SEC Petition Evaluation Report
Petition SEC-00163

Report Rev #: 0 Report Submittal Date: January 21, 2010

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Site Expert(s):	N/A

Petitioner Administrative Summary			
Petition Under Evaluation			
Petition #	Petition Type	Petition A Receipt Date	DOE/AWE Facility Name
SEC-00163	83.14	1/21/2010	Lawrence Livermore National Laboratory

NIOSH-Proposed Class Definition

All employees of the Department of Energy, its predecessor agencies, and their contractors and subcontractors who worked at the Lawrence Livermore National Laboratory in Livermore, California from January 1, 1950 through December 31, 1973, 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.

Related Petition Summary Information			
SEC Petition Tracking #(s)	Petition Type	DOE/AWE Facility Name	Petition Status
SEC-00092	83.14	Lawrence Livermore National Laboratory	Class added to the SEC for 1950-1973

Related Evaluation Report Information	
Report Title	DOE/AWE Facility Name
SEC Petition Evaluation Report for Petition SEC-00092	Lawrence Livermore National Laboratory

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Evaluation Report Summary: SEC-00163
Lawrence Livermore National Laboratory (LLNL)

This evaluation report by the National Institute for Occupational Safety and Health (NIOSH) addresses a class of employees proposed for addition to the Special Exposure Cohort (SEC) per the *Energy Employees Occupational Illness Compensation Program Act of 2000*, as amended, 42 U.S.C. § 7384 *et seq.* (EEOICPA) and 42 C.F.R. pt. 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*.

NIOSH-Proposed Class Definition

All employees of the Department of Energy, its predecessor agencies, and their contractors and subcontractors who worked at the Lawrence Livermore National Laboratory in Livermore, California from January 1, 1950 through December 31, 1973, 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.

Feasibility of Dose Reconstruction Findings

NIOSH lacks sufficient information, which includes biological monitoring data, sufficient air monitoring information, or sufficient process and radiological source information, to allow it to estimate with sufficient accuracy the potential internal exposures to mixed fission and/or activation product radionuclides to which the proposed class may have been subjected.

NIOSH finds that it is likely feasible to reconstruct occupational medical dose for LLNL workers with sufficient accuracy.

There is currently a class of Lawrence Livermore National Laboratory workers associated with a previous NIOSH evaluation (NIOSH, 2007) of SEC petition SEC-00092: *Employees of the Department of Energy (DOE), its predecessor agencies, and DOE contractors or subcontractors who were monitored for radiation exposure while working at the Lawrence Livermore National Laboratory from January 1, 1950 through December 31, 1973, 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 Special Exposure Cohort.* This class was added to the SEC effective April 2, 2008 (HHS, 2008). This class was based on the NIOSH determination at that time, using the information at hand, that all workers with the potential for radiation exposures during the proposed SEC class time period were included in the external dose monitoring program, and that unmonitored workers had no potential for radiation exposures.

In the course of its on-going dose reconstruction and continued data capture efforts, NIOSH has determined that the monitoring records are not complete for some LLNL workers who may have been exposed to fission and activation product radionuclides during the period from January 1, 1950 through December 31, 1973. Therefore, NIOSH has determined that the existence, or nonexistence, of LLNL monitoring records is not always an accurate indicator of a worker's potential for radiation exposure during the period from January 1, 1950 through December 31, 1973. Accordingly, NIOSH has also determined that it is necessary to remove the "… who were monitored …" criterion from the

description of the LLNL SEC class and to, therefore, expand the SEC class definition implemented in SEC-00092 to include all employees of the DOE, its predecessor agencies, and their contractors and subcontractors who worked at LLNL during the specified time period.

Although NIOSH found that it is not possible to completely reconstruct radiation doses for the proposed class, NIOSH intends to use any internal and external monitoring data that may become available (and that can be interpreted using existing NIOSH dose reconstruction processes or procedures) for an individual claim. Therefore, dose reconstructions for individuals employed at LLNL during the period from January 1, 1950 through December 31, 1973, but who do not qualify for inclusion in the SEC, may be performed using these data as appropriate.

