

## SEC Petition Evaluation Report Petition SEC-00124

Report Rev #: 0

Report Submittal Date: 08/13/2008

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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-00124	83.14	August 1, 2008	Connecticut Aircraft Nuclear Engine Laboratory (CANEL)

NIOSH-Proposed Class Definition
The NIOSH-proposed class includes all employees of DOE, its predecessor agencies, and DOE contractors or subcontractors who worked at the Connecticut Aircraft Nuclear Engine Laboratory in Middletown, Connecticut, from January 1, 1958 through December 31, 1965, 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 SEC.

Related Petition Summary Information			
SEC Petition Tracking #(s)	Petition Type	DOE/AWE Facility Name	Petition Status
NONE			

Related Evaluation Report Information	
Report Title	DOE/AWE Facility Name

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## **Evaluation Report Summary: SEC-00124, CANEL**

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 the Connecticut Aircraft Nuclear Engine Laboratory in Middletown, Connecticut, from January 1, 1958 to December 31, 1965, 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

Per EEOICPA and 42 C.F.R. § 83.14(b), NIOSH has established that it does not have sufficient information to complete dose reconstructions for individual members of the class with sufficient accuracy. NIOSH lacks sufficient dosimetry data, workplace monitoring data, and source term data, making reconstruction of total internal and external doses infeasible.

### 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, plutonium, fission and metal activation products 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 SEC.

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## SEC Petition Evaluation Report for SEC-00124

*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 Mahathy, Oak Ridge Associated Universities. 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 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.<sup>1</sup>

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

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<sup>1</sup> 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>.

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 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.<sup>2</sup>

### **3.0 NIOSH-Proposed Class Definition and Petition Basis**

The NIOSH-proposed class includes all employees of DOE, its predecessor agencies, and DOE contractors or subcontractors who worked at the Connecticut Aircraft Nuclear Engine Laboratory in Middletown, Connecticut, from January 1, 1958 through December 31, 1965, 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 SEC. During this period, employees at this facility were involved with design, development, and testing of nuclear engines for aircraft and research activities using radiological materials.

The evaluation responds to Petition SEC-00124 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 an analytical chemist and corrosion chemist from 1958 through 1977. 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 the Connecticut Aircraft Nuclear Engine Laboratory (CANEL) from January 1, 1958 through December 31, 1965 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**

CANEL staff worked from 1958 through 1961 on an Atomic Energy Commission (AEC) program to develop a nuclear reactor for propelling aircraft. The CANEL site, approximately five miles south of Middletown, Connecticut, was chosen in part because of its proximity to Pratt & Whitney Aircraft (PWAC) in East Hartford, Connecticut. The CANEL facility conducted research and development of indirect cycle technology that relied on steam generated by a nuclear reactor as a power source. The program focused on developing high-temperature materials and reactor technology for application to

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<sup>2</sup> 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>.

high-performance systems used in military aircraft. The indirect cycle consisted of a primary heat transfer fluid circuit that carried heat from the reactor to a heat exchanger or radiator where the heat was transferred to the air going through the engine. Pratt & Whitney eventually produced a mock-up of the physical concept but an actual power-producing reactor was never built. The mock-up involved testing at CANEL using an actual reactor (built at Oak Ridge National Laboratory) using fissionable material operating at zero power. Because no power was produced, no heat removal system was necessary and little or no shielding was installed (Giguere-Davis, 1980). In 1961, the federal government canceled all efforts to develop nuclear-powered aircraft (Giguere-Davis, 1980).

Starting in 1962, CANEL assisted the AEC in design and development of the SNAP-50, a lightweight nuclear power reactor designed to operate in space. This effort used technology acquired in the indirect cycle technology work. CANEL's primary objective with SNAP-50 was the further development of heat dissipation in the reactor using lithium as a coolant. The use of lithium required CANEL to develop and test alloys for tubes, pumps, and valves to contain and move the coolant (Space, 1962). While there is no evidence that CANEL built a SNAP-50 reactor, CANEL did perform bench-scale experiments using critical assemblies in a hot-cell facility (PWAC-474).

From 1961 through 1965, CANEL operated the CANEL Fuels program for the AEC. This program was also known as the Critical Assembly Fuel Element Exchange (CAFEE) fuel storage facility (Shaw, 1965). One of the specific tasks performed during the CAFEE program was the Medium Power Reactor Program in which CANEL was tasked to fabricate components (Garnett, 1965a). In addition, CANEL performed research and development in the following areas: high-temperature nuclear fuel elements, liquid metal components, high-temperature compatibility of liquid metal coolants in other materials, and experimentation in detection of fission particles and neutrons (PWAC-378; PWAC-393; PWAC-397; PWAC-424). AEC operations were terminated at the CANEL site in 1965 (NUREG-1444). After the CANEL site was sold to United Aircraft, commercial non-AEC operations were conducted from 1967 through 1971 using AEC byproduct licenses (NUREG-1444). These operations are not covered under EEOICPA.

