

SEC Petition Evaluation Report Petition SEC-00006-2

Rev # 0

Submittal Date: 06-14-2005

Petition Administrative Summary											
Petition Under Evaluation											
Petition #		Petition Type		Submittal Date			DOE/AWE Facility Name				
SEC-00006		83.13		06-15-2004			Iowa Army Ammunition Plant				
Feasible to Estimate Doses with Sufficient Accuracy?											
Single Class				Multiple Classes				Determination Established for All Classes			
Yes	X	No		Yes		No	X	Yes	X	No	

Initial Class Definition
<p><i>Facility:</i> Iowa Ordnance Plant (also known as the Iowa Army Ammunition Plant), Burlington, Iowa</p> <p><i>Locations:</i> Line 1 (which includes Yard C, Yard G, Yard L, Firing Site Area, Burning Field "B" and Storage Sites for Pits and Weapons including Buildings 73 and 77)</p> <p><i>Job Titles and/or Job Duties:</i> All Technicians (Laboratory, Health Physics, Chemical, X-ray, etc.), Production Personnel, Physical Security Personnel (hourly and salaried), Engineers, Inspectors, Safety Personnel, Physical Security Personnel, and Maintenance Persons.</p> <p><i>Period of Employment:</i> 1947-1974</p>

Proposed Class Definition (Abbreviated)
<p>Industrial radiographers who conducted radiography on non-radiological high explosive weapons components at the Iowa Ordnance Plant from May 1948-March 1949.</p>

Related Petition Summary Information			
SEC Petition Tracking #(s)	Petition Type	DOE/AWE Facility Name	Petition Status
SEC-00007	83.13	Iowa Army Ammunition Plant	Merged with SEC-00006
SEC-00014	83.13	Iowa Army Ammunition Plant	Merged with SEC-00006
SEC-00015	83.13	Iowa Army Ammunition Plant	Merged with SEC-00006

Lead Technical Evaluator:	Signature on File _____ <i>Timothy D. Taulbee</i>	6/14/2005 _____ <i>Date</i>
Reviewed By:	Signature on File _____ <i>James W. Neton</i>	6/14/2005 _____ <i>Date</i>
Approved By:	Signature on File _____ <i>Larry J. Elliott</i>	6/14/2005 _____ <i>Date</i>

Evaluation Summary

This evaluation report by the National Institute for Occupational Safety and Health (NIOSH) covers a subset of the employees proposed as a class for addition to the Special Exposure Cohort (SEC) in SEC Petition SEC00006, which was qualified for evaluation on October 20, 2004. The petition was submitted on behalf of all technicians (laboratory, HP, chemical, X-ray, etc.), production personnel (hourly and salary), engineers, inspectors, safety personnel, physical security personnel and maintenance persons working at the Iowa Army Ammunition Plant (IAAP) Line 1. On April 4, 2005, NIOSH completed its evaluation of this petition regarding all such employees except for a class comprising IAAP radiographers employed by Line 1 during the period from May 1948 to March 1949. NIOSH required the additional information provided in this report to complete its evaluation of the petition with respect to this class of radiographers. Hence, this report completes the NIOSH evaluation of SEC Petition SEC00006.

The evaluation report addresses the feasibility of estimating radiation doses with sufficient accuracy (i.e., the feasibility of dose reconstruction) and the evidence concerning the possible health endangerment for IAAP radiographers employed by Line 1 during the period from May 1948 to March 1949. As discussed below, these two factors, the feasibility of dose reconstruction and health endangerment, govern decisions by the Department of Health and Human Services (HHS) on whether or not to designate a class of employees for addition to the SEC and on the definition of such classes.

Feasibility of Dose Reconstruction

The feasibility determination for the class of employees covered by this evaluation report is governed by 42 C.F.R. § 83.13(c)(1). Under this regulation, NIOSH must establish whether or not it has access to sufficient information to either estimate the maximum radiation dose, for every type of cancer for which radiation doses are reconstructed, that could have been incurred under plausible circumstances by any member of the class, or to estimate the radiation doses of members of the class more precisely than a maximum dose estimate. If NIOSH were to have access to the information sufficient for either case, then dose reconstruction would be feasible.

NIOSH has established in this evaluation that it has insufficient information to estimate either the maximum radiation dose incurred by radiographers, or to estimate such radiation doses more precisely than a maximum dose estimate. The sum of information available from the site profile and additional resources is not sufficient to document or estimate the maximum external potential exposure to radiographers, under plausible circumstances during the period of radiological operations at IAAP, from May 1948 to March 1949. On this basis, NIOSH has determined that dose reconstruction is not feasible for radiographers at IAAP from May 1948 to March 1949.