Health Endangerment Determination

The NIOSH evaluation did not identify any evidence supplied by the petitioners or from other resources that would establish that the class was exposed to radiation during a discrete incident likely to have involved exceptionally high-level exposures, such as nuclear criticality incidents or other events involving similarly high levels of exposures. However, the evidence reviewed in this evaluation indicates that some workers in the class may have accumulated chronic radiation exposures through intakes of inadequately monitored radionuclides and from direct exposure to radioactive materials. Therefore, 42 C.F.R. § 83.13(c)(3)(ii) requires NIOSH to specify that health may have been 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 Special Exposure Cohort.

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SEC Petition Evaluation Report for SEC-00163

ATTRIBUTION AND ANNOTATION: This is a single-author document. All conclusions drawn from the data presented in this evaluation were made by the ORAU Team Lead Technical Evaluator: James M. Mahathy, Oak Ridge Associated Universities. The rationales for all conclusions in this document are explained in the associated text.

1.0 Purpose and Scope

This report evaluates the feasibility of reconstructing doses for employees who worked at a specific facility during a specified time. It provides information and analysis germane to considering a petition for adding a class of employees to the Congressionally-created SEC.

This report does not make any determinations concerning the feasibility of dose reconstruction that necessarily apply to any individual energy employee who might require a dose reconstruction from NIOSH, with the exception of the employee whose dose reconstruction could not be completed, and whose claim consequently led to this petition evaluation. The finding in this report is not the final determination as to whether or not the proposed class will be added to the SEC. This report will be considered by the Advisory Board on Radiation and Worker Health (the Board) and by the Secretary of Health and Human Services (HHS). The Secretary of HHS will make final decisions concerning whether or not to add one or more classes to the SEC in response to the petition addressed by this report.

This evaluation, in which NIOSH provides its findings both on the feasibility of estimating radiation doses of members of this class with sufficient accuracy and on health endangerment, was conducted in accordance with the requirements of EEOICPA and 42 C.F.R. § 83.14.

2.0 Introduction

Both EEOICPA and 42 C.F.R. pt. 83 require NIOSH to evaluate qualified petitions requesting that the Department of Health and Human Services add a class of employees to the SEC. The evaluation is intended to provide a fair, science-based determination of whether it is feasible to estimate, with sufficient accuracy, the radiation doses of the proposed class of employees through NIOSH dose reconstructions.[1]

NIOSH is required to document its evaluation in a report, and to do so, relies upon both its own dose reconstruction expertise as well as technical support from its contractor, Oak Ridge Associated Universities (ORAU). Once completed, NIOSH provides the report to both the petitioners and the Advisory Board on Radiation and Worker Health. The Board will consider the NIOSH evaluation report, together with the petition, comments of the petitioner(s) and such other information as the Board considers appropriate, 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 propose a decision on behalf of HHS. The Secretary

[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 http://www.cdc.gov/niosh/ocas.

of HHS will make the final decision, 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 final decisions issued by the Secretary of HHS.[2]

3.0 NIOSH-Proposed Class Definition and Petition Basis

The NIOSH-proposed class includes all employees of the Department of Energy, its predecessor agencies, and their contractors and subcontractors who worked at the Lawrence Livermore National Laboratory in Livermore, California from January 1, 1950 through December 31, 1973, 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.

During this period, employees at this facility were involved in research and development, testing of the nuclear weapons lifecycle, strategic defense research, development of arms control and treaty verification technology, energy research, atmospheric sciences, and nuclear waste research.

The evaluation responds to Petition SEC-00163 which was submitted by an EEOICPA claimant whose dose reconstruction could not be completed by NIOSH due to a lack of sufficient dosimetry-related information. NIOSH's determination that it is unable to complete a dose reconstruction for an EEOICPA claimant is a qualified basis for submitting an SEC petition pursuant to 42 C.F.R. § 83.9(b).