Documents available to NIOSH provide general process descriptions of the nuclear propulsion work and the radioactive materials remaining from the CANEL Fuels program. The radionuclides of concern during the nuclear propulsion work were depleted and enriched uranium, plutonium, metal activation products, and mixed fission products. The site also had several fission product sources used for calibration and radiography. Radionuclides of concern during the CANEL Fuels program included depleted uranium (Corley, 1962), and enriched uranium up to 65% (Fader, 1964; ORNL, 1960). The use of U-233 is suggested by a CANEL materials forecast for 1961 (CNLM-2438). Activation and fission products resulted from SNAP-50 activities. Two such activities that potentially resulted in small sources of activation and fission product exposures are discussed in PWAC-453 and PWAC-474; however, NIOSH does not have documentation that locates these tasks in particular buildings. CANEL documents discuss work with irradiated materials being done in hot cells, venting of fission products during post-irradiation experiments, and the storage and shipment of radioactive wastes and materials (capsules, powders, and metals).

Some of the CANEL inventory of enriched uranium was transferred to General Atomics in July 1964 (Fader, 1964). Additional enriched uranium, equipment, and fuel capsules formerly used in the SNAP-50 program were shipped to Atomics International, Lawrence Livermore National Laboratory, and Oak Ridge National Laboratory from September through November 1965 (Harms, 1965; Weinberg, 1965). Additional contaminated equipment was removed from CANEL by the AEC from

November 1965 through July 1966; the site was transferred to Pratt & Whitney in September 1966 (Glauberman, 1966). Prior to the site transfer, all areas were decontaminated to AEC levels for unconditional release except for Buildings 150 (Fuel Elements Laboratory) and 450 (Hot Laboratory), particularly the hot cells in those areas (Glauberman, 1966). However, Pratt & Whitney assumed responsibility for these buildings and used them for commercial applications under AEC byproduct licenses.

## **4.2 Radiation Exposure Potential from Operations**

The potential for external radiation dose existed at CANEL. Based on the site operations outlined in Section 4.1, sources of exposure included electrons, photons, and neutrons emitted during nuclear interactions or from decay products of, U-235, U-238, Pu-239, metal activation products, and mixed fission products. CANEL personnel handled uranium (natural, enriched, and depleted) and plutonium during the indirect cycle technology work. Workers were potentially exposed to external radiation of varying types and energies, and to surface and airborne contamination resulting from spillage, venting, or loss of containment of radioactive materials. Workers were also potentially exposed to small levels of neutrons resulting from tests of the critical assemblies. CANEL had several fission product sources used for calibration and radiography. These sources, which included Co-60 and Ir-192, would have been a source of external electron and photon radiation.

The primary sources of internal radiation exposure at the site were the potential release of airborne uranium and plutonium and the spread and re-suspension of these contaminants. Radiation surveys performed in 1966 measured surface contamination (Glauberman, 1966). Forms of uranium used at CANEL included uranium metal, uranium dioxide, uranium nitride, uranium carbide, and uranyl nitrate, some of which was formed during fuel assembly testing (Corley, 1962; Harms, 1965). NIOSH has no information regarding the chemical forms or solubility characteristics of the plutonium and fission and activation products encountered at CANEL. NIOSH does not have documentation to determine the total concentrations of uranium, plutonium materials, fission and metal activation products used or generated from 1958 through 1965, although a total activity amount of 500,000 curies is given for all radioactive materials (NUREG-1444). NIOSH has found documents presenting activity forecasts for enriched U-233, U-235, U-238, and plutonium for some of the operational years; however, NIOSH cannot assume that the amounts actually placed into inventory corresponded to the forecasts.

## **4.3 Time Period Associated with Radiological Operations**

Per the DOE Office of Health, Safety and Security, the DOE operational period was from 1958 through 1965 (DOE, 2001).

## **4.4 Site Locations Associated with Radiological Operations**

The CANEL facility covered about 1,100 acres. It had its own security force, fire department, sewage treatment plant, power generator, and water supply. Work with radioactive materials was conducted in 22 of the 34 buildings on site, including Buildings 140 (Nuclear Materials Research and Development Laboratory), 150 (Fuel Elements Laboratory), 440 (Nuclear Physics Laboratory) and 450 (Hot Laboratory). Radioactive materials and waste were also stored in other areas of the site, though these buildings and locations have not been documented by building number.

The potential for radiation dose existed in all locations at CANEL where radioactive materials were handled, used, transported, disposed, or stored. While NIOSH does have documentation indicating buildings where radioactive materials were known to have been used, NIOSH has no documentation to confirm that all radioactive materials were restricted to such areas or that contamination was adequately controlled. As a result, NIOSH must assume that the potential for exposure to radioactive materials existed in all CANEL buildings and areas.

#### **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 CANEL focused on the Nuclear Regulatory Commission (ADAMS electronic records repository), the DOE (OpenNet repository; Office of Scientific and Technical Information [OSTI], and the Oak Ridge Operations office), United Technologies, and the National Archives record centers. NIOSH found some documents detailing CANEL history, operations, and some very limited personnel monitoring data. Attachment One contains a summary of CANEL

documents. The summary specifically identifies specific data capture details for each document retrieved.

NIOSH examined DOE records for the 25 CANEL claimants in the NIOSH OCAS Claims Tracking System (NOCTS). No external or internal monitoring data have been provided by DOE for any of these claimants.

## 5.2 Internal Personnel Monitoring Data

NIOSH has obtained uranium urinalysis results for 20 CANEL workers (AEC, 1958). These results represent analysis for total uranium with result values of 0.000 mg/l with no reported error or minimum detectable activity provided. All samples were collected on February 4, 1958. None of these 20 urinalysis results represent data for any of the present 25 CANEL EEOICPA claimants.