Health Endangerment

The health endangerment determination for the class of employees covered by this evaluation report is governed by the Energy Employees occupational Illness Compensation Program Act of 2000 (EEOICPA) and 42 C.F.R. § 83.13(c)(3). Under these requirements, if it is not feasible to estimate with sufficient accuracy radiation doses for members of the class, NIOSH must also make a determination whether or not there is a reasonable likelihood that such radiation doses may have endangered the

health of members of the class. The regulation requires NIOSH to assume that any duration of unprotected exposure may have endangered the health of members of a class when it has been established that the class may have been exposed to radiation during a discrete incident likely to have involved levels of exposure similarly high to those occurring during nuclear criticality incidents. If the occurrence of such an exceptionally high level exposure has not been established, then NIOSH is required to specify that health was endangered for those workers who were employed for a number of work days aggregating at least 250 work days within the parameters established for the class or in combination with work days within the parameters established for one or more other classes of employees in the SEC.

The NIOSH evaluation did not identify any evidence from the petitioners or from other sources that would establish that the class was exposed to radiation during a discrete incident likely to have involved exceptionally high level exposures, as described above. NIOSH is not aware of any report of such an occurrence at the facility. Evidence presented by the petitioner and uncovered by NIOSH associates the hazard to chronic exposures. Consequently, NIOSH has specified that health was endangered for those workers covered by this evaluation who were employed for a number of work days aggregating at least 250 work days within the parameters established for this class or in combination with work days within the parameters established for one or more other classes of employees in the SEC.

Proposed Class Definition

This evaluation defines a single class of employees for which NIOSH cannot estimate radiation doses with sufficient accuracy and whose health may have been endangered by such radiation doses. This class includes employees of DOE or DOE contractors or subcontractors employed by the IAAP who worked as radiographers from May 1948 to March 1949 in support of the Line 1 operations and whom were employed for a number of work days aggregating at least 250 work days occurring under this employment in combination with work days within the parameters (excluding aggregate work day requirements) established for classes of employees presently included in the SEC.

1.0 Purpose

The purpose of this report for SEC Petition SEC00006 is to provide an evaluation of the feasibility of reconstructing the dose for a worker class at the Iowa Army Ammunition Plant (IAAP) in Des Moines County, near Middletown, Iowa who were employed from May 1948 to March 1949.

NIOSH established in SEC Evaluation Report SEC-0006-1 that there were three separate classes of employees covered by petition SEC-00006: one class who worked from June 1947-May 1948, during which existing documentation indicated there were not any radioactive materials at the facility, nor any radiological exposures associated with the Atomic Energy Commission (AEC) work at the site; a second class composed of industrial radiographers who may have conducted radiography on non-radiological high explosive weapons components from May 1948-March 1949; and a third class comprising all employees at Line 1 of the facility from March 1949-1974.

This report provides the results of NIOSH's completed research to verify the existence of the class composed of industrial radiographers with employment at the Iowa Ordnance Plant (IOP) between May 1948 and March 1949. It also provides an evaluation of the feasibility of dose reconstructions for any members of this class and on the potential for the health of this class to have been endangered.

This evaluation was conducted in accordance with the requirements of 42 C.F.R. pt. 83 and the guidance contained in NIOSH's Internal Procedures for SEC Evaluations, OCAS-PR-004. It provides information and analyses germane to considering a petition for adding a class of employees to the SEC. It does not provide any determinations concerning the feasibility of dose reconstruction that necessarily apply in the particular case of any individual energy employee who might require a dose reconstruction from NIOSH.

2.0 Introduction

Title 42 of the Code of Federal Regulations (C.F.R.), Part 83, *Procedures for Designating Classes of Employees as Members of the Special Exposure Cohort Under the Energy Employees Occupational Illness Compensation Program Act of 2000*, requires NIOSH to evaluate qualified petitions requesting HHS to add a class of employees to the SEC. The evaluation is intended to provide a fair, science-based determination of whether or not it is feasible to estimate with sufficient accuracy the radiation doses of the class of employees through NIOSH dose reconstructions¹. If it is not feasible, the evaluation is further required to make a determination with respect to the health endangerment of the class of employees.