There is currently one class of LLNL workers associated with the previous NIOSH evaluation of SEC petition SEC-00092, for which the Secretary of Health and Human Services (HHS) has designated for inclusion in the Special Exposure Cohort:

> Class added to the SEC effective April 2, 2008 (HHS, 2008): Employees of the Department of Energy (DOE), its predecessor agencies, and DOE contractors or subcontractors who were monitored for radiation exposure while working at the Lawrence Livermore National Laboratory from January 1, 1950, through December 31, 1973, 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 Special Exposure Cohort.

Detailed information associated with the worker class added to the SEC in 2008 can be found in the NIOSH evaluation report, *SEC Petition Evaluation Report, Petition SEC-00092* (NIOSH, 2007). The SEC class previously proposed by NIOSH (NIOSH, 2007) was based on inadequate monitoring for internal exposures to mixed fission products and activation products during the proposed time period. The associated SEC class designated by HHS (HHS, 2008) included only those employees "*... who were monitored for radiation exposure while working at the Lawrence Livermore National Laboratory…*" This class description was based on the NIOSH determination at that time, based on the information at hand, that all workers with the potential for radiation exposures during the proposed SEC class time period were included in the external dose monitoring program, and that unmonitored workers had no potential for radiation exposures.

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

Through the course of on-going dose reconstruction, NIOSH has determined that the monitoring records are not complete for some LLNL workers who may have been exposed to fission and activation product radionuclides during the period January 1, 1950, through December 31, 1973. Therefore, NIOSH has determined that the existence, or non-existence, of LLNL monitoring records is not always an accurate indicator of a worker's potential for radiation exposure during the period January 1, 1950, through December 31, 1973. Accordingly, NIOSH has also determined that it is necessary to remove the "… who were monitored …" criterion from the description of the LLNL SEC class and to, therefore, expand the SEC class definition implemented in SEC-00092 to include all employees of the DOE, its predecessor agencies, and their contractors and subcontractors who worked at LLNL during the specified time period.

4.0 Radiological Operations Relevant to the Proposed Class

The following subsections summarize the radiological operations at the Lawrence Livermore National Laboratory (including both the main site located in Livermore, California, and the Explosive Test Site (aka Site 300) near Tracy, California) from January 1, 1950 through December 31, 1973, and the information available to NIOSH to characterize particular processes and radioactive source materials. Using available sources, NIOSH has attempted to gather process and source descriptions, information regarding the identity and quantities of radionuclides of concern, and information describing processes through which the radiation exposures of concern may have occurred and the physical environment in which they may have occurred. The information included within this evaluation report is meant only to be a summary of the available information.

Unless otherwise indicated, information for Section 4.0 and its subsections was obtained from *SEC Petition Evaluation Report for Petition SEC-00092, Lawrence Livermore National Laboratory* (NIOSH, 2007), and its referenced documents.

4.1 Operations Description

This section summarizes the operations performed at LLNL that are relevant to the proposed SEC time period. Detailed information associated with the operations at LLNL can be found in the NIOSH evaluation report, *SEC Petition Evaluation Report, Petition SEC-00092* (NIOSH, 2007).

LLNL was involved in Atomic Energy Commission (AEC) work starting in 1950. LLNL was originally known as the University of California Radiation Laboratory at Livermore, and later as the Lawrence Radiation Laboratory at Livermore. LLNL, which is still in operation under DOE direction, consists of two sites, the main Laboratory site, which is in a densely-populated area in Livermore, California, and the Explosive Test Site (also known as Site 300) located near Tracy, California.

The original mission of LLNL was thermonuclear weapons development. By 1957, and continuing thereafter, the mission of LLNL was expanded to include diverse scientific and engineering research activities. These activities have included research and development, testing of the nuclear weapons lifecycle, strategic defense research, development of arms control and treaty verification technology, fusion research, atomic vapor laser isotope separation for defense and commercial applications, magnetic fusion, as well as other energy research in basic energy sciences, atmospheric sciences,

fossil energy, and commercial nuclear waste. Many of the radiological operations included ancillary functions of chemistry, non-destructive testing, maintenance, and security.

