally-derived radiation exposures at covered facilities must be included in dose reconstructions⁷. These are assessed for each year of exposure from the date of initial radiation exposure at a covered AWE facility to the date of cancer diagnosis, which is established by the Department of Labor. This not only includes the internal and external sources of exposure associated with the production of material for the DOE, but also includes radiation exposure related to the Naval Nuclear Propulsion Program and any radiation exposure received from the production of commercial radioactive products that were concurrently manufactured by the AWE facility during the covered period. For example, the exposure associated with the commercial production of enriched uranium fuel would be reconstructed during the AWE contract period, even though it is unrelated to work associated with the production of an atomic weapon.

In addition, any doses associated with radiation or radiation generating devices that were used at the AWE facility during the covered period, even if they were not associated with nuclear weapons related work, must also be reconstructed. This includes, but is not limited to, doses from: 1) non-destructive testing devices such as radiography units; 2) process or flow gauges that employ radioactive sources; 3) moisture or density gauges; 4) electrostatic eliminators; and, 5) radiation generating laboratory instruments, such as x-ray diffraction units.

3.1.1 Occupational Environmental Exposure

⁵ See 42 U.S.C. § 7384l(3).

⁶ See 42 U.S.C. § 7384n(c)(4) (defining the doses of radiation to be included in dose reconstructions during the residual contamination period).

⁷ Occupationally-derived exposure, defined as that exposure incurred during the performance of duty at an AWE facility, does not include certain sources of radiation exposure that are described later in this document.

Effective Date: 11/05/2007	Revision No. 0	OCAS Document No. OCAS-IG-003	Page 7 of 11
-------------------------------	-------------------	----------------------------------	--------------

Environmental exposures due to elevated radiation background levels from DOE, commercial, and other operations are included in dose reconstructions during the contract period.⁸ This includes the external exposure associated with environmentally deposited radioactivity, as well as the inhalation or ingestion intake of radioactive materials due to either: 1) the direct inhalation or ingestion of material released from the facility to the environment; or 2) the inhalation or ingestion of radioactive material that has been deposited on the ground and resuspended due to plant operations.

For workers who have been monitored for internal and external exposures, via bioassay samples and personal dosimeter badges, their exposure to environmental sources is included in these measurements. A separate assessment of this mode of exposure is, therefore, not necessary in this case.

Intakes attributable to globally distributed fallout from the above ground testing of nuclear weapons are not included in dose reconstructions at AWE facilities (see attachment A).

3.1.2 Natural Background Exposure

Exposure to internal or external natural background radiation is not included in dose reconstructions, unless there is evidence that the natural background was increased due to either DOE or commercial operations (see attachment A). This is what is known as Technologically Enhanced Naturally Occurring Radioactive Material (TENORM). Exposure to radon in the workplace would only be considered in a dose reconstruction at an AWE facility if there was an increase in natural radon levels due to the presence of a refined material that included ²²⁶Ra. For example, enhanced radon levels due to the production of uranium from phosphate rock ore would be a covered exposure at an AWE facility, while natural radon present in the workplace at an AWE facility that only processed uranium devoid of any progeny would not be covered.

For bioassay samples that have been collected from site workers, and analyzed for radionuclides that are naturally present in excreta (e.g., natural uranium in urine, natural thorium in feces), the amount of radioactivity present in the sample is not considered in the assessment of the dose from site operations. If, however, the information is not available to subtract the contribution of the natural background component in the samples, it is an acceptable practice, which is favorable to the claimants, to consider the background as part of the occupationally-derived exposure.

3.1.3 Occupational Medical X-ray Exposure

⁸ Exposures due to increased natural background radiation, a subset of environmental exposure, are discussed in section 3.1.2.

Effective Date: 11/05/2007	Revision No. 0	OCAS Document No. OCAS-IG-003	Page 8 of 11
-------------------------------	-------------------	----------------------------------	--------------

At many AWE facilities, physical examinations were required as a condition of employment. Some of these examinations included the use of medical screening x-rays. In accordance with 42 C.F.R. pt. 81, external doses received from occupational x-ray screening procedures, which were provided to the energy employee as a condition of employment, are included in dose reconstructions. X-rays performed for diagnostic or therapeutic reasons, however, are excluded. Screening x-rays are systematic examinations performed on asymptomatic people without history, complaint, physical findings, or physician evaluation. Diagnostic x-rays are examinations of people who already have suspicious signs or symptoms of a potential condition performed after physician evaluation.

3.1.4 Nuclear Navy Related Exposure

It should be noted that under subparagraph A of 42 U.S.C. § 7384n(c)(4), radiation associated with the Naval Propulsion Program is specifically excluded from the employee's radiation dose. This exclusion, however, only applies to those AWE employees described in 42 U.S.C. § 7384l(3)(B), that is, AWE employees who worked during the residual contamination period. Because this provision does not apply to AWE employees during the DOE contract period, dose reconstructions for this period must include all occupationally-derived radiation exposures at a covered AWE facility, including exposure associated with work for the nuclear navy propulsion program.

