SEC Petition Evaluation Report
Petition SEC-00145

Report Rev #: 0 Report Submittal Date: July 1, 2009

Subject Expert(s):	Larry Page
Site Expert(s):	N/A

Petitioner Administrative Summary			
Petition Under Evaluation			
Petition #	Petition Type	Petition A Receipt Date	DOE/AWE Facility Name
SEC-00145	83.14	May 18, 2009	Lake Ontario Ordnance Works

NIOSH-Proposed Class Definition
All employees of DOE, its predecessor agencies, and their contractors and subcontractors who worked at Lake Ontario Ordnance Works in Niagara Falls, New York, from January 1, 1944 through December 31, 1953, for a number of work days aggregating at least 250 work days, occurring either solely under this employment, or in combination with work days within the parameters established for one or more other classes of employees included in the SEC.

Related Petition Summary Information			
SEC Petition Tracking #(s)	Petition Type	DOE/AWE Facility Name	Petition Status
N/A	N/A	N/A	N/A

Related Evaluation Report Information	
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ORAU Lead Technical Evaluator: Larry Page	**ORAU Review Completed By:** Michael Kubiak

Peer Review Completed By:	[Signature on file] *LaVon Rutherford*	07/02/2009 *Date*
SEC Petition Evaluation Reviewed By:	]Signature on file] *J. W. Neton*	07/02/2009 *Date*
SEC Evaluation Approved By:	]Signature on file] *Larry Elliott*	07/02/2009 *Date*

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Evaluation Report Summary: SEC-00145, Lake Ontario Ordnance Works

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 DOE, its predecessor agencies, and their contractors and subcontractors who worked at Lake Ontario Ordnance Works (LOOW) in Niagara Falls, New York, from January 1, 1944 through December 31, 1953, for a number of work days aggregating at least 250 work days, occurring either solely under this employment or in combination with work days within the parameters established for one or more other classes of employees included in the SEC.

Feasibility of Dose Reconstruction Findings

NIOSH lacks sufficient information, which includes sufficient bioassay, air monitoring, and radiological shipment records, to allow it to estimate with sufficient accuracy the potential internal exposures to which the proposed class may have been subjected. Additionally, there are no external exposure records available for LOOW prior to March 1949, preventing the determination of external dose to the proposed class prior March 1, 1949.

- Principal sources of internal and external radiation for members of the proposed class included exposures to uranium, thorium, plutonium, radium, and fission products received during operations involving the receipt, storage, and shipment of radioactive wastes. Other radionuclides from unidentified transient shipments may also have been present at the LOOW site.

- Inbound shipments to LOOW, ending in 1953, included shipments that were transient in nature, and for which little characterization data can be found. Shipments included, but were not limited to processing wastes containing plutonium and fission products, and uranium and thorium billets which were received, stored, and later shipped offsite.

- NIOSH has obtained only limited bioassay results for the period prior to 1954, when shipments of radioactive material were still being received. Incoming shipments to LOOW ceased in 1953. NIOSH has sufficient job-specific personnel and workplace monitoring records to allow for sufficiently accurate internal dose reconstruction after 1953.

- External exposure records are not available for LOOW prior to 1949. NIOSH has sufficient information to assign external dose to monitored workers during the period 1949 through 1953. For the period from January 1, 1954 through the end of covered operations, sufficient external monitoring records exist for NIOSH to develop external co-worker dose distributions and adequately bound the external exposures at LOOW.

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

- Pursuant to 42 C.F.R. § 83.13(c)(1), NIOSH determined that there is insufficient information to either: (1) 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 (2) estimate the radiation doses of members of the class more precisely than a maximum dose estimate.

- Although NIOSH found that it is not possible to completely reconstruct radiation doses for employees working at LOOW prior to 1954, NIOSH intends to use any internal and external monitoring data that may be available for an individual claim (and that can be interpreted using existing NIOSH dose reconstruction processes or procedures). Furthermore, NIOSH has determined that occupational medical dose for all workers can be reconstructed. Therefore, dose reconstructions may be performed using these data, as appropriate, for individuals with non-presumptive cancers or fewer than 250 days employment during the class period.

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 uranium, thorium, radium, fission products, or other unidentified radionuclides. 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 SEC.

Table of Contents

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SEC Petition Evaluation Report for SEC-00145

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: Larry Page, MJW Corporation. These conclusions were peer-reviewed by the individuals listed on the cover page. 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 Lake Ontario Ordnance Works (LOOW) 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 of HHS will make the final decision, taking into account the NIOSH evaluation, the advice of the

[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.

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 DOE, its predecessor agencies, and their contractors and subcontractors who worked at Lake Ontario Ordnance Works in Niagara Falls, New York, from January 1, 1944 through December 31, 1953, for a number of work days aggregating at least 250 work days, occurring either solely under this employment, or in combination with work days within the parameters established for one or more other classes of employees included in the SEC. During this period, employees at this facility were involved with receiving and storing radioactive wastes from other Atomic Energy Commission (AEC) sites. The LOOW site also served as a transient point for shipments between sites.

The evaluation responds to Petition SEC-00145 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. This claimant was employed as a security guard and foreman during the NIOSH-proposed class period. 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).

4.0 Radiological Operations Relevant to the Proposed Class

The following subsections summarize the radiological operations at LOOW from January 1, 1944 through December 31, 1953, 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.

4.1 Operations Description

Shipments from Linde Air Products Division of the Union Carbide Corporation
In 1944, the Manhattan Engineer District (MED) requested to use a small portion of the LOOW site to store solid uranium chemical residues originating from the refining of pitchblende ores, for uranium oxide recovery, performed at the Linde Air Products Division of the Union Carbide Corporation, in Tonawanda, New York. In 1946, the Tonawanda site was decommissioned and the contaminated portions of the site were disposed of at LOOW (NLC, 1979, p. 15).

The MED contracts stipulated that only uranium was being sold to MED; all other minerals were to remain under the control of the African Metals Company (AMC), which leased several buildings at

[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.

LOOW to store the residues. Those residues from Tonawanda were identified as F-32, L-30, and L-50, and were stored in these leased facilities (NLC, 1979, p. 15).

Additional residues from Linde, identified as R-10, were not covered under the agreement with AMC and were unpackaged and stored in an aboveground location, just north of the buildings in which the Belgian-owned residues were stored. In 1964, these residues were covered with dirt and seeded to provide a grass-covered sod layer. Smaller quantities of similar residues were handled in the same manner (NLC, 1979, p.17).

Shipments from Mallinckrodt Chemical Works
From 1946 through March 1949, the Mallinckrodt Chemical Works in St. Louis, Missouri, shipped pitchblende residues to Belgium. From April 1, 1949 though 1953, these residues were shipped to LOOW. These residues were identified as K-65, and were unpackaged and stored in a modified silo, with the empty drums shipped away from LOOW (NLC, 1979, p. 15).

Shipments from Various Facilities
In the late 1940s, contaminated materials from several different wartime facilities undergoing decommissioning were shipped to LOOW. Uranium reduction slag and discarded graphite crucibles from a uranium metal reduction and casting plant were also unpackaged and stored aboveground at LOOW. All of these materials were removed in the late 1950s and shipped to Y-12 (NLC, 1979, p. 17).

Shipments from Knolls Atomic Power Laboratory
From 1950 through 1952, LOOW was used as a staging point for uranium and thorium metal billets (Epp, 1951; Smith, March 1951; LOOW, November 1951; Smith, November 1951a; Smith, November 1952b; Blatz, 1951; LOOW, January 1952; Koenig, 1952a; Koenig, 1952b; Smith, 1958; LOOW, March 1952; LOOW, April 1952; LOOW, June 1952; Hershman, 1952. During the period from 1950 through 1953, wastes generated at the University of Rochester and Knolls Atomic Power Laboratory (KAPL) in Schenectady, New York, were transferred to LOOW.

The KAPL wastes were described as combustibles stored in wooden crates and processing wastes stored in 55-gallon drums. The processing wastes included plutonium and fission products in evaporator bottoms. There is no evidence that the plutonium-bearing wastes were ever opened while in storage. These wastes were accumulated in the Baker-Smith area (NLC, 1979, p. 17). Specifically, the liquid waste containing plutonium was stored in Building 444, which was demolished after the KAPL wastes were removed. In March 1958, it was determined that this building was in a deteriorated condition and that some of the markings on the drums and crates had weathered to the point of being illegible (Sweeney, 1958). By April 7, 1958, guidance had been established to ensure that plutonium-bearing materials were shipped to Oak Ridge (Hanner, 1958).