4.2 Radiation Exposure Potential from Operations

The potential for exposure to mixed fission and activation products existed from operations performed at LLNL, as indicated by the site monitoring for mixed fission product exposures using gross activity methods. LLNL also maintained administrative limits to control exposures to mixed fission products. Potential for fission product exposures existed with accelerator and reactor operations, handling and analyses of weapon-testing shot samples, biomedical research, research and development activities, safeguards and security programs, miscellaneous laboratory analyses, and from waste management research operations. Most research projects performed at LLNL were conducted in small groups consisting of only a few workers and the Hazard Control staff assigned to monitor a particular project. Different labs in a common building were sometimes associated with unique source terms, including fission products.

While NIOSH has access to documents that describe some of the activities and radionuclides specific to certain buildings, NIOSH does not have sufficient data to document the quantities and types of most mixed fission and activation products. NIOSH also often does not have sufficient information to rule out the use of mixed fission and activation products in specific buildings where radioactive material was handled and stored. However, NIOSH has no indication that exposures to mixed fission and activation products would have been a concern in administrative areas (e.g., cafeterias, libraries, and office areas outside of radiological areas).

Additional information regarding the radioisotopes, work areas, and operations associated with radiation exposures at LLNL can be found in the NIOSH evaluation report, *SEC Petition Evaluation Report, Petition SEC-00092* (NIOSH, 2007).

4.3 Time Period Associated with Radiological Operations

Per the DOE Office of Health, Safety and Security, the time period associated with DOE operations at LLNL is from 1950 to the present. As presented in Section 3.0 of this report, HHS has already designated that monitored LLNL workers during the period from January 1, 1950 through December 31, 1973 be included in the SEC. The period of radiological operations associated with this evaluation remains the same as that associated with the previously designated class for SEC-00092. Accordingly, the time period for this evaluation report on LLNL mixed fission product exposures remains January 1, 1950 through December 31, 1973.

4.4 Site Locations Associated with Radiological Operations

While NIOSH does have access to some information that details which radionuclides were handled in particular areas, NIOSH does not have adequate data to determine if exposures to particular radionuclides were limited to the buildings where the radionuclides were known to be handled. Given the extensive list of site areas involved with mixed fission product operations (NIOSH, 2007, Table 4-2), and NIOSH's inability to rule out the use or storage of mixed fission and activation products within other buildings where radioactive material was stored or used, NIOSH is unable to define individual worker exposure scenarios based on specific work locations within LLNL.

4.5 Job Descriptions Affected by Radiological Operations

NIOSH has determined that the LLNL site-specific and claimant-specific data available for the time period of this evaluation are insufficient to allow NIOSH to characterize worker movements across the site or to determine that any specific work group was not potentially exposed to mixed fission or activation products. NIOSH has insufficient information associating job titles and/or job assignments with specific radiological operations or conditions and is, therefore, unable to define potential radiation exposure conditions based on worker job descriptions.

5.0 Summary of Available Monitoring Data for the Proposed Class

The primary data used for determining internal exposures are derived from personal monitoring data, such as urinalyses, fecal samples, and whole-body counting results. If these are unavailable, the air monitoring data from breathing zone and general area monitoring are used to estimate the potential internal exposure. If personal monitoring and breathing zone area monitoring are unavailable, internal exposures can sometimes be estimated using more general area monitoring, process information, and information characterizing and quantifying the source term.

This same hierarchy is used for determining the external exposures to the cancer site. Personal monitoring data from film badges or thermoluminescent dosimeters (TLDs) are the primary data used to determine such external exposures. If there are no personal monitoring data, exposure rate surveys, process knowledge, and source term modeling can sometimes be used to reconstruct the potential exposure.

A more detailed discussion of the information required for dose reconstruction can be found in OCAS-IG-001, *External Dose Reconstruction Implementation Guideline*, and OCAS-IG-002, *Internal Dose Reconstruction Implementation Guideline*. These documents are available at: http://www.cdc.gov/niosh/ocas/ocasdose.html.

5.1 Data Capture Efforts and Sources Reviewed

In addition to examining its Site Research Database (SRDB) to locate documents supporting the evaluation of the proposed class, NIOSH identified and reviewed numerous data sources to locate information relevant to determining the feasibility of dose reconstruction for the class of employees proposed for this petition. This included determining the availability of information on personnel monitoring, workplace monitoring, and radiological source term data.

