

## SEC Petition Evaluation Report

### Petition SEC-00151

Report Rev #: 0

Report Submittal Date: January 25, 2010

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Site Expert(s):		N/A		
<b>Petition Administrative Summary</b>				
<b>Petition Under Evaluation</b>				
Petition #	Petition Type	Petition Receipt Date	Qualification Date	DOE/AWE Facility Name
SEC-00151	83.13	July 27, 2009	October 16, 2009	Canoga Avenue Facility, Los Angeles, CA
<b>Petitioner Class Definition</b>				
All workers employed by North American Aviation who worked in any areas in any job capacity at the Canoga Avenue Facility, Los Angeles, California, from January 1, 1955 through December 31, 1960.				
<b>Class Evaluated by NIOSH</b>				
All workers employed by North American Aviation who worked in any areas in any job capacity at the Canoga Avenue Facility, Los Angeles California, from January 1, 1955 through December 31, 1960.				
<b>NIOSH-Proposed Class(es) to be Added to the SEC</b>				
All employees of the Department of Energy, its predecessor agencies, and its contractors and subcontractors who worked in the Vanowen Building at the Canoga Avenue Facility, Los Angeles, California, from January 1, 1955 through December 31, 1960 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.				
<b>Related Petition Summary Information</b>				
SEC Petition Tracking #(s)	Petition Type	DOE/AWE Facility Name	Petition Status	
N/A				
<b>Related Evaluation Report Information</b>				
Report Title	DOE/AWE Facility Name			
N/A				
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<b>SEC Evaluation Approved By:</b>	<u>[Signature on file]</u> <i>Stuart L. Hinnefeld</i>		<u>1/26/2010</u> <i>Date</i>	

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## **Evaluation Report Summary: SEC-00151, Canoga Avenue Facility**

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*.

### Petitioner-Requested Class Definition

Petition SEC-00151 was received on July 27, 2009 and qualified on October 16, 2009. The petitioner requested that NIOSH consider the following class: *All workers employed by North American Aviation who worked in any areas in any job capacity at the Canoga Avenue Facility, Los Angeles California, from January 1, 1955 through December 31, 1960.*

### Class Evaluated by NIOSH

Based on its preliminary research, NIOSH accepted the petitioner-requested class. NIOSH evaluated the following class: All workers employed by North American Aviation who worked in any areas in any job capacity at the Canoga Avenue Facility, Los Angeles California, from January 1, 1955 through December 31, 1960.

### NIOSH-Proposed Class(es) to be Added to the SEC

Based on its full research of the class under evaluation, NIOSH has defined a single class of employees for which NIOSH cannot estimate radiation doses with sufficient accuracy. The NIOSH-proposed class includes all employees of the Department of Energy, its predecessor agencies, and its contractors and subcontractors who worked in the Vanowen Building at the Canoga Avenue Facility, Los Angeles, California, from January 1, 1955 through December 31, 1960, 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. The class under evaluation was modified (see Section 3.0 below) because the AEC radiologically-related work performed by Atomics International employees was performed only in the Vanowen Building. The remainder of the work performed in the buildings at the Canoga Avenue Facility was non-radiological work performed by Rocketdyne employees. These companies were both divisions of North American Aviation and NIOSH research has indicated that their employees wore badges according to their division and would only work in the facility for which they were badged.

### Feasibility of Dose Reconstruction

Per EEOICPA and 42 C.F.R. § 83.13(c)(1), NIOSH has established that it does not have access to sufficient information to: (1) estimate the maximum radiation dose, for every type of cancer for which radiation doses are reconstructed, that could have been incurred in plausible circumstances by any member of the NIOSH-proposed class; or (2) estimate radiation doses of members of the NIOSH-proposed class more precisely than an estimate of maximum dose. Information available from the site profile and additional resources is not sufficient to document or estimate the maximum internal and external potential exposure to members of the NIOSH-proposed class under plausible circumstances during the specified period. NIOSH's feasibility findings include the following:

- Principal sources of both internal and external radiation doses for members of the NIOSH-proposed class included exposures to uranium and fission products.
- NIOSH finds that it is likely feasible to reconstruct external dose, including occupational medical dose, for Canoga Avenue-Vanowen Building workers with sufficient accuracy.
- NIOSH lacks sufficient information for the time period from January 1, 1955 through December 31, 1960, which includes biological monitoring data, sufficient air monitoring information, or sufficient process and radiological source information, to allow it to estimate with sufficient accuracy the potential internal exposures to various radionuclides to which the NIOSH-proposed class may have been subjected.
- Although NIOSH found that it is not possible to completely reconstruct radiation doses for the NIOSH-proposed class, NIOSH intends to use any internal and external monitoring data available for members of that proposed class that may become available for an individual claim (and that can be interpreted using existing NIOSH dose reconstruction processes or procedures). Therefore, partial dose reconstructions for individuals employed at the Canoga Avenue-Vanowen Building site during the period from January 1, 1955 through December 31, 1960, but who do not qualify for inclusion in the SEC, may be performed using these data as appropriate.