NIOSH has obtained an AEC annual summary for 1961 that shows CANEL had no workers with measured body depositions of U-238 or fission products in 1960 (AEC, 1961a). However, that summary report did not provide the number of workers who were monitored or information on monitoring and analytical methodologies. NIOSH has found such data only for the year 1960.

## 5.3 External Personnel Monitoring Data

NIOSH has not identified any personnel external monitoring data for CANEL workers. NIOSH has identified some film badge data for Pratt & Whitney workers, but the monitoring was performed at Lawrence Livermore National Laboratory in 1956 and 1957 (LLNL, 1957) and does not correspond to CANEL work.

NIOSH has obtained AEC annual summaries of whole-body exposure from external penetrating radiation for CANEL workers, as shown in Table 5-1.

<b>Table 5-1: AEC Annual Whole-Body Exposure Results</b>					
<b>Year (Reference)</b>	<b>Unmonitored Workers</b>	<b>Monitored Workers</b>	<b>Number of Workers with Specified Results</b>		
			<b>0 to 1 rem</b>	<b>1 to 2 rem</b>	<b>2 to 3 rem</b>
1960 (AEC, 1961b)	2132	258	237	15	6
1961 (AEC, 1962)	1107	235	220	14	1
1962 (AEC, 1963)	1411	197	192	5	0
1964 (AEC, 1965)	1041	152	143	8	1
1965 (AEC, 1966)	1041	132	126	6	0

NIOSH has obtained no data associated with any occupationally-required medical X-ray examinations for CANEL claimants or workers.

## 5.4 Workplace Monitoring Data

NIOSH has not identified any workplace surface monitoring or air monitoring results for the DOE operations period. NIOSH has obtained surface contamination (gross alpha) and air concentration data (gross alpha) for Buildings 140 and 150 from a 1966 close-out survey conducted at CANEL (Glauberman, 1966). Around 850 smear samples were collected on floors, walls, and surfaces of equipment during the pre-, intermediate, and post-equipment removal operations. Results of the final instrument and smear survey performed in May 1966 indicate that the highest removable surface concentration in a specific area was 7.7 alpha dpm/100cm<sup>2</sup> (disintegrations per minute per 100 square centimeters); the permissible level was 100 dpm/100cm<sup>2</sup>. The maximum fixed contamination level was 600 alpha dpm/100cm<sup>2</sup>; the permissible level was 2000 dpm/100cm<sup>2</sup>.

Results of air samples obtained during the disassembly and removal of contaminated equipment at various locations and times ranged from no detectable activity to 10.7 alpha dpm/m<sup>3</sup> (dpm per cubic meter) and had a composite average of approximately 2.2 dpm/100cm<sup>3</sup>; (dpm per 100 cubic centimeters); the maximum permissible concentration was 220 dpm/100cm<sup>3</sup> for enriched uranium. The highest air sample concentrations, obtained during the removal of two fume hoods in Room 81 of Building 140, were reported to have resulted in an average air concentration of 84 dpm/100cm<sup>3</sup>. Air samples taken 24 hours after the hood removal had been completed showed that the average air concentration had decreased to 4.8 dpm/100cm<sup>3</sup>.

## 5.5 Radiological Source Term Data

NIOSH has identified documentation describing and quantifying some of the CANEL source term. Records show that CANEL received depleted and enriched uranium from Oak Ridge National Laboratory (ORNL) in 1962 (Shaw, 1965), shipped enriched uranium (65%) to General Atomics in 1964 (Fader, 1964), and shipped depleted and enriched uranium to Lawrence Livermore National Laboratory, Atomics International, General Atomics, and ORNL in 1965 (Cope, 1965; Garnett, 1965b; Shaw, 1965; Weinberg, 1965). NIOSH has information on the quantities and forms of uranium shipped in 1965. However, NIOSH does not have information detailing the receipts of shipments of other radioactive materials. Forms of uranium materials used at CANEL included uranium metal, uranium dioxide, uranium nitride, uranium carbide, and uranyl nitrate (Corley, 1962; Harms, 1965).

Fission products and metal activation products were generated in CANEL processes (PWAC-453; PWAC-474). NIOSH does not have information to characterize the chemical or physical forms of the radionuclides produced, or to determine the activity levels present during AEC operations.

## 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 obtained a total of only 20 uranium bioassay results, all of which were for monitoring performed in February 1958. These bioassay results are insufficient to reconstruct dose because all 20 results were reported as 0.000 mg/l with no assessment of uncertainty; furthermore, all the results represent samples collected on the same day. NIOSH also lacks information on the CANEL locations where the sampled employees worked and whether the sampled workers represented a cross-section of potentially-exposed personnel. NIOSH has not obtained breathing zone or general air monitoring results for the CANEL operational period.

As stated in Section 5.4, NIOSH has obtained limited workplace monitoring results in the form of surface contamination and air concentration data for Buildings 140 and 150 from a 1966 close-out survey (Glauberman, 1966). The available data apply to operations after 1965 and therefore cannot be used to bound potential radiation doses during the DOE period. NIOSH lacks isotopic assumptions, total activity quantities of uranium, data on uranium enrichments, and information on chemical and

physical forms for uranium handled during the DOE period. NIOSH has obtained no workplace monitoring results for the covered DOE operations period at CANEL.