NIOSH's continuing data capture efforts since the evaluation of petition SEC-00092 (November 2007) have included three visits to the LLNL site conducted in June and October, 2009. In an attempt to gather documents and data relevant to dose reconstruction of LLNL claims. NIOSH has worked with LLNL site representatives to fulfill multiple document requests and to update LLNL Personnel Exposure databases. NIOSH's SRDB currently contains over 18,000 documents and subdocuments associated with the LLNL site.

5.2 Internal Personnel Monitoring Data

To support dose reconstruction and its evaluation of SEC-00092, NIOSH had obtained about 35,000 laboratory-reported bioassay results in electronic format (NIOSH, 2007). These data were supplied by LLNL in the MAPPER (Maintaining and Preparing Executive Reports) database, a data storage system developed for LLNL by the Sperry Corporation. The LLNL MAPPER database examined by NIOSH for its evaluation of SEC-00092 contained only *in vitro* monitoring data, primarily from urinalyses analyzed for uranium, plutonium, gross alpha, gross beta, gross gamma, and mixed fission products. Although NIOSH found that the MAPPER data do not include any *in vivo* analysis results, NIOSH obtained logbooks for two whole-body counter systems used at LLNL (NIOSH, 2007).

In its evaluation of SEC-00092, NIOSH found that the available internal monitoring data were not of sufficient number, or sufficient detail to quantify potential exposures to fission and activation products prior to 1974. NIOSH determined that the number of mixed fission product analyses increased in 1974, peaking in 1978 (NIOSH, 2007), giving NIOSH adequate data beginning in January 1974.

Additional information regarding the quantity and condition of the LLNL internal personnel monitoring data available to NIOSH, and the NIOSH evaluation of such data, can be found in the NIOSH evaluation report, *SEC Petition Evaluation Report, Petition SEC-00092* (NIOSH, 2007).

5.3 External Personnel Monitoring Data

To support dose reconstruction and its evaluation of SEC-00092, NIOSH identified personnel external monitoring data going back to 1952, as well as documentation describing LLNL monitoring programs. This documentation includes dialogue regarding the rationale for monitoring (ORAUT-TKBS-0035-6, pages 8-11). The data include extensive external results, including neutron exposure data; these external monitoring results are available for reconstructing external doses. NIOSH has obtained the documentation necessary to define the geometry and energy ranges experienced with each process (NIOSH, 2007).

Additional information regarding the quantity and condition of the LLNL external personnel monitoring data available to NIOSH, and the NIOSH evaluation of such data, can be found in the NIOSH evaluation report, *SEC Petition Evaluation Report, Petition SEC-00092* (NIOSH, 2007).

5.4 Workplace Monitoring Data

To support dose reconstruction and its evaluation of SEC-00092, NIOSH obtained mixed fission product air monitoring data (gross beta) for a limited number of specific buildings/areas for the time period from 1959 through 1967. Although air monitoring data do exist, in its evaluation of SEC-00092 NIOSH found insufficient information to link specific air monitoring results to the high-risk work areas. Considering the episodic and dynamic high-activity work associated with laboratory analysis of various nuclear test samples at LLNL, NIOSH found that the available general area air sample results cannot be used to adequately bound the potential air concentrations that may have existed in the breathing zones of laboratory personnel (NIOSH, 2007).

Additional information regarding the quantity and condition of the LLNL workplace monitoring data available to NIOSH, and the NIOSH evaluation of such data, can be found in the NIOSH evaluation report, *SEC Petition Evaluation Report, Petition SEC-00092* (NIOSH, 2007).

5.5 Radiological Source Term Data

To support dose reconstruction and its evaluation of SEC-00092, NIOSH obtained documentation that defines some of the radioactive source term encountered at LLNL. Predominant radionuclides in the source term were plutonium, uranium, and tritium; these are well documented. However, fission and activation products were also part of the total source term. Fission and activation products were generated as a result of weapons research, shot sample analysis and handling, development and testing, nuclear fuel fabrication, reactor operations, materials research, biological research, nuclear jet research, fuel testing, reactor operations, linear accelerator operations, and chemical separations (NIOSH, 2007).