It appears that some of the KAPL combustible waste was stored in the boiler building, designated 401, which later became the Boron Metals Plant. In a letter dated April 18, 1958, the hope was expressed that the KAPL wastes would be disposed of prior to June 30th, when the New York Operations Office of the AEC would take administrative responsibility for the Boron Metals Plant (Sapirie, 1958). A portion of the combustible waste was incinerated as late as 1958. Based on the monitoring records, the radioactivity in this incinerated waste appears to have been fission products only (Vessels, 1958; Roth, 1958). The last outgoing shipment record found by NIOSH was dated January 30, 1959. After that date, there is no further discussion of the KAPL waste (Janca, 1959).

Shipments from University of Rochester
The University of Rochester wastes were described as animal residues and wastes and miscellaneous contaminated materials. The wastes were reportedly buried in a separate area from other residues (NLC, 1979, p. 15).

Cessation of Incoming Waste Shipments
No additional wastes were received at LOOW after 1953 (Bechtel, 1986, p. 14). After 1953, the radiologically-related operations at LOOW consisted of:

- removal of the KAPL waste, completed in 1959;
- seeding the open-air piles of material, completed in the 1964-1965 period;
- various corrective actions throughout the site history, usually involving radon reduction; and
- remediation of the site, beginning in 1982.

4.2 Radiation Exposure Potential from Operations

The potential for external radiation dose existed at all locations where radioactive materials were handled or stored. NIOSH has documentation describing receipt and storage of raffinates from different sites. There is no information regarding the handling of raffinates, though the quantities and storage locations are known. Based on the site operations outlined in Section 4.1, sources of external exposure included alpha, electron, and photon radiation emitted from radioactive shipments received at the site, whether for transient shipment/storage or permanent onsite storage.

The primary source of internal radiation exposure at the site was airborne radioactivity generated during handling of radioactive shipments. The data examined by NIOSH, as presented in Section 4.1, are representative of the types of shipments received at the site, including thorium, uranium, plutonium, and fission products. However, the data available to NIOSH for the period while incoming waste shipments were being received lack specific radiological information necessary to clearly define the radiation exposure potential.

4.3 Time Period Associated with Radiological Operations

Per the DOE Office of Health, Safety and Security, the time period associated with AEC operations at LOOW is from 1944 through 1997 (DOE, 2009). NIOSH has discovered no additional data to support more specific dates for the start and stop of AEC/DOE operations. Therefore, AEC/DOE work at LOOW is assumed to have started on January 1, 1944, and ended on December 31, 1997. As stated above, no additional wastes were received at LOOW after 1953. NIOSH has insufficient data to determine the specific date in 1953 when the last shipment was received, so waste receipt is assumed to have ceased on December 31, 1953. For the remainder of covered operations period at LOOW, from January 1, 1954 through December 31, 1997, the site entered a largely caretaker status.

4.4 Site Locations Associated with Radiological Operations

While some buildings and outside areas are specifically noted for the use or storage of radiological materials, documentation available to NIOSH does not indicate any definite boundaries between radiological and non-radiological areas. NIOSH has insufficient information to completely describe the diverse source term, operations processes, worker movements, or potential for contamination

spread at LOOW; therefore. NIOSH must assume that the potential for exposure to radioactive materials existed in all areas of LOOW during the period being evaluated.

4.5 Job Descriptions Affected by Radiological Operations

NIOSH has found no documentation associating job titles and/or job assignments with specific radiological operations or conditions. Without such information, NIOSH is 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 data capture efforts for LOOW focused on:

- various site contractors (i.e., Bechtel National, National Lead of Ohio, Nuclear Materials and Equipment Corp., Babcock & Wilcox (Nuclear Materials and Equipment Corp. successor), Page Airways, Hooker Chemical, and OxyChem (Hooker successor);
- the U.S. Army Corp of Engineers (USACE);
- the New York State Department of Environmental Conservation;
- the Nuclear Regulatory Commission (including the Agency-wide Documents Access and Management System (ADAMS) electronic records repository);

- the DOE (including Office of Scientific and Technical Information (OSTI) and OpenNet repository); and
- the National Archives record centers.

Attachment One contains a summary of LOOW documents. The summary specifically identifies specific data capture details for each document retrieved.

5.2 Worker Interviews

In an effort to locate potentially useful data, NIOSH has contacted the following individuals:

- Representatives from Bechtel National, Babcock & Wilcox (NUMEC successor), Signature Flight Services (Page Airways successor), and New York State Department of Environmental Conservation;
- An attorney for OxyChem (Hooker Chemical successor); and
- The project manager at USACE LOOW.

Decontamination documentation indicates that former employees of Linde Air were interviewed to determine basic general knowledge of both Linde and LOOW. The interviews were conducted by ORAU in 1981 (Robie, 1981; Dupree, 1981; Beck 1981**).**

Additionally, NIOSH has reviewed the computer-assisted telephone interviews conducted for claims filed with NIOSH for energy employees who worked at the LOOW during the period from 1944 through 1953. These interviews provided no information to change NIOSH's feasibility determination.

5.3 Internal Personnel Monitoring Data

NIOSH has obtained only limited bioassay results for the period prior to 1954, when shipments of radioactive material were still being received. Available data for the period include some radon (breath) sampling results starting in 1951 (Radon Results, April 1949-September 1951; Radon Results, August 1949-March 1951), and urinalysis results for 1951 (mostly for radium, with some limited uranium analysis) (Urine Sample Results, September 1950-August 1951).

Requests for dosimetry-related information were made directly to DOE for all LOOW claims. DOE provided results for only one of seven active claims with employment prior to 1954. Both bioassay and external dosimetry results were provided for that claim, with the bioassay results consisting of a total of four radium measurements, one uranium measurement, and two breath radon measurements. No other internal dose information was available through DOE for the remaining claims with pre-1954 employment.

When the site entered a caretaker phase, after the cessation of inbound shipments in 1953, several characterization surveys were performed, with the most recent conducted in 1980 by Battelle Memorial Institute (Battelle, 1979-1980). Long-term radon monitoring has been performed (Radon Results, July 1980-October 1981; Radon Results, October 1977-March 1980; NLC, 1980; Radon Results, April 1949-September 1951; Radon Results, October 1952; Heatherton, 1950a; Unknown author, 1960). Concentrations of radioactive material onsite after 1953 are known from these survey data (Battelle, 1979-1980; Unknown author, 1960; Heatherton, 1950b**;** AEC, 1973; Landis, 1988;

Ausmus, 1980; Battelle, 1980**)**. Bioassay results are also available for the period during the incineration of the KAPL wastes (Vessels, 1958).

5.4 External Personnel Monitoring Data

Film badge results are available to NIOSH beginning in mid-1949 (Film Badge Results, June 1949-January 1951; Film Badge Results, January 1951-December 1954; Film Badge Results, 1952; Film Badge Results, 1953a; Film Badge Results, 1953b). No records have been found prior to these. DOE provided external dose results for three of seven active claims with employment prior to 1954. The results, beginning in mid-1949, are in the form of single-page weekly summaries. No other external dose information was available through DOE for the remaining claims with pre-1954 employment.

As stated in Section 5.3, when the site entered a caretaker phase, after the cessation of inbound shipments in 1953, several characterization surveys were performed, with the most comprehensive occurring in the 1970s and 1980s (Battelle, 1979-1980; Unknown author, 1960; Heatherton, 1950b**;** AEC, 1973; Landis, 1988; Ausmus, 1980; Battelle, 1980). Co-worker doses can be established using available dosimetry results for the period after 1953. For the period after 1953, external dosimetry results exist for workers involved with the KAPL shipments to Oak Ridge, Tennessee, and for those involved with the Boron Metals Plant, including electron, photon, and neutron data (Film Badge Results, 1952; Film Badge Results, 1953a; Film Badge Results, January-June 1953; Film Badge Results, January 1951-December 1954; Film Badge Results, August 1967; Film Badge Results, July 1955-January 1956; LOOW, 1949-1960). On-site radiation levels are known from the various survey data.

5.5 Workplace Monitoring Data

NIOSH has obtained limited dust sampling results for 1950, with total alpha air sample analyses conducted only in August, October, and November, and the remainder being performed for radium and radon (Heatherton, 1950a; Air Dust Sample Results, 1950).

Concentrations of radioactive material after 1953 are known from characterization survey data and radon monitoring, with the most comprehensive occurring in the 1970s and 1980s (Radon Results, July 1980-October 1981; Radon Results, October 1977-March 1980; Battelle, 1979-1980; NLC, 1980; Radon Results, April 1949-September 1951; Radon Results, October 1952; Heatherton, 1950a; Unknown author, 1960; Heatherton, 1950b; AEC, 1973). Incineration of the KAPL waste in the late 1950s was adequately monitored though the use of air sampling at various distances from the burn site (Harris, 1956).