Indications are that CANEL operations involved handling of depleted and enriched uranium, U-233, plutonium, metal activation products, and mixed fission products. While NIOSH has obtained limited documentation on amounts and forms of uranium transferred to other sites, NIOSH cannot verify the completeness of available documentation; nor can NIOSH assume that the final forms reported in the transfer documents represent the chemical and physical forms that were handled during CANEL processing. NIOSH lacks documentation to accurately define the source term for uranium, plutonium, metal activation and mixed fission products during the covered DOE operations period at CANEL.

NIOSH does not have access to sufficient personnel monitoring, workplace monitoring, or source term data to bound potential internal exposures to uranium, plutonium, or to metal activation and mixed fission products during the period of DOE operations. Consequently, NIOSH finds that it is not feasible to estimate, with sufficient accuracy, the total internal dose for the class of employees covered by this evaluation.

## **6.2 Feasibility of Estimating External Exposures**

This evaluation responds to a petition based on NIOSH determining that internal radiation exposures to uranium, plutonium, and metal activation and mixed 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.

Based on the evaluation conducted for this report, NIOSH does not consider it feasible to estimate potential external exposures to uranium, plutonium, metal activation products, or mixed fission products during the period of DOE operations. Although NIOSH has some annual summaries of whole-body exposure data, NIOSH does not have access to any individual monitoring data, nor is there sufficient information on site radiological monitoring practices and source terms to be able to use the summary information to bound external exposures from all sources and radiation types. However, adequate reconstruction of medical dose for CANEL workers is likely to be feasible by using claimant-favorable assumptions, as well as the applicable protocols in the complex-wide Technical Information Bulletin *Dose Reconstruction from Occupationally Related Diagnostic X-Ray Procedures* (ORAUT-OTIB-0006).

## **6.3 Class Parameters Associated with Infeasibility**

NIOSH has insufficient information to identify specific start or end dates for radiological operations within the covered period at CANEL. NIOSH therefore recommends that the class definition include the entire DOE-covered period of January 1, 1958 through December 31, 1965.

As discussed in Section 4.4, NIOSH has no documentation to demonstrate that radioactive materials were restricted to specific areas or that contamination was adequately controlled. NIOSH therefore assumes that the potential for exposure to radioactive materials existed in all CANEL buildings and

areas. NIOSH recommends that the class definition include all CANEL buildings and areas 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 proposed SEC class based on worker job descriptions. NIOSH therefore recommends that the class definition include all employees of DOE, its predecessor agencies, and DOE contractors or subcontractors.

## **7.0 Summary of Feasibility Findings for Petition SEC-00124**

This report evaluates the feasibility for completing dose reconstructions for employees at the Connecticut Aircraft Nuclear Engine Laboratory from January 1, 1958 through December 31, 1965. NIOSH determined that members of this class may have received internal and external radiation exposures. NIOSH lacks sufficient information, which includes specific biological monitoring data, sufficient air monitoring information, and sufficient process and radiological source information, that would allow it to estimate the potential internal and external exposures to uranium, plutonium, metal activation products and mixed fission products to which the proposed class may have been subjected. However, adequate reconstruction of medical dose for CANEL workers is likely 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.

## **8.0 Evaluation of Health Endangerment for Petition SEC-00124**

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-00124**

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 DOE contractors or subcontractors who worked at the Connecticut Aircraft Nuclear Engine Laboratory in Middletown, Connecticut, from January 1, 1958 through December 31, 1965, 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 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 the CANEL site 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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PWAC-378, *The Thermal Decomposition of Uranium Monocarbide*, Pratt & Whitney; January 15, 1962; SRDB Ref ID: 32568

PWAC-393, *The Determination of Uranium Isotope Abundances and Reactor Fuel Burnup by Mass Spectrometry*, Pratt & Whitney; April 17, 1963; SRDB Ref ID: 32569

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AEC, 1965, *Summary of Whole Body Radiation Exposures to External Penetrating Radiation Accumulated During the Year*, New York Operations Office, Atomic Energy Commission; 1965; SRDB Ref ID: 14442, pdf pp. 62

AEC, 1966, *Summary of Whole Body Radiation Exposures to External Penetrating Radiation Accumulated During the Year*, New York Operations Office, Atomic Energy Commission; 1965; SRDB Ref ID: 13797, pdf pp. 66

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Garnett, 1965b, Memorandum, Disposition of the CANEL Fuels Program, R. R. Garnett, CANEL Project Office; Atomic Energy Commission; August 16, 1965; SRDB Ref ID: 31549, pdf pp. 28 and 29

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- LLNL, 1957, *Radiation Over-exposures of Pratt & Whitney Personnel*, Lawrence Livermore National Laboratory; 1957; SRDB Ref ID: 36118
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## Attachment 1: Data Capture Matrices for CANEL