NIOSH is required to document the evaluation in a report, which is provided to the petitioners and to the President's Advisory Board on Radiation and Worker Health (the Board). The Board will consider the NIOSH evaluation report, together with the petition and any comments of the petitioner(s), to make recommendations to the Secretary of HHS on whether or not to add one or more classes of employees to the SEC. Once NIOSH has received and considered the advice of the Board, the Director of NIOSH will

¹ NIOSH dose reconstructions under EEOICPA are performed using the methods promulgated under 42 C.F.R. pt. 82 and the detailed implementation guidelines available at www.cdc.gov/niosh/ocas.

propose decisions on behalf of HHS. The Secretary of HHS will make final decisions, taking into account the NIOSH evaluation, the advice of the Board, and the proposed decision issued by NIOSH. As part of this final decision process, the petitioner(s) may seek a review of certain types of proposed decisions issued by NIOSH.²

In this evaluation, NIOSH reviewed all available process information, radiation monitoring data, and source-term data for the period of time between May 1948 and March 1949 for the IAAP. The data were evaluated to determine if the quality and quantity of the measurements, process, and source term information are sufficient to support radiation dose reconstruction for this class.

3.0 Initial Class Definition and Petition Basis

The initial class definition specified in SEC Petition SEC00006 is: all technicians (laboratory, HP, chemical, X-ray, etc.), production personnel (hourly and salary), engineers, inspectors, safety personnel, physical security personnel and maintenance persons at the Iowa Ordnance Plant (also known as the Iowa Army Ammunition Plant), Burlington, Iowa that worked on Line 1 (which includes Yard C, Yard G, Yard L, Firing Site Area, Burning Field "B", and storage sites for pits and weapons including Buildings 73 and 77) from 1947 to 1974.

The basis cited in the petition is that radiation exposures potentially incurred by members of the petitioning class were not monitored, either through personal monitoring or through area monitoring. The petitioners contend that reconstruction of the radiological exposures received by members of the class with sufficient accuracy is not possible. As the basis for this belief, the petitioners provided affidavits and documents indicating that radiation exposures and doses to members of the proposed class were not monitored, either through personal or area monitoring, and that radiation monitoring records for members of the proposed class have been lost, falsified, or destroyed. One of the affidavits references the IAAP Technical Basis Document (TBD), the Pantex TBD and two technical reports.

4.0 Data Resources

To evaluate the petition, NIOSH reviewed available data sources for the existence of personal monitoring, area monitoring, industrial process, and radiological source information relevant to determining the feasibility of dose reconstruction for the class of employees covered by the petition.

This information was retrieved from existing site profiles, Technical Information Bulletins (TIBs), dose reconstructions, internal databases containing personnel and area monitoring data, DOE records, NIOSH documents, other scientific reports, information gained through interviews with former workers, and information provided by the petitioners.

² See 42 C.F.R. pt. 83 for a full description of the procedures summarized here. Additional internal procedures are available at www.cdc.gov/niosh/ocas.

The following sections discuss the resources identified and reviewed.

4.1 Site Profile or Technical Basis Documents

A revised site profile exists for the IAAP. The site profile, *Technical Basis Document for Atomic Energy Operations at the Iowa Army Ammunition Plant (IAAP)* was reviewed. The site profile only covers radiological exposures during assembly and disassembly operations which began in March 1949 at IAAP. Prior to March 1949, the only operations that involved radiation exposure were radiographic operations in which explosive components were radiographed.

4.2 NIOSH and ORAU Research Documents

A search of the NIOSH and ORAU site research database (SRDB) was conducted for documentation relating to IAAP. All 162 IAAP related documents on the database were evaluated for relevance to the radiographers. These documents contained external dosimetry measurement results (for both IAAP and Pantex), annual Department of Defense (DoD) dosimetry reports, pocket ionization chamber logs, air sample results, survey reports, site incident reports, standing operating procedures, effluent data, and radon measurements. A needs assessment conducted by the University of Iowa, College of Public Health, and a significant number of the transcripts of interviews with former site employees, also in the holdings of the SRDB, provided important information concerning the exposure and operational history of the site.

The information from these documents relevant to the class, as evaluated in this report, is summarized in sections 5.0 and 7.0 of this report.

5.0 Summary of Available Monitoring Data

Dosimetry programs were implemented in phases in conjunction with the development of the nuclear weapons work at IAAP. External dosimetry monitoring was not implemented until 1955. Thus, during the time period from May 1948 to March 1949 individual dosimetry information is not available.

Subsequent records searches to date have also not identified any detailed information concerning the radiographic process, equipment or procedures during this early time period. According to Poole and Harrison (1954), gammagraph and radiograph facilities were required for inspection operations.