5.6 Radiological Source Term Data

Source term data regarding residues shipped to, and permanently stored at LOOW can be determined by survey data (conducted after 1953) that are available to NIOSH. Source term data for shipments and site storage of a transient nature are not available (NLC, 1979, pp. 15-17; Epp, 1951; Smith, March 1951; LOOW, November 1951; Smith, November 1951a; Smith, November 1952b; Blatz, 1951; LOOW, January 1952; Koenig, 1952a; Koenig, 1952b; Smith, 1958; LOOW, March 1952; LOOW, April 1952; LOOW, June 1952; Hershman, 1952.

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.

NIOSH has been unable to locate any internal monitoring data prior to 1951, and after that time there are only limited uranium monitoring data. The monitoring for internal radium, while more complete than that for uranium, are spotty in nature and do not address the major portion of the period prior to 1954.

Several shipments of thorium to the site have been identified, along with documentation that thorium material was briefly stored at the LOOW site. No internal monitoring for thorium has been found. Shipments containing fission products were received from KAPL during the period from 1950 through 1953 (NLC, 1979, p. 17); no internal monitoring data for fission products have been found, with the exception of air monitoring performed during the incineration of KAPL wastes, performed from 1956-1958.

NIOSH has insufficient data to determine that shipments to the site prior to 1954 did not potentially include other radionuclides.

During the period prior to 1954, the inventory of radioactive material at LOOW was in a constant state of flux. While NIOSH has identified many of the shipments received during the period 1944 through 1953, NIOSH has insufficient data to ensure that all possible shipments have been accounted for. Uranium and thorium billets were known to be shipped to LOOW and stored temporarily. Both the quantity stored and lengths of the storage periods are unknown. The possibility of additional shipments to and from LOOW, including those of unknown content, makes dose reconstruction infeasible for the period from 1944 through 1953.

After 1953, incoming shipments to LOOW ceased and the site entered a largely caretaker status. Sufficient records exist to allow dose reconstruction after that time. The materials remaining on site during the post-1953 static period have been adequately characterized, and workplace monitoring records exist for the incineration of the low-level KAPL wastes (Vessels, 1958; Roth 1958**)**. For monitored workers after 1953, NIOSH will assign fitted internal dose where the data are available. For unmonitored individuals after 1953, there is a potential for intakes of radioactive materials from uncovered storage piles. For these individuals, NIOSH will assign intakes based on soil activity distributions derived from available soil analysis results (Battelle, 1979-1980; Unknown author, 1960; Heatherton, 1950b; AEC, 1973; Landis, 1988; Ausmus, 1980; Battelle, 1980), and bounding breathing rate and suspension rate assumptions.

NIOSH does not have access to sufficient personnel monitoring, workplace monitoring, or source term data to estimate potential internal exposures to radionuclide(s) during the period from January 1, 1944 through December 31, 1953. Consequently, NIOSH finds that it is not feasible to estimate, with sufficient accuracy, internal exposures to radionuclide(s) 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, 1944 through December 31, 1953, NIOSH intends to use any available 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 LOOW during the period from January 1, 1944 through December 31, 1953, 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 waste materials containing thorium, uranium, plutonium, and fission products could not be reconstructed for a dose reconstruction referred to NIOSH by the Department of Labor (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.

External dose records exist for the period from June 1949 through June 1958 (Film Badge Results, 1952; Film Badge Results, 1953a; Film Badge Results, June 1949-January 1951; Film Badge Results, January-June 1953; Film Badge Results, January 1951-December 1954; Film Badge Results, January 1955; Film Badge Results, 1954; Film Badge Results, January-June 1958; Film Badge Results, 1956-1957; Film Badge Results, 1956), and for December 1959 (Film Badge Results, December 1959). NIOSH has sufficient information to assign external dose to monitored workers during the period

1949 through 1953. For the period from January 1, 1954 through the end of covered operations, sufficient external monitoring records exist for NIOSH to develop external co-worker dose distributions and adequately bound the external exposures at LOOW.

Adequate reconstruction of medical dose for LOOW workers is feasible by using claimant-favorable assumptions in the complex-wide Technical Information Bulletin, *Dose Reconstruction from Occupationally Related Diagnostic X-Ray Procedures* (ORAUT-OTIB-0006).

Although NIOSH found that it is not possible to completely reconstruct external radiation doses for the period from January 1, 1944 through December 31, 1953, NIOSH intends to use any available external 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 LOOW during the period from January 1, 1944 through December 31, 1953, 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

Shipments to LOOW were conducted from 1944 through 1953. After this period, all inbound shipments to the site ceased, and the site entered a largely caretaker status. NIOSH recommends that the class include the time period January 1, 1944, through December 31, 1953, the period while shipments were being received by LOOW.

While some buildings are specifically noted for the use of radiological materials, documentation available to NIOSH does not indicate any definite boundaries between radiological and non-radiological areas. NIOSH recommends that the class definition include ALL areas and buildings during the specified time period.

NIOSH has found no documentation associating job titles and/or job assignments with specific radiological operations or conditions. Without such information, NIOSH is unable to define the SEC class based on worker job descriptions. NIOSH recommends that the class definition include ALL workers during the specified time period.

7.0 Summary of Feasibility Findings for Petition SEC-00145

This report evaluates the feasibility for completing dose reconstructions for employees at LOOW from January 1, 1944 through December 31, 1953. NIOSH determined that members of this class may have received radiation exposures from internal and external radiation sources. NIOSH lacks sufficient information, which includes biological monitoring data, sufficient air monitoring information, or sufficient process and radiological source information that would allow it to estimate the potential internal and external radiation exposures to which the proposed class may have been exposed. NIOSH considers the adequate reconstruction of medical dose for LOOW workers to be feasible.

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 internal and external radiation doses for the period from January 1, 1944 through December 31, 1953, NIOSH intends to use any available 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 LOOW during the period from January 1, 1944 through December 31, 1953, 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-00145

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 radionuclides and from direct exposure to radioactive materials. 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-00145

The evaluation defines a single class of employees for which NIOSH cannot estimate radiation doses with sufficient accuracy. This class includes all employees of DOE, its predecessor agencies, and their contractors and subcontractors who worked at Lake Ontario Ordnance Works in Niagara Falls, New York, from January 1, 1944 through December 31, 1953, for a number of work days aggregating at least 250 work days, occurring either solely under this employment, or in combination with work days within the parameters established for one or more other classes of employees included in the SEC.

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 analyses 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 LOOW for whom dose reconstruction may not be feasible.

11.0 References

42 C.F.R. pt. 81, *Guidelines for Determining the Probability of Causation Under the Energy Employees Occupational Illness Compensation Program Act of 2000;* Final Rule, Federal Register/Vol. 67, No. 85/Thursday, p 22,296; May 2, 2002; SRDB Ref ID: 19391

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

ORAUT-OTIB-0006, *Dose Reconstruction from Occupationally Related Diagnostic X-Ray Procedures*, Rev. 03 PC-1; Oak Ridge Associated Universities (ORAU); Oak Ridge, Tennessee; December 21, 2005; SRDB Ref ID: 20220

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Film Badge Results, 1952, *Lake Ontario Ordnance Works Film Badge Results*; results reported for all months in 1952; SRDB Ref ID: 9107

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Attachment 1: Data Capture Synopsis