Per EEOICPA and 42 C.F.R. § 83.13(c)(1), NIOSH has established that it has access to sufficient information for Canoga Avenue Facility employees who worked outside of the Vanowen Building to: (1) estimate the maximum radiation dose, for every type of cancer for which radiation doses are reconstructed, that could have been incurred in plausible circumstances; or (2) estimate radiation doses of members of the class more precisely than an estimate of maximum dose. Personnel monitoring data coupled with ambient environmental information from available additional resources are sufficient to document or estimate the maximum internal and external environmental exposure to members of the evaluated class who worked outside of the Vanowen Building under plausible circumstances during the specified period.

### Health Endangerment Determination

Per EEOICPA and 42 C.F.R. § 83.13(c)(3), a health endangerment determination is required because NIOSH has determined that it does not have sufficient information to estimate dose for the members of the NIOSH-proposed class.

NIOSH did not identify any evidence supplied by the petitioners or from other resources that would establish that the proposed class was exposed to radiation during a discrete incident likely to have involved exceptionally high-level exposures. However, evidence indicates that some workers in the proposed class may have accumulated substantial chronic exposures through episodic intakes of radionuclides, combined with external exposures to gamma, beta, and neutron radiation. Consequently, NIOSH has determined that health was endangered for those workers covered by this evaluation who were employed for at least 250 aggregated work days either solely under their employment or in combination with work days within the parameters established for other SEC classes (excluding aggregate work day requirements).

Per EEOICPA and 42 C.F.R. § 83.13(c)(3), a health endangerment determination is not required for Canoga Avenue employees who worked outside of the Vanowen Building because NIOSH has determined that it has sufficient information to estimate dose for this portion of the evaluated class.

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## SEC Petition Evaluation Report for SEC-00151

*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: Robert Coblentz, Quantaflux, LLC. 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 all workers employed by North American Aviation who worked in any areas in any job capacity at the Canoga Avenue Facility, Los Angeles California, from January 1, 1955 through December 31, 1960. It provides information and analyses 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. This report also does not contain the final determination as to whether the proposed class will be added to the SEC (see Section 2.0).

This evaluation was conducted in accordance with the requirements of EEOICPA, 42 C.F.R. pt. 83, and the guidance contained in the Office of Compensation Analysis and Support's (OCAS) *Internal Procedures for the Evaluation of Special Exposure Cohort Petitions*, OCAS-PR-004.

### 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 (HHS) 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 class of employees through NIOSH dose reconstructions.<sup>1</sup>

42 C.F.R. § 83.13(c)(1) states: *Radiation doses can be estimated with sufficient accuracy if NIOSH has established that it has access to sufficient information to estimate the maximum radiation dose, for every type of cancer for which radiation doses are reconstructed, that could have been incurred in plausible circumstances by any member of the class, or if NIOSH has established that it has access to sufficient information to estimate the radiation doses of members of the class more precisely than an estimate of the maximum radiation dose.*

Under 42 C.F.R. § 83.13(c)(3), if it is not feasible to estimate with sufficient accuracy radiation doses for members of the class, then NIOSH must determine that there is a reasonable likelihood that such radiation doses may have endangered the health of members of the class. The regulation requires

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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>.

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 at least 250 aggregated work days within the parameters established for the class or in combination with work days within the parameters established for other SEC classes (excluding aggregate work day requirements).

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 petitioner(s) and to the Advisory Board on Radiation and Worker Health (Board). The Board will consider the NIOSH evaluation report, together with the petition, petitioner(s) comments, and other information the Board considers appropriate, in order 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 Board, and the proposed decision issued by NIOSH. As part of this decision process, petitioners may seek a review of certain types of final decisions issued by the Secretary of HHS.<sup>2</sup>

### **3.0 SEC-00151 Canoga Ave. Facility Class Definitions**

The following subsections address the evolution of the class definition for SEC-00151, Canoga Avenue Facility. When a petition is submitted, the requested class definition is reviewed as submitted. Based on its review of the available site information and data, NIOSH will make a determination whether to qualify for full evaluation all, some, or no part of the petitioner-requested class. If some portion of the petitioner-requested class is qualified, NIOSH will specify that class along with a justification for any modification of petitioner's class. After a full evaluation of the qualified class, NIOSH will determine whether to propose a class for addition to the SEC and will specify that proposed class definition.