Gammagraph and radiograph facilities were required for inspection operations and for accumulation of data from which adjustments could be made where necessary in production procedures. Since the initial operation was Baratol production, the gammagraph facility, utilizing a radium source, was given first priority. The facilities required consisted essentially of adequate shielding and safety devices for protection of personnel. (Poole and Harrison, 1954)

NIOSH does have access to dosimetry data on radiographers beginning in 1955.

6.0 Summary of Radiological Operations Relevant to the Initial Class

The IAAP is a government-owned, contractor operated, military-industrial installation that was established initially for the loading, assembly and packing of 75MM and 155MM artillery shells and 100 pound bombs. The IAAP site was historically shared with the DoD. Construction of the plant began in January 1941. On August 5, 1947 the Silas Mason Co. (Mason & Hanger-Silas Mason Co., Inc.) was contracted to complete rehabilitation of Line 1 and the construction of new facilities on behalf of the AEC. The phase one construction was completed in late 1948. In May 1948, the Silas Mason Company sent supervisors of production personnel to the Naval Ordnance Test Site at China Lake, California for training on the production of high explosives (Poole and Harrison, 1954). Upon completion of the training, these supervisors trained production personnel at the Iowa Ordnance Plant. Within a year, the Burlington Plant was at full production for high explosives fabrications and plans were underway to begin assembly of non-nuclear components, duplicating the assembly capabilities of Sandia (Mitchell, 2003). Based on this information the earliest date that explosive component manufacturing for the Mark IV could have commenced at IAAP was May 1948.

In March of 1949, AEC decided that certain weapons assembly operations would be conducted at the Iowa Ordnance Plant (Poole and Harrison, 1954). According to DOE's Office of Worker Advocacy, nuclear weapons assembly operations that were performed at Los Alamos and Sandia were transferred to the Iowa Ordnance Plant by 1949 (DOE Website 2005). In 1949, Silas Mason accepted responsibility for operation of highly classified facilities, known locally as Division B.

During this early time period (May 1948 – March 1949), radiography was conducted as part of the non-destructive quality control analysis explosive components. Radiography was the only radiological work conducted at IAAP prior to the first assembly of nuclear weapons in March 1949.

Building 1-73

Building 1-73 was used as a gammagraph and radiograph facility. This building was used for inspection operations and necessary for production procedures. The building was designed to provide adequate shielding and safety devices for protection of personnel (Poole and Harrison, 1954). Interlocks and physical barriers were designed to shield workers from radiation exposures associated with the inspection equipment.

7.0 Evaluation of Feasibility of Dose Reconstruction

7.1 Internal Dose

Radiography at IAAP involved the use of sealed radioactive sources and / or radiation generating devices. Since the sources were sealed, there was no potential for internal radiation exposure from the radiography equipment. Since assembly of nuclear weapons was not conducted until March 1949, radiographic operations between May 1948 and March 1949 would have been conducted entirely on non-radioactive high explosive components. Therefore, there would not have been any potential for internal exposure prior to March 1949.

7.2 External Dose

NIOSH evaluated whether dosimetry from later time periods (1955) could be used as a surrogate for the early time period. To use this potential surrogate data, NIOSH would require a means to validate that radiographic operations did not change substantially between 1948 and 1955. Because NIOSH lacks process information on this early period of radiography, it is not possible to validate that the operations were comparable. Furthermore, a review of both classified and unclassified records could not even establish the actual number of radiographs conducted during early and later time periods at IAAP, let alone component-specific procedural details, which would also be required for the use of surrogate data from the later period. As a result, dose reconstruction during this early time period is not feasible based on monitoring data.

Dose reconstruction might also be feasible if NIOSH could use a combination of process and radiological source information. However, as discussed above, NIOSH lacks any substantive process information for the period of concern. Furthermore, NIOSH does not have information on the radiation source strength and shielding used during this period. This information would be essential.

For example, a review of early radiographer exposures at a naval shipyard indicates that average exposures were on the order of 100 - 200 mrem per week (Daniels et al., 2004). If IAAP radiographers had similar equipment, shielding and procedures, over the 9 month period between May 1948 and March 1949, the total external dose to IAAP radiographers could have been at a minimum in the 4,000 to 8,000 mrem range. However, the actual doses experienced by early IAAP radiographers could have been higher or lower than the recorded doses of shipyard workers. This depends, in part, on the volume of work. Furthermore, if shielding was less effective and the radiation source strength was significantly greater than that used at the shipyard, the values could be an order of magnitude or more higher at IAAP. Conversely, the actual dose could have been significantly lower than that experienced by the shipyard workers, if effective training had been conducted and experienced workers conducted the first radiographs.