Table A1-1: Data Capture Synopsis for Lake Ontario Ordnance Works			
Data Capture Information	**Data Capture Description**	**Completed**	**Uploaded into SRDB**
Primary Site/Company Name: Lake Ontario Ordnance Works (LOOW); 1944-1997 Other company names: Niagara Falls Storage Site (NFSS), an AKA for LOOW; Bechtel National, 1981-1997: Last attempt to contact Scherry Snow, Bechtel representative, was 11/03/2008. She has been unresponsive. National Lead of Ohio, 1971-1981: NLO is defunct. Their documents were captured from DOE Legacy Management. See below for details. NUMEC, 1964-1971: Terry Chalker, A Babcock & Wilcox (NUMEC successor) attorney confirmed on 01/08/2008 that B&W holds no LOOW records. Page Airways, 1958-1964: Priscilla Kehoe, paralegal for Signature Flight Services (Page successor) confirmed on 05/14/2008 that Signature holds no LOOW records. Hooker Chemical, 1953-1958: Marc Kennedy, Attorney for OxyChem (Hooker successor) provided 3 relevant documents that were captured on 05/16/2008.	Documents from Occidental Chemical: shotgun source – best management practice, appraisal of controls and facilities for the protection of property in outside storage areas, and moving scrap material from eastern portion of site.	05/16/2008	3
State Contacted: NY Department of Environmental Conservation: Barbara Youngberg *(retired)* and John Frisone (518) 402-8579	Aerial radiological survey, compilation of air and water sampling results and radiation survey results, NFSS environmental monitoring reports, soil samples for the Modern Landfill Inc., radon concentration measurements, and remedial measures for L-50 residue storage structures.	03/05/2007	64
Cincinnati/Hamilton, OH Public Library	Formerly utilized Manhattan Engineering District/Atomic Energy Commission (MED/AEC) Sites remedial action program radiological survey of the Hooker Chemical Company Niagara Falls, New York.	01/19/2004	1
Comprehensive Epidemiologic Data Resource (CEDR)	No relevant documents identified.	03/31/2008	0
DOE Environmental Management	Environmental reports, radioactivity at LOOW, summary environmental report on radiological doses and releases, the bomb that fell on Niagara, uncertainty and variability in historical time-weighted average exposure data, and utilizing isotopic uranium ratios in groundwater.	10/28/2007	6
DOE Germantown	Personnel monitoring reports, LOOW dirt and plant samples, site	02/24/2004	12

Table A1-1: Data Capture Synopsis for Lake Ontario Ordnance Works			
Data Capture Information	**Data Capture Description**	**Completed**	**Uploaded into SRDB**
	description and history, radiation, radon and dust surveys, trip reports, and sample results.		
DOE Hanford Declassified Document Retrieval System (DDRS)	Uranium rolling at Simonds Saw and Steel Company.	03/31/2008	1
DOE Legacy Management Considered Sites	Post remedial action survey property of modern landfill, results of the mobile gamma scanning activities, radiological surveys, post-remedial action report, monthly progress report, aerial radiological survey, Niagara Falls vicinity fact sheet, long-term surveillance, and a maintenance needs assessment.	11/12/2007	14
DOE Legacy Management - Grand Junction Office	Shipment of thorium metal for storage request number D-1-198 and Tonawanda progress reports.	07/11/2008	186
DOE Legacy Management - MoundView (Fernald Holdings, includes Fernald Legal Database)	Residues and by-products, scrap shipment to Vitro Manufacturing, health physics activities, and medical hazards with regard to storage of radium-containing sludge from processing 3% pitchblende ores at Linde, radiological surveys, symposium on occupational health experience and practices in the uranium industry, environmental monitoring reports, DOE Office of Legacy Management Niagara Falls vicinity properties fact sheet, and a long range plan for Fernald.	06/21/2008	165
DOE OpenNet	Monthly status and progress reports.	03/31/2008	9
DOE OSTI Energy Citations	Site remedial action project information, aerial radiological survey, annual site environmental report, assessment of alternatives for long term management of uranium ore residues and contaminated soils.	05/19/2008	9
DOE OSTI Information Bridge	Performance monitoring report for the Niagara Falls Storage Site waste containment structure.	06/17/2008	1
DOL/Paragon	Accountability of radium and valuable metals, aerial radiological survey, boron metal plant review, cesium-137 contamination, changing land uses, comparison of predicted doses to the general public, doses from other radiation sources, data on the K-65 tower, disposal and storage of radioactive material, recovery, and scrap metal, Eberline radiological survey of modern landfill site, environmental assessment plan for the decontamination of 156.25 acres of the AEC-Niagara Falls Site, evaluation of potential hazards, final environmental impact statement, health and safety plan for the NFFS, licensing of uranium residues stored at LOOW, monthly report of field activities, NFSS annual environmental report, NFSS record of decision, operational reports, radiation exposures, radiological surveys including air and dust sample results, radon monitoring data, site history, inventory, operations and shipping information, vitrification of the	01/13/2009	772

Table A1-1: Data Capture Synopsis for Lake Ontario Ordnance Works			
Data Capture Information	**Data Capture Description**	**Completed**	**Uploaded into SRDB**
	residues at NFSS, waste shipment and storage at LOOW, weekly monitoring report for off-site locations, and weekly progress reports.		
Environmental Measurements Laboratory (EML) / Health and Safety Laboratory (HASL)	Site visits, annual report, thorium sampling, and storage information.	03/08/2005	1
Environmental Protection Agency (EPA)	EPA superfund site information on Niagara Falls Storage Site actions.	10/27/2007	5
Google	Report for the formerly utilized Manhattan Engineer District/Atomic Energy Commission Sites, radiological surveys, history of the Tonawanda, NY FUSRAP Site, and K-65 residues.	07/16/2008	62
Lewiston, NY Public Library	Field sampling plan and remedial investigation.	03/31/2009	1
Missouri Department of Natural Resources	Oldest atomic waste found in the St. Louis area.	09/30/2008	2
NARA - Atlanta	Annual health protection status report, breath radon measurements, comments on residues and by-products stored within the Tonawanda area, disposition of Knolls Atomic Power Laboratory (KAPL) wastes and bioassay results, aerial photograph, neutron source - BMP, radiation monitoring progress reports, shipment of iron cakes to LOOW, storage of tailings in barrels at LOOW, unloading K-65 from railroad car at model town, and a health physics report.	06/20/2008	30
NARA - Kansas City	NYSHD sampling at Niagara Falls Site, open field burning of low level radioactive waste, progress reports, radiation hazards at LOOW, Bechtel radon data, bioassay sample results, description of residues and stored waste, film badge data, radiological incident investigations, water and sediment radiological data, environmental monitoring data, radiation work permits, radiochemical analyses of urine samples, radiological survey of off site property, and TLD area monitor reports.	10/14/2008	229
National Academies Press (NAP)	No relevant documents identified.	04/01/2008	0
National Nuclear Security Administration (NNSA) - Nevada Site Office	No relevant documents identified.	03/31/2008	0
NRC Agencywide Document Access and Management (ADAMS)	No relevant documents identified.	03/31/2008	0
Oak Ridge Operations (ORO) Vault	Soil and water uranium and radium survey progress reports, dosimetry and hazardous area information, Linde progress reports, Mallinckrodt Chemical Works study classifications of radium, radon and thorium exposures, miscellaneous Linde correspondence, storage of K-65, film badge data, and radiation and dust exposures.	10/28/2005	17
Office of Scientific & Technical Information (OSTI)	NFSS environmental surveillance reports, evaluation of alternatives for the disposition of Niagara Falls Storage Site's residues and wastes, report on the performance monitoring system for the interim waste containment, and	11/03/2008	14

Table A1-1: Data Capture Synopsis for Lake Ontario Ordnance Works			
Data Capture Information	**Data Capture Description**	**Completed**	**Uploaded into SRDB**
	a radiological survey of LOOW and vicinity.		
ORAU Team	Site profile, dose document summary, documented communication, Data Completeness Verification for Lake Ontario Ordnance Works, description of work with U-235, and processes at LOOW.	04/18/2008	13
Southern Illinois University	Disposal of radioactive wastes in the metropolitan St. Louis area and the environmental and health legacy of the Mallinckrodt Chemical Works Co.	10/08/2008	1
University of Rochester	Former University of Rochester burial area investigation.	08/18/2008	1
Unknown	Background and history reports on LOOW, beta sample results, environmental surveillance plan, evaluation of exposure potential, exploration of contaminated residue areas at LOOW, film badge monitoring reports, gamma doses from K-65 operations, health group monthly reports, health hazards in New York Operations Office (NYOO) facilities producing and processing uranium, health physics progress reports, health physics requirements for work, investigations regarding thorium location of contaminated areas, monthly reports, radon, dust, urine and film badge reports, remedial investigation report for the Tonawanda Site, smear results, uranium inventory, and trip reports.	03/30/2007	98
US Army Corps of Engineers	Identification of known past and present waste areas and solid waste management units, excavation of drums, remedial action performed at the Niagara Falls Storage Site, report on treatment, storage and disposal facilities for hazardous, toxic and radioactive waste, final engineering evaluation/cost analysis for removal actions in operable units 1and 2, remedial investigation report, and a FUSRAP NFSS environmental surveillance technical memorandum.	12/01/2008	41
Washington State University (U.S. Transuranium and Uranium Registries)	No relevant documents identified.	03/31/2008	0
Total			**1758**