Additional information regarding the LLNL source term data available to NIOSH can be found in the NIOSH evaluation report, *SEC Petition Evaluation Report, Petition SEC-00092* (NIOSH, 2007), and in ORAUT-TKBS-0035-2.

6.0 Feasibility of Dose Reconstruction for the Proposed Class

42 C.F.R. § 83.14(b) states that HHS will consider a NIOSH determination that there was insufficient information to complete a dose reconstruction, as indicated in this present case, to be sufficient, without further consideration, to conclude that it is not feasible to estimate the levels of radiation doses of individual members of the class with sufficient accuracy.

In the case of a petition submitted to NIOSH under 42 C.F.R. § 83.9(b), NIOSH has already determined that a dose reconstruction cannot be completed for an employee at the DOE or AWE facility. This determination by NIOSH provides the basis for the petition by the affected claimant. Per § 83.14(a), the NIOSH-proposed class defines those employees who, based on completed research, are similarly affected and for whom, as a class, dose reconstruction is similarly not feasible.

In accordance with § 83.14(a), NIOSH may establish a second class of co-workers at the facility for whom NIOSH believes that dose reconstruction is similarly infeasible, but for whom additional research and analysis is required. If so identified, NIOSH would address this second class in a separate SEC evaluation rather than delay consideration of the claim currently under evaluation (see Section 10). This would allow NIOSH, the Board, and HHS to complete, without delay, their consideration of the class that includes a claimant for whom NIOSH has already determined a dose reconstruction cannot be completed, and whose only possible remedy under EEOICPA is the addition of a class of employees to the SEC.

This section of the report summarizes research findings by which NIOSH determined that it lacked sufficient information to complete the relevant dose reconstruction and on which basis it has defined the class of employees for which dose reconstruction is not feasible. NIOSH's determination relies on the same statutory and regulatory criteria that govern consideration of all SEC petitions.

6.1 Feasibility of Estimating Internal Exposures

NIOSH has evaluated the available personnel and workplace monitoring data and source term information and has determined that there are insufficient data for estimating internal exposures, as described below.

As presented in Section 3.0 of this report, HHS has designated an SEC class for LLNL workers for the period from January 1, 1950 through December 31, 1973 (HHS, 2008). In the class designation letter, HHS states:

> *Because NIOSH does not have information to sufficiently quantify the activity levels for the wide array of fission product radionuclides encountered throughout the LLNL site, NIOSH finds that it is not feasible to reconstruct with sufficient accuracy the internal doses from intakes of fission and activation products.*

The associated SEC class designated by HHS (HHS, 2008) included only those employees *"... who were monitored for radiation exposure while working at the Lawrence Livermore National Laboratory…"* This class description was based on the NIOSH determination that all workers with the potential for radiation exposures during the proposed SEC class time period were included in the external dose monitoring program, and that unmonitored workers had no potential for radiation exposures.

Through the course of on-going dose reconstruction, NIOSH has determined that the monitoring records are not complete for some LLNL workers who may have been exposed to fission and activation product radionuclides during the period January 1, 1950, through December 31, 1973. Therefore, NIOSH has determined that the existence, or non-existence, of LLNL monitoring records is not always an accurate indicator of a LLNL worker's potential for radiation exposure during the period from January 1, 1950, through December 31, 1973. Accordingly, NIOSH has also determined that it is necessary to remove the "… who were monitored …" restriction from the description of the LLNL SEC class and to, therefore, expand the SEC class definition to include workers regardless of the availability of individual-specific monitoring data.