**Table A1-1: SUMMARY OF SRDB HOLDINGS RELATED TO CANEL**

Data Capture Information	General Description of Documents Captured	Date Completed	Uploaded
Primary Site/Company Name: Connecticut Aircraft Nuclear Engine Laboratory (CANEL)1958-1965  Other Site Names: Pratt & Whitney Corp.	E-mail correspondence including a summary report of the ANP project history.	05/14/2007	2
State Contacted: Connecticut Division of Radiation, Department of Environmental Protection.	Connecticut, as a non-agreement state, does not have monitoring or inspection records for licensed facilities.	03/13/2007	0
Comprehensive Epidemiologic Data Resource (CEDR)	No relevant documents identified.	04/15/2008	0
DOE Hanford Declassified Document Retrieval System (DDRS)	No relevant documents identified.	04/14/2008	0
DOE Legacy Management Considered Sites	Removal of contaminated equipment and final post-decon survey.	05/18/2007	1
DOE Legacy Management - MoundView (Fernald Holdings, includes Fernald Legal Database)	Proceedings of the ninth annual conference on bio assay and analytical chemistry, October 10 and 11, 1963.	02/07/2007	1
DOE OpenNet	No relevant documents identified.	04/12/2008	0
DOE OSTI Energy Citations	Environmental data and hazards summaries.	04/12/2008	5
DOE OSTI Information Bridge	Bibliography of CANEL reports, NRC decommissioning overview of CANEL, and effects of neutron irradiation on columbium base alloys.	04/10/2008	2
General Atomics	Nuclear materials transfer reports.	11/02/2005	1
Google	General information, NRC inspection, a news story regarding perception of delayed claim settlement, and an individual's resume.	07/22/2008	7
Lawrence Livermore National Laboratory (LLNL)	Radiation overexposures of Pratt & Whitney personnel.	05/17/2007	1
NARA Atlanta	Material transfers, process information, equipment transfers, outline and status report on ORNL-ANP program, and a summary of data presented by Pratt & Whitney Aircraft at the ANPO materials meeting in Germantown, Maryland.	05/21/2008	12
National Academies Press (NAP)	No relevant documents identified.	05/09/2008	0

**Table A1-1: SUMMARY OF SRDB HOLDINGS RELATED TO CANEL**

<b>Data Capture Information</b>	<b>General Description of Documents Captured</b>	<b>Date Completed</b>	<b>Uploaded</b>
National Nuclear Security Administration (NNSA) - Nevada Site Office	No relevant documents identified.	04/18/2008	0
NRC Agencywide Document Access and Management System (ADAMS)	Communications concerning radiation exposure, licensing documents, inspections, and responses to FOIA requests.	04/15/2008	9
ORAU	Data completion verification and project spreadsheet.	05/18/2008	2
OSTI	NRC's decommissioning overview of CANEL, bibliography of CANEL reports, recoverable scrap at station SYL to be shipped to station CYT, forecast of nuclear materials requirements, progress reports of hot laboratory operations, and a CANEL material specification.	06/12/2008	38
U.S. NRC	FOIA requests.	10/09/2007	2
Washington State University (U.S. Transuranium and Uranium Registries)	No relevant documents identified.	04/15/2008	0
Washington University Libraries - St. Louis	Research reports from the Atomic Energy technical report PWAC series.	04/25/2007	10
Unknown (typical explanation: part of the original OCAS download when the SRDB was set up)	Bioassay results, accident reports, general information, and a license renewal.	10/09/2007	11
<b>TOTAL</b>			<b>104</b>

**Table A1-2: INTERNET DATABASE SEARCHES RELATED TO CANEL**

<b>Database / Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
DOE Legacy Management Considered Sites <a href="http://csd.lm.doe.gov/">http://csd.lm.doe.gov/</a>	N/A	4	1
COMPLETED 05/18/2007 DOE OSTI Information Bridge <a href="http://www.osti.gov/bridge/advancedsearch.jsp">http://www.osti.gov/bridge/advancedsearch.jsp</a> COMPLETED 04/10/2008	"connecticut aircraft nuclear engine laboratory" "United Aircraft Corp" "connecticut advanced nuclear engineering laboratory"	336	2

Table A1-2: INTERNET DATABASE SEARCHES RELATED TO CANEL

Database / Source	Keywords / Phrases	Hits	Uploaded
	"pratt and whitney" "canel"		
DOE OpenNet <a href="http://www.osti.gov/opennet/advancedsearch.jsp">http://www.osti.gov/opennet/advancedsearch.jsp</a> COMPLETED 04/12/2008	"connecticut aircraft nuclear" "connecticut advanced nuclear" "pratt and whitney" "united aircraft corp" "canel"	246	0
DOE Energy Citations <a href="http://www.osti.gov/energycitations/">http://www.osti.gov/energycitations/</a> COMPLETED 04/12/2008	"canel" "connecticut advanced nuclear" "connecticut aircraft nuclear engine laboratory" "united aircraft corp" "pratt and whitney" "middletown"	1,714	5
DOE Hanford DDRS <a href="http://www2.hanford.gov/declass/">http://www2.hanford.gov/declass/</a> COMPLETED 04/14/2008	connecticut aircraft nuclear "connecticut advanced nuclear" "connecticut aircraft nuclear" "pratt and whitney" "united aircraft" "canel"	2	0
NRC ADAMS Reading Room <a href="http://www.nrc.gov/reading-rm/adams/web-based.html">http://www.nrc.gov/reading-rm/adams/web-based.html</a> COMPLETED 04/15/2008	"united technologies" "connecticut aircraft nuclear engine laboratory" "United Aircraft Corp" "connecticut advanced nuclear" "pratt and whitney" "canel"	265	9
CEDR <a href="http://cedr.lbl.gov/">http://cedr.lbl.gov/</a> COMPLETED 04/15/2008	"united technologies" "connecticut advanced nuclear" "connecticut aircraft nuclear" "pratt and whitney" "united aircraft" "canel" "united technologies"	0	0