Table A1-2: Database Searches for Lake Ontario Ordnance Works			
Database/Source	**Keywords**	**Hits**	**Uploaded into SRDB**
DOE CEDR http://cedr.lbl.gov/ COMPLETED 03/31/2008	"Lake Ontario Ordnance Works" in Title "Niagara Falls Storage Site" in any Title	0	0
DOE Hanford DDRS http://www2.hanford.gov/declass/ COMPLETED 03/31/2008	"Lake Ontario Ordnance Works" in any field "Niagara Falls Storage Site" in any field	1	1
DOE OpenNet http://www.osti.gov/opennet/advancedsearch.jsp COMPLETED 03/31/2008	"Lake Ontario Ordnance Works" in any field "Niagara Falls Storage Site" in any field	9	9
DOE OSTI Energy Citations http://www.osti.gov/energycitations/ COMPLETED 05/19/2008	"Lake Ontario Ordnance Works" in any field "Niagara Falls Storage Site" in any field	70	9
DOE OSTI Information Bridge http://www.osti.gov/bridge/advancedsearch.jsp COMPLETED 06/17/2008	"Lake Ontario Ordnance Works" in any field "Niagara Falls Storage Site" in any field	41	1
National Academies Press http://www.nap.edu/ COMPLETED 04/01/2008	"Lake Ontario Ordnance Works" in any field "Niagara Falls Storage Site" in any field	244	0
NNSA - Nevada Site Office www.nv.doe.gov/main/search.htm COMPLETED 03/31/2008	"Lake Ontario Ordnance Works" in any field "Niagara Falls Storage Site" in any field	0	0
NRC ADAMS Reading Room http://www.nrc.gov/reading-rm/adams/web-based.html COMPLETED 03/31/2008	"Lake Ontario Ordnance Works" in any field "Niagara Falls Storage Site" in any field	17	0
U.S. Transuranium & Uranium Registries http://www.ustur.wsu.edu/ COMPLETED 03/31/2008	"Lake Ontario Ordnance Works" in any field "Niagara Falls Storage Site" in any field	0	0
Google http://www.google.com COMPLETED 07/16/2008	"Lake Ontario Ordnance Works" oralloy "Lake Ontario Ordnance Works" postum "Lake Ontario Ordnance Works" tuballoy "Lake Ontario Ordnance Works" "uranyl nitrate hexahydrate" OR UNH "Lake Ontario Ordnance Works" "K-65" "Lake Ontario Ordnance Works" "sump cake"	18,489	62

Table A1-2: Database Searches for Lake Ontario Ordnance Works			
Database/Source	**Keywords**	**Hits**	**Uploaded into SRDB**
	"Lake Ontario Ordnance Works" "uranium dioxide" "Lake Ontario Ordnance Works" "uranium tetrafluoride" "Lake Ontario Ordnance Works" "uranium trioxide" "Lake Ontario Ordnance Works" "uranium hexafluoride" "Lake Ontario Ordnance Works" accident "Lake Ontario Ordnance Works" "air count" "Lake Ontario Ordnance Works" "air dust" "Lake Ontario Ordnance Works" "air filter" "Lake Ontario Ordnance Works" "airborne test" "Lake Ontario Ordnance Works" alpha "Lake Ontario Ordnance Works" "belgian congo ore" "Lake Ontario Ordnance Works" beta "Lake Ontario Ordnance Works" bioassay OR "Lake Ontario Ordnance Works" bio-assay "Lake Ontario Ordnance Works" breath OR "Lake Ontario Ordnance Works" "breathing zone" OR "Lake Ontario Ordnance Works" BZ "Lake Ontario Ordnance Works" "body burden" "Lake Ontario Ordnance Works" calibration "Lake Ontario Ordnance Works" "chest count" "Lake Ontario Ordnance Works" columnation "Lake Ontario Ordnance Works" contamination "Lake Ontario Ordnance Works" curie "Lake Ontario Ordnance Works" "denitration" OR "Lake Ontario Ordnance Works" "denitration pot" "Lake Ontario Ordnance Works" derby OR "Lake Ontario Ordnance Works" regulus "Lake Ontario Ordnance Works" "derived air concentration" OR "Lake Ontario Ordnance Works" DAC "Lake Ontario Ordnance Works" dose "Lake Ontario Ordnance Works" dosimeter "Lake Ontario Ordnance Works" dosimetric "Lake Ontario Ordnance Works" dosimetry "Lake Ontario Ordnance Works" electron "Lake Ontario Ordnance Works" environment		

Table A1-2: Database Searches for Lake Ontario Ordnance Works			
Database/Source	**Keywords**	**Hits**	**Uploaded into SRDB**
	"Lake Ontario Ordnance Works" "Ether-Water Project" "Lake Ontario Ordnance Works" exposure OR "Lake Ontario Ordnance Works" "exposure investigation" OR "Lake Ontario Ordnance Works" "radiation exposure" "Lake Ontario Ordnance Works" external "Lake Ontario Ordnance Works" "F machine" "Lake Ontario Ordnance Works" fecal "Lake Ontario Ordnance Works" "feed material" "Lake Ontario Ordnance Works" femptocurie "Lake Ontario Ordnance Works" film "Lake Ontario Ordnance Works" fission "Lake Ontario Ordnance Works" fluoroscopy "Lake Ontario Ordnance Works" "Formerly Utilized Sites Remedial Action Program" OR "Lake Ontario Ordnance Works" FUSRAP "Lake Ontario Ordnance Works" gamma-ray OR "Lake Ontario Ordnance Works" "gamma ray" "Lake Ontario Ordnance Works" "gas proportional" "Lake Ontario Ordnance Works" "gaseous diffusion" "Lake Ontario Ordnance Works" health OR "Lake Ontario Ordnance Works" "health instrument" OR "Lake Ontario Ordnance Works" "health physics" OR "Lake Ontario Ordnance Works" H.I. OR "Lake Ontario Ordnance Works" HI OR "Lake Ontario Ordnance Works" HP "Lake Ontario Ordnance Works" highly enriched uranium" OR "Lake Ontario Ordnance Works" HEU "Lake Ontario Ordnance Works" hydrofluorination "Lake Ontario Ordnance Works" "in vitro" "Lake Ontario Ordnance Works" "in vivo" "Lake Ontario Ordnance Works" incident "Lake Ontario Ordnance Works" ingestion "Lake Ontario Ordnance Works" inhalation "Lake Ontario Ordnance Works" internal "Lake Ontario Ordnance Works" investigation "Lake Ontario Ordnance Works" isotope "Lake Ontario Ordnance Works" isotopic		

Table A1-2: Database Searches for Lake Ontario Ordnance Works			
Database/Source	**Keywords**	**Hits**	**Uploaded into SRDB**
	"Lake Ontario Ordnance Works" "isotopic enrichment" "Lake Ontario Ordnance Works" "JS Project" "Lake Ontario Ordnance Works" Landauer "Lake Ontario Ordnance Works" "liquid scintillation" "Lake Ontario Ordnance Works" log OR "Lake Ontario Ordnance Works" "log sheet" OR "Lake Ontario Ordnance Works" "log book" "Lake Ontario Ordnance Works" "low enriched uranium" OR "Lake Ontario Ordnance Works" LEU "Lake Ontario Ordnance Works" "lung count" "Lake Ontario Ordnance Works" "maximum permissible concentration" OR "Lake Ontario Ordnance Works" MPC "Lake Ontario Ordnance Works" metallurgy "Lake Ontario Ordnance Works" microcurie "Lake Ontario Ordnance Works" millicurie "Lake Ontario Ordnance Works" "mixed fission product" OR "Lake Ontario Ordnance Works" MFP "Lake Ontario Ordnance Works" monitor OR "Lake Ontario Ordnance Works" "air monitoring" "Lake Ontario Ordnance Works" nanocurie "Lake Ontario Ordnance Works" "nasal wipe" "Lake Ontario Ordnance Works" neutron "Lake Ontario Ordnance Works" "nose wipe" "Lake Ontario Ordnance Works" nuclear OR "Lake Ontario Ordnance Works" "Chicago-Nuclear" OR "Lake Ontario Ordnance Works" "nuclear fuels" "Lake Ontario Ordnance Works" "nuclear track emulsion" OR "Lake Ontario Ordnance Works" "type A" OR "Lake Ontario Ordnance Works" NTA "Lake Ontario Ordnance Works" "occupational radiation exposure" "Lake Ontario Ordnance Works" occurrence "Lake Ontario Ordnance Works" "ore concentrate" "Lake Ontario Ordnance Works" "PC Project"		