NIOSH does not have access to sufficient personnel monitoring, workplace monitoring, or source term data to estimate potential internal exposures to fission and activation products potentially received at LLNL during the period from January 1, 1950 through December 31, 1973. Consequently, NIOSH finds that it is not feasible to estimate, with sufficient accuracy, internal exposures to fission and activation products and resulting doses for the class of employees covered by this evaluation. Although NIOSH found that it is not possible to completely reconstruct internal radiation doses for the period from January 1, 1950 through December 31, 1973, NIOSH intends to use any internal monitoring data that may become available for an individual claim (and that can be interpreted using existing NIOSH dose reconstruction processes or procedures). Dose reconstructions for individuals employed at LLNL during the period from January 1, 1950 through December 31, 1973, but who do not qualify for inclusion in the SEC, may be performed using these data as appropriate.

6.2 Feasibility of Estimating External Exposures

This evaluation responds to a petition based on NIOSH determining that internal radiation exposures to fission and activation products could not be reconstructed for a dose reconstruction referred to NIOSH by DOL. As noted above, HHS will consider this determination to be sufficient without further consideration to determine that it is not feasible to estimate the levels of radiation doses of individual members of the class with sufficient accuracy. Consequently, it is not necessary for NIOSH to fully evaluate the feasibility of reconstructing external radiation exposures for the class of workers covered by this report.

In its previous SEC class designation for SEC-00092 (HHS, 2008), HHS states:

> *Although NIOSH found that it is not possible to completely reconstruct radiation doses for these employees, NIOSH determined that it is possible to reconstruct occupational medical dose and the external dose.*

This current evaluation has found no evidence to the contrary; NIOSH has established that it has access to sufficient information to either: (1) estimate the maximum external 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 (2) estimate the external radiation doses to members of the class more precisely than a maximum dose estimate.

Adequate reconstruction of medical dose is likely to be feasible by using claimant-favorable assumptions in the technical information bulletin, *Dose Reconstruction from Occupationally Related Diagnostic X-Ray Procedures* (ORAUT-OTIB-0006), and LLNL site profile documents (ORAUT-TKBS-0035).

Although NIOSH found that it is not possible to completely reconstruct radiation doses for all workers for the period from January 1, 1950 through December 31, 1973, NIOSH intends to use any external monitoring data that may become available (and that can be interpreted using existing NIOSH dose reconstruction processes or procedures) for an individual claim. Dose reconstructions for individuals employed at LLNL during the period from January 1, 1950 through December 31, 1973, but who do not qualify for inclusion in the SEC, may be performed using these data as appropriate.

6.3 Class Parameters Associated with Infeasibility

HHS has designated an SEC class for LLNL workers for the period from January 1, 1950 through December 31, 1973 (HHS, 2008). The time period covered by this current report is unchanged from that previously designated by HHS in 2008. NIOSH recommends that the proposed class include the period from January 1, 1950 through December 31, 1973.

As discussed in Section 4.4, NIOSH is unable to define individual worker exposure scenarios based on specific work locations within LLNL. Therefore, NIOSH recommends that the proposed class definition include all areas of LLNL during the specified time period.

The SEC class previously designated by HHS (HHS, 2008) included only those employees *"... who were monitored for radiation exposure while working at the Lawrence Livermore National Laboratory…"* Through the course of on-going dose reconstruction, NIOSH has determined that the existence, or non-existence, of LLNL monitoring records is not always an accurate indicator of a LLNL worker's potential for radiation exposure during the period from January 1, 1950, through December 31, 1973. As discussed in Section 4.5, NIOSH has also found insufficient documentation associating job titles and/or job assignments with specific radiological operations or conditions. NIOSH is unable to define the proposed SEC class based on worker job descriptions. NIOSH is also unable to define the proposed SEC class based on whether or not an individual appears to have been monitored for radiation exposure at LLNL. NIOSH therefore recommends that the proposed class definition include all employees of the Department of Energy, its predecessor agencies, and their contractors and subcontractors who worked at LLNL during the specified time period, regardless of the availability of individual monitoring data.