In later years, there is evidence that shielding and safety devices were included in the design of the main radiography building (1-73) at IAAP. NIOSH has not been able to determine, however, when Building 1-73 was built. Since virtually no information is available on the radiography practices, equipment, and source strength at IAAP during the period in question, it is not feasible to estimate an upper bound on the potential external dose incurred by IAAP radiographers.

In summary, information available to NIOSH is insufficient for dose reconstructions based on either dosimetry and process data or process and radiological source information. Accordingly, it is not feasible to estimate with sufficient accuracy the external radiation doses potentially incurred by radiographers at IAAP during the period evaluated in this report.

8.0 Health Endangerment

The health endangerment determination for the class of employees covered by this evaluation report is governed by EEOICPA and 42 C.F.R. § 83.13(c)(3). Under these requirements, if it is not feasible to estimate with sufficient accuracy radiation doses for members of the class, NIOSH must also determine that there is a reasonable likelihood

that such radiation doses may have endangered the health of members of the class. The regulation requires NIOSH to assume that any duration of unprotected exposure may have endangered the health of members of a class when it has been established that the class may have been exposed to radiation during a discrete incident likely to have involved levels of exposure similarly high to those occurring during nuclear criticality incidents. If the occurrence of such an exceptionally high level exposure has not been established, then NIOSH is required to specify that health was endangered for those workers who were employed for a number of work days aggregating at least 250 work days within the parameters established for the class or in combination with work days within the parameters established for one or more other classes of employees in the SEC.

As discussed in Section 7.2 of this report the doses to radiographers during the 9 month period could have exceeded 8,000 mrem. On this basis, NIOSH has determined that it is reasonably likely that such exposures may have endangered the health of the IAAP employees covered by the class definition provided in section 9.0 of this evaluation.

The NIOSH evaluation did not identify any evidence from the petitioners or from other resources that would establish that the classes were exposed to radiation during a discrete incident or similar conditions resulting from the failure of radiation exposure controls and likely to have produced levels of exposure similarly high to those occurring during nuclear criticality incidents. NIOSH is not aware of any report of such an occurrence at the facility. The evidence reviewed in this evaluation indicates that some workers in the classes may have accumulated substantial doses through chronic exposure to external sources of radiation. Consequently, NIOSH is specifying that health was endangered for those workers covered by this evaluation who were employed for a number of work days aggregating at least 250 work days within the parameters established for this class in combination with work days within the parameters established for one or more other classes of employees in the SEC.

9.0 Proposed Class Definition

This evaluation defines a single class of employees for which NIOSH has established that it cannot estimate radiation doses with sufficient accuracy and whose health may have been endangered by such radiation doses. The class only includes employees whose job title was radiographer working at the IAAP Line 1, which includes Yard C, Yard G, Yard L, Firing Site Area, Burning Field "B" and Buildings 73 and 77, from May 1948 to March 1949, and whom were employed for a number of work days aggregating at least 250 work days occurring under this employment in combination with work days of employment occurring within the parameters (excluding aggregate work day requirements) established for other classes of employees included in the SEC.

10.0 References

Daniels et al. (2004)

Daniels, R.D., Taulbee, T.D., Chen, P., (2004) "Radiation Exposure Assessment for Portsmouth Naval Shipyard Health Studies," *Radiation Protection Dosimetry*, Vol. 111, No. 2, pp. 139-150.

Mitchell (2003)

Mitchell, Kris C. (2003) Rhetoric to Reality: A Cold War Context Statement for the Pantex Plant (1951-1991) BWXT Pantex, LLC.

Poole and Harrison (1954)

Silas Mason Company, Inc. "Project History of Line 1 Operations at Iowa Ordnance Plant January 1, 1947 – July 1, 1954" Contract No. W-49-010-ORD-68. This report is a project history to record the initial rehabilitation, construction and activation of the facilities of Line 1. October 1954. Document File Location: IAAP\08-28-03 – Data Capture\010001487\Project History of Line 1 Operations January 1947 Through June 1954.pdf.

ORAUT-TKBS-0018 (2005)

ORAU Team NIOSH Dose Reconstruction Project (ORAUT) "Technical Basis Document for Atomic Energy Operations at the Iowa Army Ammunition Plant (IAAP)" Rev 1, ORAUT-TKBS-0018; 03/14/2005.