Table A1-2: Database Searches for Lake Ontario Ordnance Works			
Database/Source	**Keywords**	**Hits**	**Uploaded into SRDB**
	"Lake Ontario Ordnance Works" permit OR "Lake Ontario Ordnance Works" "radiation work permit" OR "Lake Ontario Ordnance Works" "safe work permit" OR "Lake Ontario Ordnance Works" "special work permit" OR "Lake Ontario Ordnance Works" RWP OR "Lake Ontario Ordnance Works" SWP "Lake Ontario Ordnance Works" "phosphate research" "Lake Ontario Ordnance Works" photon "Lake Ontario Ordnance Works" picocurie "Lake Ontario Ordnance Works" pitchblende "Lake Ontario Ordnance Works" "pocket ion chamber" OR "Lake Ontario Ordnance Works" PIC "Lake Ontario Ordnance Works" problem "Lake Ontario Ordnance Works" procedure "Lake Ontario Ordnance Works" radeco "Lake Ontario Ordnance Works" radiation "Lake Ontario Ordnance Works" radioactive "Lake Ontario Ordnance Works" radioactivity "Lake Ontario Ordnance Works" radiograph "Lake Ontario Ordnance Works" radiological "Lake Ontario Ordnance Works" "Radiological Survey Data Sheet" OR "Lake Ontario Ordnance Works" RSDS "Lake Ontario Ordnance Works" radionuclide "Lake Ontario Ordnance Works" raffinate "Lake Ontario Ordnance Works" reactor "Lake Ontario Ordnance Works" respiratory "Lake Ontario Ordnance Works" "retention schedules" "Lake Ontario Ordnance Works" roentgen "Lake Ontario Ordnance Works" sample OR "Lake Ontario Ordnance Works" "air sample" OR "Lake Ontario Ordnance Works" "dust sample" OR "Lake Ontario Ordnance Works" "general area air sample" "Lake Ontario Ordnance Works" sampling OR "Lake Ontario Ordnance Works" "air sampling" OR "Lake Ontario Ordnance Works" "dust sampling" OR "Lake Ontario Ordnance Works" "general area air sampling"		

Table A1-2: Database Searches for Lake Ontario Ordnance Works			
Database/Source	**Keywords**	**Hits**	**Uploaded into SRDB**
	"Lake Ontario Ordnance Works" "solvent extraction" "Lake Ontario Ordnance Works" source OR "Lake Ontario Ordnance Works" "sealed source" "Lake Ontario Ordnance Works" spectra "Lake Ontario Ordnance Works" spectrograph "Lake Ontario Ordnance Works" spectroscopy "Lake Ontario Ordnance Works" spectrum "Lake Ontario Ordnance Works" standard OR "Lake Ontario Ordnance Works" "operating standard" OR "Lake Ontario Ordnance Works" "processing standard" "Lake Ontario Ordnance Works" survey "building survey" OR "Lake Ontario Ordnance Works" "routine survey" OR "Lake Ontario Ordnance Works" "special survey" "Lake Ontario Ordnance Works" "technical basis" "Lake Ontario Ordnance Works" "thermal diffusion" "Lake Ontario Ordnance Works" "thermoluminescent dosimeter" OR "Lake Ontario Ordnance Works" TLD "Lake Ontario Ordnance Works" "Tiger Team" "Lake Ontario Ordnance Works" "tolerance dose" "Lake Ontario Ordnance Works" "Uranium aluminum alloy" OR "Lake Ontario Ordnance Works" Ualx OR "Lake Ontario Ordnance Works" "Uranium aluminide" "Lake Ontario Ordnance Works" urinalysis "Lake Ontario Ordnance Works" urine "Lake Ontario Ordnance Works" "whole body count" OR "Lake Ontario Ordnance Works" WBC "Lake Ontario Ordnance Works" "working level" OR "Lake Ontario Ordnance Works" WL "Lake Ontario Ordnance Works" "X-ray" OR "Lake Ontario Ordnance Works" "X ray" OR "Lake Ontario Ordnance Works" Xray "Lake Ontario Ordnance Works" americium OR Am241 OR Am-241 OR "AM 241" OR 241Am OR 241-Am OR "241 Am" "Lake Ontario Ordnance Works" ionium OR Th230 OR Th-230 OR "Th 230" OR 230Th OR 230-Th OR "230 Th"		

Table A1-2: Database Searches for Lake Ontario Ordnance Works			
Database/Source	**Keywords**	**Hits**	**Uploaded into SRDB**
	"Lake Ontario Ordnance Works" neptunium OR Np237 OR Np-237 OR "Np 237" OR 237Np OR 237-Np OR "237 Np" "Lake Ontario Ordnance Works" polonium OR Po210 OR Po-210 OR "Po 210" OR 210Po OR 210-Po OR "210 Po" "Lake Ontario Ordnance Works" thorium OR Th232 OR Th-232 OR "Th 232" OR 232Th OR 232-Th OR "232 Th" OR "Z metal" OR myrnalloy OR "chemical 10-66" OR "chemical 10-12" OR ionium OR UX1 OR UX2 "Lake Ontario Ordnance Works" Th-230 OR Th230 OR "Th 230" OR 230-Th OR "230 Th" OR 230Th OR Th-234 OR Th234 OR "Th 234" OR 234-Th OR 234Th OR "234 Th" "Lake Ontario Ordnance Works" neptunium OR Np237 OR Np-237 OR "Np 237" OR 237Np OR 237-Np OR "237 Np" "Lake Ontario Ordnance Works" uranium OR U233 OR U-233 OR "U 233" OR 233U OR 233-U OR "233 U" OR U234 OR "U 234" OR U-234 OR 234U OR 234-U OR "234 U" OR U235 OR "U 235" OR U-235 OR 235-U "Lake Ontario Ordnance Works" 235U OR "235 U" OR U238 OR "U 238" OR U-238 OR 238-U OR 238U OR "238 U" OR U308 OR "U 308" OR U-308 OR 308-U OR 308U OR 308 U OR "uranium extraction" "Lake Ontario Ordnance Works" "black oxide" OR "brown oxide" OR "green salt" OR "orange oxide" OR "yellow cake" OR UO2 OR UO3 OR UF4 OR UF6 OR C-216 OR C-616 OR C-65 OR C-211 OR U3O8 "Lake Ontario Ordnance Works" plutonium OR Pu-238 OR Pu238 OR Pu 238 OR 238Pu OR 238-Pu OR "238 Pu" OR Pu-239 OR Pu239 OR "Pu 239" OR 239Pu OR 239-Pu OR "239 Pu" "Lake Ontario Ordnance Works" Pu-240 OR Pu240 OR "Pu 240" OR 240Pu OR 240-Pu OR "240 Pu" OR Pu-241 OR Pu241 OR "Pu 241" OR 241Pu OR 241-Pu OR "241 Pu" "Lake Ontario Ordnance Works" radium OR Ra-226 OR Ra226 OR Ra 226 OR 226-Ra OR 226Ra OR 226-Ra OR Ra-228 OR Ra228 OR Ra 228 OR 228Ra OR 228-Ra OR 228 Ra "Lake Ontario Ordnance Works" radon OR Rn-222 OR Rn222 OR Rn 222 OR 222Rn OR 222-Rn OR 222 Rn		

Table A1-2: Database Searches for Lake Ontario Ordnance Works			
Database/Source	**Keywords**	**Hits**	**Uploaded into SRDB**
	"Lake Ontario Ordnance Works" thoron OR Rn-220 OR Rn220 OR "Rn 220" OR 220Rn OR 220-Rn OR "220 Rn" "Lake Ontario Ordnance Works" protactinium OR Pa-234m OR Pa234m OR "Pa 234m" OR 234mPa OR 234m-Pa OR "234m Pa" "Lake Ontario Ordnance Works" strontium OR Sr-90 OR Sr90 OR "Sr 90" OR 90-Sr OR 90Sr OR "90 Sr" "Niagara Fall Storage Site" -NIOSH "Niagara Falls Storage Site" oralloy "Niagara Falls Storage Site" postum "Niagara Falls Storage Site" tuballoy "Niagara Falls Storage Site" "uranyl nitrate hexahydrate" OR UNH "Niagara Falls Storage Site" "K-65" "Niagara Falls Storage Site" "sump cake" "Niagara Falls Storage Site" "uranium dioxide" "Niagara Falls Storage Site" "uranium tetrafluoride" "Niagara Falls Storage Site" "uranium trioxide" "Niagara Falls Storage Site" "uranium hexafluoride" "Niagara Falls Storage Site" accident "Niagara Falls Storage Site" "air count" "Niagara Falls Storage Site" "air dust" "Niagara Falls Storage Site" "air filter" "Niagara Falls Storage Site" "airborne test" "Niagara Falls Storage Site" alpha "Niagara Falls Storage Site" "belgian congo ore" "Niagara Falls Storage Site" bioassay OR "Niagara Falls Storage Site" bio-assay "Niagara Falls Storage Site" breath OR "Niagara Falls Storage Site" "breathing zone" OR "Niagara Falls Storage Site" BZ "Niagara Falls Storage Site" calibration "Niagara Falls Storage Site" columnation "Niagara Falls Storage Site" contamination "Niagara Falls Storage Site" curie "Niagara Falls Storage Site" "denitration" OR "Niagara Falls Storage Site" "denitration pot"		