Table A1-2: INTERNET DATABASE SEARCHES RELATED TO CANEL

Database / Source	Keywords / Phrases	Hits	Uploaded
U.S. Transuranium & Uranium Registries http://www.ustur.wsu.edu/ COMPLETED 04/15/2008	"connecticut advanced nuclear" "connecticut aircraft nuclear" "pratt and whitney" "united aircraft" "canel" "united technologies"	0	0
Google http://www.google.com COMPLETED 07/22/2008	"connecticut aircraft nuclear engine laboratory" "uranium" "connecticut aircraft nuclear engine laboratory" "canel" "nuclear" "uranium" radiation 1955 OR 1956 "united aircraft corp" plant operations "united aircraft corp" connecticut advanced nuclear engineering laboratory "pratt and whitney" "radiation monitoring" "pratt and whitney" "radiation accidents" "pratt and whitney" "radiation injuries" "pratt and whitney corp" "dosimetry" "pratt and whitney corp" "radioactive" "united aircraft corp" "radiation injuries" "united aircraft corp" "radiation exposure" "united aircraft corp" "radiation monitoring" "united aircraft corp" "radiation safety" "united aircraft corp" "radiation accidents" "united aircraft corp" "radioactivity" "united aircraft corp" "uranium" "united aircraft corp" "thorium" united aircraft corp "safety report" pratt and whitney "radiation" "middletown"	3,041	7
NNSA - Nevada Site Office www.nv.doe.gov/main/search.htm COMPLETED 04/18/2008	Historical Publications	5	0

**Table A1-2: INTERNET DATABASE SEARCHES RELATED TO CANEL**

<b>Database / Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
National Academy Press http://www.nap.edu COMPLETED 05/09/2008	CANEL	1	0

**Table A1-3: OSTI DOCUMENTS REQUESTED FOR CANEL**

<b>Document Number</b>	<b>Document Title</b>	<b>Requested Date</b>	<b>Received Date</b>
CNLM-1387	Reactor Hazards Dated 1/26/1959	10/19/2007	6/12/2008
CNLM-1424	Presentation to Members of the Advisory Committee on Reactor Safeguards and the Reactor Hazards Evaluation Staff of the Atomic Energy Commission Dated 3/4/1959	10/19/2007	6/12/2008
CNLM-1935	Evaluation of the Residual Uranium Scrap Dated 9/18/1959	10/19/2007	6/12/2008
CNLM-1978	Forecast of Nuclear Materials Requirements - Third Edition Fiscal Year 1960 (Plutonium) Dated 10/2/1959	10/19/2007	6/12/2008
CNLM-2328	Work on a Preliminary Hazards Summary Report for Testing the PWAR-11C 2/15/1960	10/19/2007	
CNLM-2438	Form AEC-408 Forecast Nuclear Materials Requirements First Revision Kilograms of U233 Dated 4/4/1960	10/19/2007	6/12/2008
CNLM-2440	Forecast of Nuclear Materials Requirements First Revision Dated 4/4/1960	10/19/2007	6/12/2008
CNLM-2441	Forecast Nuclear Materials Requirements First Revision Kilograms of Enriched Plutonium Dated 4/4/1960	10/19/2007	6/12/2008
CNLM-2442	Forecast Nuclear Materials Requirements First Revision Kilograms of Normal Uranium Dated 4/4/1960	10/19/2007	6/12/2008
CNLM-2469	Resume of Anticipated P&WA Irradiation Experiments in Fiscal Years 1961 and 1962 Dated 4/8/1960	10/19/2007	
CNLM-2470	Facilities for P&WA Reactor Development Program Dated 4/21/1960	10/19/2007	
CNLM-2509	Graded Ingots Dated 4/28/1960	10/19/2007	

**Table A1-3: OSTI DOCUMENTS REQUESTED FOR CANEL**

<b>Document Number</b>	<b>Document Title</b>	<b>Requested Date</b>	<b>Received Date</b>
CNLM-2543	Base Data for Environmental (Supp. A) Monitoring Samples Dated 1/31/1961	10/19/2007	6/12/2008
CNLM-2543	Base Data for Environmental Monitoring Samples Dated 5/11/1960	10/19/2007	6/12/2008
CNLM-2586	Reactor Fuel Burn up Analysis Report Dated 5/23/1960	10/19/2007	
CNLM-2661	Operating Procedure for Pneumomatic Controls Irradiation Test Using Moore Mod. 68-1 M. F. Relays Dated 6/22/1960	10/19/2007	
CNLM-2665	Technical Program Summary of CANEL Dated 6/27/1960	10/19/2007	
CNLM-2732	Transmittal of FXD-523, Magnetic Tape and Print-Out of Information on Materials and Radiation Flux Data Dated 7/8/1960	10/19/2007	6/12/2008
CNLM-275	Requirements for U235 and Normal Uranium Dated 10/14/1957	10/19/2007	6/12/2008
CNLM-276	Requirements for U235 and Normal Uranium Dated 10/14/1957	10/19/2007	6/12/2008
CNLM-3048	Manpower Requirements - Radiation Effects Unit Dated 10/24/1960	10/19/2007	6/12/2008
CNLM-3450	Post-Irradiation Examination (Supp. 26) of Fuel Capsules Dated 2/16/1962	10/19/2007	
CNLM-3450	Post-Irradiation Examination (Supp. 28) of Fuel Capsules. May 2, 1962 Dated 5/4/1962	10/19/2007	
CNLM-3450	Post-Irradiation Examination (Supp. 29) of Inpile Capsules Covering the Period May 1 - 11, 1962 Dated 5/23/1962	10/19/2007	
CNLM-3450	Post-Irradiation Examination (Supp. 30) of Inpile Capsules Covering the Period May 14 - June 30, 1962 Dated 7/10/1962	10/19/2007	6/12/2008
CNLM-3450	Post-Irradiation Examination (Supp. 31) of Inpile Capsules Covering the Period July 1 - July 31, 1962 Dated 8/6/1962	10/19/2007	6/12/2008
CNLM-3450	Post-Irradiation Examination (Supp. 32) of Inpile Capsules Covering the Period August 1 - August 31, 1962 Dated 9/17/1962	10/19/2007	6/12/2008
CNLM-3450	Post-Irradiation Examination (Supp. 33) of Inpile Capsules Covering the Period September 1 - September 30, 1962 Dated 10/17/1962	10/19/2007	
CNLM-3450	Post-Irradiation Examination (Supp. 34) of Inpile Capsules Covering the Period October 1 - 31, 1962 Dated 11/23/1962	10/19/2007	
CNLM-3558	Fuel Elements for Criticality Hazards Experiments Dated 3/28/1961	10/19/2007	6/12/2008
CNLM-3796	Submitting AEC-22 Form Entitled "Irradiation Services Purchase Order" Dated 8/16/1961	10/19/2007	