7.0 Summary of Feasibility Findings for Petition SEC-00163

This report evaluates the feasibility for completing dose reconstructions for workers at LLNL from January 1, 1950 through December 31, 1973. NIOSH determined that members of this class may have received radiation exposures from fission and activation products. NIOSH lacks sufficient information, which includes fission product bioassay, source term data, and workplace monitoring data that would allow it to estimate the potential fission and activation products exposures to which the proposed class may have been exposed. Consequently, NIOSH finds that it is not feasible to estimate, with sufficient accuracy, the total radiation dose received by members of this class of employees. Consistent with the HHS findings associated with SEC-00092 (HHS, 2008), NIOSH determined that it is likely feasible to reconstruct with sufficient accuracy the occupational medical dose and external dose received by LLNL workers.

NIOSH has documented herein that it cannot complete the dose reconstructions related to this petition. The basis of this finding demonstrates that NIOSH does not have access to sufficient information to estimate either the maximum radiation dose incurred by any member of the class or to estimate such radiation doses more precisely than a maximum dose estimate.

Although NIOSH found that it is not possible to completely reconstruct radiation doses for the proposed class, 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 individuals employed at LLNL during the period from January 1, 1950 through December 31, 1973, but who do not qualify for inclusion in the SEC, may be performed using these data as appropriate.

8.0 Evaluation of Health Endangerment for Petition SEC-00163

The health endangerment determination for the class of employees covered by this evaluation report is governed by EEOICPA and 42 C.F.R. § 83.14(b) and § 83.13(c)(3). Pursuant to these requirements, if it is not feasible to estimate with sufficient accuracy radiation doses for members of the class, NIOSH must determine that there is a reasonable likelihood that such radiation doses may have endangered the health of members of the class. The regulations require 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.

NIOSH has determined that members of the class were not exposed to radiation during a discrete incident likely to have involved levels of exposure similarly high to those occurring during nuclear criticality incidents. However, the evidence reviewed in this evaluation indicates that some workers in the class may have accumulated chronic radiation exposures through intakes of fission and activation products. 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 or in combination with work days within the parameters established for one or more other classes of employees in the SEC.

9.0 NIOSH-Proposed Class for Petition SEC-00163

The evaluation defines a single class of employees for which NIOSH cannot estimate radiation doses with sufficient accuracy. This class includes all employees of the Department of Energy, its predecessor agencies, and their contractors and subcontractors who worked at the Lawrence Livermore National Laboratory in Livermore, California from January 1, 1950 through December 31, 1973, 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.

10.0 Evaluation of Second Similar Class

In accordance with § 83.14(a), NIOSH may establish a second class of co-workers at the facility, similar to the class defined in Section 9.0, for whom NIOSH believes that dose reconstruction may not be feasible, and for whom additional research and analysis is required. If a second class is identified, it would require additional research and analyses. Such a class would be addressed in a separate SEC evaluation rather than delay consideration of the current claim. At this time, NIOSH has not identified a second similar class of employees at LLNL for whom dose reconstruction may not be feasible.

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11.0 References

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42 C.F.R. pt. 82, *Methods for Radiation Dose Reconstruction Under the Energy Employees Occupational Illness Compensation Program Act of 2000*; Final Rule; May 2, 2002; SRDB Ref ID: 19392

42 C.F.R. pt. 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*; Final Rule; May 28, 2004; SRDB Ref ID: 22001

42 U.S.C. §§ 7384-7385 [EEOICPA], *Energy Employees Occupational Illness Compensation Program Act of 2000*; as amended; OCAS website

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ORAUT-TKBS-0035-4, *Lawrence Livermore National Laboratory – Occupational Environmental Dose*, Rev. 00; Oak Ridge Associated Universities (ORAU); Oak Ridge, Tennessee; November 18, 2005; SRDB Ref ID: 19557

ORAUT-TKBS-0035-5, DRAFT *Lawrence Livermore National Laboratory – Occupational Internal Dose*; Rev. 01C; July 9, 2007; SRDB Ref ID: not currently in the SRDB—Draft document

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NIOSH, 2007, *SEC Petition Evaluation Report, Petition SEC-00092*, Office of Compensation Analysis and Support (OCS), National Institute for Occupational Safety and Health; December 3, 2007; OCAS website: http://www.cdc.gov/niosh/ocas/pdfs/sec/llnl/llnler.pdf