Table A1-2: Database Searches for Lake Ontario Ordnance Works			
Database/Source	**Keywords**	**Hits**	**Uploaded into SRDB**
	"Niagara Falls Storage Site" derby OR "Niagara Falls Storage Site" regulus "Niagara Falls Storage Site" dose "Niagara Falls Storage Site" dosimeter "Niagara Falls Storage Site" dosimetric "Niagara Falls Storage Site" dosimetry "Niagara Falls Storage Site" electron "Niagara Falls Storage Site" environment "Niagara Falls Storage Site" "Ether-Water Project" "Niagara Falls Storage Site" exposure OR "Niagara Falls Storage Site" "exposure investigation" OR "Niagara Falls Storage Site" "radiation exposure" "Niagara Falls Storage Site" external "Niagara Falls Storage Site" "F machine" "Niagara Falls Storage Site" fecal "Niagara Falls Storage Site" "feed material" "Niagara Falls Storage Site" femptocurie "Niagara Falls Storage Site" film "Niagara Falls Storage Site" fission "Niagara Falls Storage Site" fluoroscopy "Niagara Falls Storage Site" "Formerly Utilized Sites Remedial Action Program" OR "Niagara Falls Storage Site" FUSRAP "Niagara Falls Storage Site" gamma-ray "Niagara Falls Storage Site" "gas proportional" "Niagara Falls Storage Site" "gaseous diffusion" "Niagara Falls Storage Site" health OR "Niagara Falls Storage Site" "health instrument" OR "Niagara Falls Storage Site" "health physics" OR "Niagara Falls Storage Site" H.I. OR "Niagara Falls Storage Site" HI OR "Niagara Falls Storage Site" HP "Niagara Falls Storage Site" "highly enriched uranium" OR "Niagara Falls Storage Site" HEU "Niagara Falls Storage Site" hydrofluorination "Niagara Falls Storage Site" "in vitro" "Niagara Falls Storage Site" "in vivo"		

Table A1-2: Database Searches for Lake Ontario Ordnance Works			
Database/Source	**Keywords**	**Hits**	**Uploaded into SRDB**
	"Niagara Falls Storage Site" incident "Niagara Falls Storage Site" ingestion "Niagara Falls Storage Site" inhalation "Niagara Falls Storage Site" internal "Niagara Falls Storage Site" investigation "Niagara Falls Storage Site" isotope "Niagara Falls Storage Site" isotopic "Niagara Falls Storage Site" "isotopic enrichment" "Niagara Falls Storage Site" "JS Project" "Niagara Falls Storage Site" Landauer "Niagara Falls Storage Site" "liquid scintillation" "Niagara Falls Storage Site" log OR "Niagara Falls Storage Site" "log sheet" OR "Niagara Falls Storage Site" "log book" "Niagara Falls Storage Site" "low enriched uranium" OR "Niagara Falls Storage Site" LEU "Niagara Falls Storage Site" "maximum permissible concentration" OR "Niagara Falls Storage Site" MPC "Niagara Falls Storage Site" metallurgy "Niagara Falls Storage Site" microcurie "Niagara Falls Storage Site" millicurie "Niagara Falls Storage Site" "mixed fission product" OR "Niagara Falls Storage Site" MFP "Niagara Falls Storage Site" monitor OR "Niagara Falls Storage Site" "air monitoring" "Niagara Falls Storage Site" nanocurie "Niagara Falls Storage Site" "nasal wipe" "Niagara Falls Storage Site" neutron "Niagara Falls Storage Site" "nose wipe" "Niagara Falls Storage Site" nuclear OR "Niagara Falls Storage Site" "Chicago-Nuclear" OR "Niagara Falls Storage Site" "nuclear fuels" "Niagara Falls Storage Site" "nuclear track emulsion" OR "Niagara Falls Storage Site" "type A" OR "Niagara Falls Storage Site" NTA "Niagara Falls Storage Site" "occupational radiation exposure" "Niagara Falls Storage Site" occurrence		

Table A1-2: Database Searches for Lake Ontario Ordnance Works			
Database/Source	**Keywords**	**Hits**	**Uploaded into SRDB**
	"Niagara Falls Storage Site" "ore concentrate" "Niagara Falls Storage Site" "PC Project" "Niagara Falls Storage Site" permit OR "Niagara Falls Storage Site" "radiation work permit" OR "Niagara Falls Storage Site" "safe work permit" OR "Niagara Falls Storage Site" "special work permit" OR "Niagara Falls Storage Site" RWP OR "Niagara Falls Storage Site" SWP "Niagara Falls Storage Site" "phosphate research" "Niagara Falls Storage Site" photon "Niagara Falls Storage Site" picocurie "Niagara Falls Storage Site" pitchblende "Niagara Falls Storage Site" "pocket ion chamber" OR "Niagara Falls Storage Site" PIC "Niagara Falls Storage Site" problem "Niagara Falls Storage Site" procedure "Niagara Falls Storage Site" radeco "Niagara Falls Storage Site" radiation "Niagara Falls Storage Site" radioactive "Niagara Falls Storage Site" radioactivity "Niagara Falls Storage Site" radiograph "Niagara Falls Storage Site" radiological "Niagara Falls Storage Site" "Radiological Survey Data Sheet" OR "Niagara Falls Storage Site" RSDS "Niagara Falls Storage Site" radionuclide "Niagara Falls Storage Site" raffinate "Niagara Falls Storage Site" reactor "Niagara Falls Storage Site" respiratory "Niagara Falls Storage Site" "retention schedules" "Niagara Falls Storage Site" roentgen "Niagara Falls Storage Site" sample OR "Niagara Falls Storage Site" "air sample" OR "Niagara Falls Storage Site" "dust sample" OR "Niagara Falls Storage Site" "general area air sample"		

Table A1-2: Database Searches for Lake Ontario Ordnance Works			
Database/Source	**Keywords**	**Hits**	**Uploaded into SRDB**
	"Niagara Falls Storage Site" sampling OR "Niagara Falls Storage Site" "air sampling" OR "Niagara Falls Storage Site" "dust sampling" OR "Niagara Falls Storage Site" "general area air sampling" "Niagara Falls Storage Site" "solvent extraction" "Niagara Falls Storage Site" source OR "Niagara Falls Storage Site" "sealed source" "Niagara Falls Storage Site" spectra "Niagara Falls Storage Site" spectrograph "Niagara Falls Storage Site" spectroscopy "Niagara Falls Storage Site" spectrum "Niagara Falls Storage Site" standard OR "Niagara Falls Storage Site" "operating standard" OR "Niagara Falls Storage Site" "processing standard" "Niagara Falls Storage Site" survey "building survey" OR "Niagara Falls Storage Site" "routine survey" OR "Niagara Falls Storage Site" "special survey" "Niagara Falls Storage Site" "technical basis" "Niagara Falls Storage Site" "thermal diffusion" "Niagara Falls Storage Site" "thermoluminescent dosimeter" OR "Niagara Falls Storage Site" TLD "Niagara Falls Storage Site" "Tiger Team" "Niagara Falls Storage Site" "tolerance dose" "Niagara Falls Storage Site" urinalysis "Niagara Falls Storage Site" urine "Niagara Falls Storage Site" "whole body count" OR "Niagara Falls Storage Site" WBC "Niagara Falls Storage Site" "working level" OR "Niagara Falls Storage Site" WL "Niagara Falls Storage Site" "X-ray" OR "Niagara Falls Storage Site" "X ray" OR "Niagara Falls Storage Site" Xray "Niagara Falls Storage Site" americium OR Am241 OR Am-241 OR "AM 241" OR 241Am OR 241-Am OR "241 Am" "Niagara Falls Storage Site" ionium OR Th230 OR Th-230 OR "Th 230" OR 230Th OR 230-Th OR "230 Th"		