**Table A1-3: OSTI DOCUMENTS REQUESTED FOR CANEL**

<b>Document Number</b>	<b>Document Title</b>	<b>Requested Date</b>	<b>Received Date</b>
CNLM-3797	AEC-22 Form "Irradiation Services Purchase Order Number 609116 Contract" Dated 8/16/1961	10/19/2007	
CNLM-498	Columbium Exposure Test Dated 1/24/1958	10/19/2007	
CNLM-5070	Core Installation and Assembly Hazards Summary Report for the Lithium Cooled Reactor Experiment (LCRE) Dated 6/25/1963	10/19/2007	6/12/2008
CNLM-668	Kilograms of Plutonium, Kilograms Contained U235, Kilograms Normal Uranium Dated 4/3/1958	10/19/2007	
CNLM-777-10	Zirconium - Hydride (Reactor Grade) Dated 11/18/1958	10/19/2007	6/12/2008
CNLM-777-11	Yttrium - Hydride (Com. Grade) Dated 11/18/1958	10/19/2007	6/12/2008
CNLM-777-12	Yttrium - Hydride (Reactor Grade) Dated 11/18/1958	10/19/2007	6/12/2008
CNLM-777-9	Zirconium - Hydride (Com. Grade) Dated 11/18/1958	10/19/2007	6/12/2008
CNLM-891	Handling Limitations for Mixtures of Uranium, Beryllium, Beryllium Oxide and Lithium-7 Dated 7/14/1958	10/19/2007	6/12/2008
CNLM-997	Data for Hazards Study-PWAR-12 and PWAR-12C Dated 7/30/1958	10/19/2007	6/12/2008
FXM-4347	Criticality Hazards Analysis of Uranium Handling Operation Proposed in Standard Practice 440-19 Dated 12/9/1959	10/19/2007	
FXM-4931	The Selection of the NJ-18A Power-plant Shield Coolant and the Determination of its Maximum Allowable Exposure Time to Radiation Dated 4/5/1961	10/19/2007	
PWAC-139	Hazards Summary Report on Nuclear Physics Laboratory at CANEL Dated 10/10/1955	10/19/2007	
PWAC-170	Hazards Summary Report on (Supp. 1) Critical Experiment Program Number 1 at CANEL Dated 11/27/1957	10/19/2007	
PWAC-170	Hazards Summary Report on Critical Experiment - Program Number 1 at CANEL Dated 5/31/1957	10/19/2007	
PWAC-205	CTF Summary Hazards Report Dated 11/15/1957	10/19/2007	
PWAC-277	Hazards Summary Report for 10 Mw Reactor Experiment at CANEL Dated 7/27/1959	10/19/2007	
PWAC-281	Hazards Summary Report on Critical Experiment Program Number 3 at CANEL Dated 11/2/1959	10/19/2007	
PWAC-283	Hazards Summary Report for (Supp. 1) Critical Experiment Program Dated 2/3/1961	10/19/2007	