3.2 During the Residual Contamination Period

For employment during the residual contamination period, only the radiation exposures defined in 42 U.S.C. § 7384n(c)(4) [i.e., radiation doses received from DOE-related work] must be included in dose reconstructions. That is, internal or external radiation exposure, associated with commercial sources of exposure, is not reconstructed. For example, the exposure incurred from the manufacture and distribution of commercial uranium and/or thorium products would not be reconstructed during the residual contamination period.

Under subparagraph B of 42 U.S.C. § 7384n(c)(4), however, radiation from a source that cannot be reliably distinguished from radiation covered under subparagraph A (i.e., radiation doses received from DOE related work) is considered part of the employee's radiation dose and must be reconstructed.

During the residual contamination period, doses associated with radiation or radiation generating devices that were used at the AWE facility for commercial purposes that are distinguishable from the non-commercial sources are not included in the dose reconstruction. This includes, but is not limited to, doses from: 1) non-destructive testing devices such as radiography units; 2) process or flow gauges that employ radioactive sources; 3) moisture or density gauges; 4) electrostatic eliminators; and, 5) radiation generating laboratory instruments, such as x-ray diffraction units.

Effective Date: 11/05/2007	Revision No. 0	OCAS Document No. OCAS-IG-003	Page 9 of 11
-------------------------------	-------------------	----------------------------------	--------------

3.2.1 Occupational Environmental Exposure

Environmental exposures due to elevated radiation background levels from residual contamination due to DOE related activities during the contract period are included in dose reconstructions during the residual contamination period.⁹ This includes the external exposure associated with environmentally deposited radioactivity, as well as the inhalation or ingestion intake of radioactive materials due to: 1) the direct intake of material released from processes in the facility, or 2) the intake of radioactive material that has been deposited on the ground and resuspended due to plant operations.

For workers who have been monitored for internal and external exposures, through bioassay samples and personal dosimeter badges, their exposure to environmental sources is included in these measurements. A separate assessment of this mode of exposure is, therefore, not necessary in this case.

Intakes attributable to globally distributed fallout from the above ground testing of nuclear weapons are not included in dose reconstructions at AWE facilities (see Attachment A).

3.2.2 Natural Background Exposure

Exposure to internal or external natural background radiation is not included in dose reconstructions, unless there is evidence that the natural background was increased due to the presence of residual contamination from DOE activities during the contract period. This is what is known as Technologically Enhanced Naturally Occurring Radioactive Material (TENORM). For example, exposure to radon in the workplace would only be considered TENORM and included in a dose reconstruction if there was an increase in natural radon levels due to the presence of residual contamination from a DOE-related refined material that was elevated in ²²⁶Ra.

For bioassay samples that have been collected for site workers, and analyzed for radionuclides that are naturally present in excreta (e.g., natural uranium in urine, natural thorium in feces), the amount of radioactivity present in the sample is not considered in the assessment of the dose from site operations. If, however, the information is not available to subtract the contribution of the natural background component in the samples, it is an acceptable practice, which is favorable to the claimants, to consider the background as part of the occupationally-derived exposure.

3.2.3 Occupational Medical X-ray Exposure

⁹ Exposures due to increased natural background radiation, a subset of environmental exposure, are discussed in section 3.2.2.

Effective Date: 11/05/2007	Revision No. 0	OCAS Document No. OCAS-IG-003	Page 10 of 11
-------------------------------	-------------------	----------------------------------	---------------

Doses from medically required X-rays are not reconstructed during the residual contamination period.

Effective Date: 11/05/2007	Revision No. 0	OCAS Document No. OCAS-IG-003	Page 11 of 11
-------------------------------	-------------------	----------------------------------	---------------

ATTACHMENT A

Technical Basis for Excluding Fallout and Natural Radiation Background from Dose Reconstructions under EEOICPA

The Energy Employees Occupational Illness Compensation Program Act (EEOICPA) specifies that the guidelines used in making a probability of causation determination shall be:

based on ...the upper 99 percent confidence interval of the probability of causation in the radioepidemiological tables published under section 7(b) of the Orphan Drug Act (42 U.S.C. 241note), as such tables may be updated under section 7(b)(3) of such Act from time to time.¹⁰

In the report of the NCI-CDC working group that revised the 1985 radioepidemiological tables (NCI 1985), the probability of causation (PC) is defined as:

$$PC = \frac{\text{risk due to radiation exposure}}{\text{baseline risk} + \text{risk due to radiation exposure}}$$

The baseline risk included in the probability of causation calculation above was established using the cancer incidence of a population that was exposed to a variety of carcinogens, including natural background radiation and fallout due to atmospheric weapons testing. Because the exposure to natural background and fallout is already included in the baseline risk estimate, it would be inappropriate to include these exposures a second time in the estimate of risk from radiation exposure due to activities that are covered under EEOICPA.

Reference

National Cancer Institute (NCI). Report of the NCI-CDC Working Group to Revise the 1985 NIH Radioepidemiological Tables, September 2003, pp. 118.

¹⁰ See 42 U.S.C. § 7384n(c)(3)(A)