Table A1-2: Database Searches for Lake Ontario Ordnance Works			
Database/Source	**Keywords**	**Hits**	**Uploaded into SRDB**
	"Niagara Falls Storage Site" neptunium OR Np237 OR Np-237 OR "Np 237" OR 237Np OR 237-Np OR "237 Np" "Niagara Falls Storage Site" polonium OR Po210 OR Po-210 OR "Po 210" OR 210Po OR 210-Po OR "210 Po" "Niagara Falls Storage Site" thorium OR Th232 OR Th-232 OR "Th 232" OR 232Th OR 232-Th OR "232 Th" OR "Z metal" OR myrnalloy OR "chemical 10-66" OR "chemical 10-12" OR ionium OR UX1 OR UX2 "Niagara Falls Storage Site" Th-230 OR Th230 OR "Th 230" OR 230-Th OR "230 Th" OR 230Th OR Th-234 OR Th234 OR "Th 234" OR 234-Th OR 234Th OR "234 Th" "Niagara Falls Storage Site" neptunium OR Np237 OR Np-237 OR "Np 237" OR 237Np OR 237-Np OR "237 Np" "Niagara Falls Storage Site" uranium OR U233 OR U-233 OR "U 233" OR 233U OR 233-U OR "233 U" OR U234 OR "U 234" OR U-234 OR 234U OR 234-U OR "234 U" OR U235 OR "U 235" OR U-235 OR 235-U "Niagara Falls Storage Site" 235U OR "235 U" OR U238 OR "U 238" OR U-238 OR 238-U OR 238U OR "238 U" OR U308 OR "U 308" OR U-308 OR 308-U OR 308U OR 308 U OR "uranium extraction" "Niagara Falls Storage Site" "black oxide" OR "brown oxide" OR "green salt" OR "orange oxide" OR "yellow cake" OR UO2 OR UO3 OR UF4 OR UF6 OR C-216 OR C-616 OR C-65 OR C-211 OR U3O8 "Niagara Falls Storage Site" plutonium OR Pu-238 OR Pu238 OR Pu 238 OR 238Pu OR 238-Pu OR "238 Pu" OR Pu-239 OR Pu239 OR "Pu 239" OR 239Pu OR 239-Pu OR "239 Pu" "Niagara Falls Storage Site" Pu-240 OR Pu240 OR "Pu 240" OR 240Pu OR 240-Pu OR "240 Pu" OR Pu-241 OR Pu241 OR "Pu 241" OR 241Pu OR 241-Pu OR "241 Pu" "Niagara Falls Storage Site" radium OR Ra-226 OR Ra226 OR Ra 226 OR 226-Ra OR 226Ra OR 226-Ra OR Ra-228 OR Ra228 OR Ra 228 OR 228Ra OR 228-Ra OR 228 Ra "Niagara Falls Storage Site" radon OR Rn-222 OR Rn222 OR Rn 222 OR 222Rn OR 222-Rn OR 222 Rn		

Table A1-2: Database Searches for Lake Ontario Ordnance Works			
Database/Source	**Keywords**	**Hits**	**Uploaded into SRDB**
	"Niagara Falls Storage Site" thoron OR Rn-220 OR Rn220 OR "Rn 220" OR 220Rn OR 220-Rn OR "220 Rn" "Niagara Falls Storage Site" protactinium OR Pa-234m OR Pa234m OR "Pa 234m" OR 234mPa OR 234m-Pa OR "234m Pa" "Niagara Falls Storage Site" strontium OR Sr-90 OR Sr90 OR "Sr 90" OR 90-Sr OR 90Sr OR "90 Sr" "Hooker Electrochemical" "Lake Ontario Ordnance" "Hooker Electrochemical" "Niagara Falls Storage Site" "Page Airways" "Lake Ontario Ordnance" "Page Airways" "Niagara Falls Storage Site" "Nuclear Materials and Equipment Company" "Lake Ontario Ordnance" "Nuclear Materials and Equipment Company" "Niagara Falls Storage Site" "National Lead Company of Ohio" "Lake Ontario Ordnance" "National Lead Company of Ohio" "Niagara Falls Storage Site" "Bechtel National" "Lake Ontario Ordnance" "Bechtel National" "Niagara Falls Storage Site" NFSS -"Niagara Falls Storage Site" radiation LOOW - "Lake Ontario Ordnance Works" radiation		

Table A1-3: OSTI Documents Ordered for Lake Ontario Ordnance Works			
Document Number	**Document Title**	**Requested Data**	**Date Received**
EGG-1183-1554 OSTI ID: 4567879 SRDB: 53189	Radiological Survey of the Lake Ontario Ordnance Works and Vicinity in June 1972. Technical Report No. L-1076.	11/09/2007	11/03/2008
DOE/OR/20722-86 OSTI ID: 6999727 SRDB: 51179	Environmental monitoring plan for the Niagara Falls Storage Site and the Interim Waste Containment Facility	11/09/2007	08/28/2008
DOE/OR/21949-289 OSTI ID: 5295809 SRDB: 51177	Niagara Falls storage site annual environmental report for calendar year 1990, Lewiston, New York	11/09/2007	08/28/2008
DOE/OR/21949-343 OSTI ID: 6936959 SRDB: 43593	Niagara Falls Storage Site annual environmental report for calendar year 1991, Lewiston, New York	11/09/2007	08/28/2008
DOE/OR/20722-21 OSTI ID: 5778790 SRDB: 51178	Design Report for the Interim Waste Containment Facility at the Niagara Falls Storage Site	11/09/2007	08/28/2008
DOE/OR/20722-197 OSTI ID: 5208766 SRDB: 43591	Niagara Falls Storage Site, Lewiston, New York: Annual site environmental report, Calendar year 1987: Formerly Utilized Sites Remedial Action Program (FUSRAP)	11/09/2007	07/09/2008
DOE/OR/20722-71 OSTI ID: 5153095 SRDB: 51175	Report on the performance monitoring system for the interim waste containment at the Niagara Falls Storage Site, Lewiston, New York	11/09/2007	07/09/2008
DOE/OR/20722-1 OSTI ID: 5451204 SRDB: 45392	Engineering evaluation of alternatives for the disposition of Niagara Falls Storage Site, its residues and wastes	11/09/2007	06/23/2008
DOE/OR/20722-8 OSTI ID: 6716374 SRDB: 43583	Niagara Falls Storage Site, Lewiston, New York: geologic report	11/09/2007	06/23/2008
DOE/OR/20722-208 OSTI ID: 6121400 SRDB: 45264	Performance monitoring report for the Niagara Falls Storage Site Waste Containment Structure, Lewiston, New York: Calendar year 1987 and January--June of 1988	11/09/2007	06/17/2008
DOE/OR/20722-219 OSTI ID: 6302162 SRDB: 44864	Niagara falls storage site: Annual site environmental report, Lewiston, New York, Calendar Year 1988: Surplus Facilities Management Program (SFMP)	11/09/2007	05/27/2008
DOE/OR/20722-150 OSTI ID: 6774453 SRDB: 44861	Niagara Falls Storage Site, Annual site environmental report, Lewiston, New York, Calendar year 1986: Surplus Facilities Management Program (SFMP)	11/09/2007	05/27/2008
DOE/OR/20722-18 OSTI ID: 6750496	Niagara Falls Storage Site environmental monitoring report. Calendar year 1983	11/09/2007	05/23/2008

Table A1-3: OSTI Documents Ordered for Lake Ontario Ordnance Works			
Document Number	**Document Title**	**Requested Data**	**Date Received**
SRDB: 43445			
ARMS-72.6.1 OSTI ID: 4458532 SRDB: 44434	Aerial radiological measuring survey of the Lake Ontario Ordnance Works and vicinity in June 1972	11/09/2007	05/19/2008
CONF-841187-28 OSTI ID: 6259907 SRDB: 44442	Assessment of alternatives for long-term management of uranium ore residues and contaminated soils located at DOE`s Niagara Falls Storage Site	11/09/2007	05/19/2008
ANL/EES-TM-377 OSTI ID: 5729472 SRDB: 44435	Determination of ecologically vital groundwater at selected sites in the Formerly Utilized Sites Remedial Action Program	11/09/2007	05/19/2008
CONF-9006270-1 OSTI ID: 6625771 SRDB: 44444	Environmental impact assessment for a radioactive waste facility: A case study	11/09/2007	05/19/2008
CONF-850242-2 OSTI ID: 6136026 SRDB: 44440	Ocean disposal option for bulk wastes containing naturally occurring radionuclides: an assessment case history	11/09/2007	05/19/2008
ORNL-6083 OSTI ID: 6417453	Geochemical information for sites contaminated with low-level radioactive wastes: I. Niagara Falls Storage Site	11/09/2007	01/16/2008 - Not Selected
CONF-891053-5 OSTI ID: 5384815	Effectiveness of interim remedial actions at a radioactive waste facility	11/09/2007	N/A - OSTI does not have this