**Table A1-3: OSTI DOCUMENTS REQUESTED FOR CANEL**

<b>Document Number</b>	<b>Document Title</b>	<b>Requested Date</b>	<b>Received Date</b>
PWAC-283	Hazards Summary Report on (Supp. 2) Critical Experiment Program Number 2 at CANEL 7/24/1961	10/19/2007	
PWAC-283	Hazards Summary Report on (Supp. 3) Critical Experiment Program Number 2 at CANEL 7/6/1963	10/19/2007	
PWAC-283	Hazards Summary Report on (Supp. 3) Critical Experiment Program Number 2 at CANEL Dated 10/9/1962	10/19/2007	
PWAC-283	Hazards Summary Report on Critical Experiment Program Number 2 at CANEL Dated 12/30/1959	10/19/2007	
PWAC-309	Hazards Summary Report on Critical Experiment Program Number 4 at CANEL Dated 1/4/1961	10/19/2007	
PWAC-314	Preliminary Hazards Report for a Reactor Experiment at CANEL Dated 1/23/1961	10/19/2007	
PWAC-366	Suitability of Available Uranium (Supp. 10) for Conversion to Enriched Uranium Nitride Dated 4/23/1965	10/19/2007	
PWAC-435	Feasibility Report for Use of Plutonium-beryllium Neutron Sources at the CANEL Nuclear Physics Laboratory Dated 8/5/1964	10/19/2007	
PWAC-488	Uranium Nitride Fuel Development - SNAP-50 Dated 10/1/1965	10/19/2007	
TIM-712	Statistical Evaluation of Revised Methods for Chemical Control of Uranium Inventories during Fuel Element Production Dated 4/24/1962	10/19/2007	6/12/2008
TIM-712 (Supp 1)	Statistical Evaluation of Revised Methods for Chemical Control of Uranium Inventories During Fuel Element Production-Sampling Dated 5/17/1962	10/19/2007	6/12/2008
TIM-813	A Program to Study the Effects Dated 5/6/1964	10/19/2007	
TIM-813	A Program to Study the Effects of Neutron Irradiation Upon Columbium Base Alloys Dated 3/12/1964	10/19/2007	11/30/2007
TIM-813 (Supp 1)	TIM-813 A Program to Study the Effects (Supp. 1) of Neutron Irradiation Upon (Rev. 1) Columbium Base Alloys Dated 6/18/64	10/19/2007	11/30/2007
TIM-814	Proposed SNAP-50 Shield Development Program Dated 5/28/1964	10/19/2007	6/12/2008
TIM-817	Irradiation and Examination Report of Capsule PW 26-190 Dated 3/26/1964	10/19/2007	6/12/2008

**Table A1-3: OSTI DOCUMENTS REQUESTED FOR CANEL**

<b>Document Number</b>	<b>Document Title</b>	<b>Requested Date</b>	<b>Received Date</b>
DPW-56-241	Visit report, Allegheny Ludlum Steel Corporation on Uranium Tubes dated 5/15/1956	05/05/2008	05/05/2008
DOE/TIC-85(Rev. 13)	Energy information database: report number codes dated 9/1/1979	05/06/2008	NA - Request Cancelled
M-7028	ENVIRONMENTAL RADIOACTIVITY AT CANEL. Summary of Data for 1958 dated 3/18/1958	05/06/2008	NA - Request Cancelled
M-7029	ENVIRONMENTAL RADIOACTIVITY AT CANEL. Summary of Data for 1958 dated 3/18/1958	05/06/2008	NA - Request Cancelled
NMI-4383	POWER REACTOR PROGRAM. Progress Report to E.I. du Pont de Nemours and Company for the Period November 1, 1958 through November 30, 1958 dated 2/12/1959	05/06/2008	NA - Request Cancelled
DPW-6429	??	05/06/2008	NA - Request Cancelled
A-4044; NNES-VII-2B (Chap. 8)	Recovery of Uranium Turnings, Chips and Borings	05/06/2008	NA - Request Cancelled
DR-3595	??	05/06/2008	NA - Request Cancelled
CNLM-2698	U-233 needs forecast	05/06/2008	NA - Request Cancelled
CNLM-3871	Reactor Program Description of Tasks	05/06/2008	NA - Request Cancelled
CNLM-3924	CANEL hot cell facility	05/06/2008	NA - Request Cancelled
CNLM-4449	General Reactor Technology	05/06/2008	NA - Request Cancelled
CNLM-5298	??	05/06/2008	NA - Request Cancelled
CNLM-5395	Nuclear Propulsion Systems	05/06/2008	NA - Request Cancelled
CNLM-5398	??	05/06/2008	NA - Request Cancelled

**Table A1-3: OSTI DOCUMENTS REQUESTED FOR CANEL**

<b>Document Number</b>	<b>Document Title</b>	<b>Requested Date</b>	<b>Received Date</b>
CNLM-577	facilities descriptions for CANEL	05/06/2008	NA - Request Cancelled
CNLM-5998	Criticality Studies	05/06/2008	NA - Request Cancelled
CNLM-71	Physics--General	05/06/2008	NA - Request Cancelled
CNLM-81	Materials	05/06/2008	NA - Request Cancelled
PWAC-153	HAZARDS SUMMARY REPORT ON HIGH FLUX TEST REACTOR FOR CANEL	05/06/2008	NA - Request Cancelled
PWAC-162REV2	Connecticut Aircraft Nuclear Engine Laboratory Current Facilities Middletown, Connecticut, Revision No. 2, July 5, 1957	05/06/2008	NA - Request Cancelled
PWAC-193	CANEL site monitoring program	05/06/2008	NA - Request Cancelled
PWAC-283SUPPL4	Supplement No. 4 Hazards summary report on Critical Experiment Program No. 2 at CANEL, July 11, 1963	05/06/2008	NA - Request Cancelled
PWAC-283SUPPL6	Materials	05/06/2008	NA - Request Cancelled
TIM-149	proposed counting room equipment	05/06/2008	NA - Request Cancelled
TIM-936	CANEL MATERIALS LABORATORY MANUAL--ANALYTICAL SECTION	05/06/2008	NA - Request Cancelled
CNLM-5241	Engineering and Equipment	05/08/2008	NA - Request Cancelled