#### **3.1 Petitioner-Requested Class Definition and Basis**

Petition SEC-00151 was received on July, 27, 2009, and qualified on October, 16, 2009. The petitioner requested that NIOSH consider the following class: *All workers employed by North American Aviation who worked in any areas in any job capacity at the Canoga Avenue Facility, Los Angeles California, from January 1, 1955 through December 31, 1960.*

The petitioner provided information in support of the petitioner's belief that accurate dose reconstruction over time is impossible for the Canoga Avenue Facility workers in question. NIOSH deemed the following information sufficient to qualify SEC-00151 for evaluation:

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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>.

The petitioner referenced and/or submitted a number of technical reports in support of the petition bases that: (1) limitations of the existing Canoga radiation exposure records might prevent the completion of dose reconstructions for members of the class; and (2) specified dosimetry and related information are unavailable for estimating the radiation doses due to either a lack of monitoring or the destruction or loss of records. In support of these assertions, the petitioner cited the following documents:

- *SEC Petition Evaluation Report, Petition SEC-00093, Santa Susana Field Laboratory-Area IV*, dated February 6, 2008. The excerpts from the February 6, 2008 version used in the support of the petition bases are in the petition file (Petition, 2009). [Note: The February 6, 2008 version has been superseded by Rev. 1 dated April 28, 2009.]
- *Environmental, Internal, and External Technical Basis Documents for the Santa Susana Field Laboratory (SSFL)-Area IV, Canoga Avenue Facility (Vanowen Building), the Downey Facility, and the Desoto Avenue Facility (ETEC or Atomics International)* (ORAUT-TKBS-0038-4; ORAUT-TKBS-0038-5; ORAUT-TKBS-0038-6).
- *Review of the Santa Susana Field Laboratory (SSFL) Area IV Special Exposure Cohort (SEC) Petition-00093 and the NIOSH SEC Petition Evaluation Report*, prepared by S. Cohen & Associates (SC&A, Technical Support for the Advisory Board on Radiation and Worker Health); Draft: January 30, 2009. The draft used in the support of the petition bases is in the petition file (Petition, 2009). [Note: The draft January 30, 2009 version has been superseded by an October 2009 draft].

As indicated in Section 5.1 of the SEC-00093 SSFL-Area IV Evaluation Report, “The DOE Office of Worker Advocacy defines the start of covered operations as 1955 for Area IV of the Santa Susana Field Laboratory; it identifies the Downey Facility, DeSoto Avenue Facility, and Canoga Avenue Facility (all located outside the boundary of the SSFL site) as separate covered facilities under EEOICPA.” As indicated in its petition review, “NIOSH recognizes that the deficiencies of the personnel monitoring data outlined in the SEC00093 Evaluation Report would also apply to the Canoga Avenue Facility given the fact that the Health and Safety division of the operating contractor was a single entity as indicated in the NIOSH Site Profile documents for Area IV of the Santa Susana Field Laboratory, the Canoga Avenue Facility (Vanowen Building), the Downey Facility, and the De Soto Avenue Facility” (Petition Document Review, 2009).

NIOSH has reviewed the documentation available on the Canoga Avenue Facility and agrees there is sufficient information in the Site Research Database (SRDB), the applicable SSFL/AI/ETEC Technical Basis Documents, and the SC&A reviews to support a petition basis. Specifically, NIOSH agrees there is a lack of personnel or area monitoring data for the Canoga Avenue Facility during the class period under evaluation.

Based on its Canoga Avenue Facility research and data capture efforts, NIOSH determined that it has access to external dosimetry data for Canoga workers during the time period under evaluation. However, NIOSH also determined that internal bioassay records are not complete for all time periods or for all radionuclides. NIOSH concluded that there is sufficient documentation to support, for at least part of the requested time period, the petition basis that internal radiation exposures and radiation doses were not adequately monitored at the Canoga Avenue Facility, either through personal

monitoring or area monitoring. The information and statements provided by the petitioner qualified the petition for further consideration by NIOSH, the Board, and HHS. The details of the petition basis are addressed in Section 7.4.

### **3.2 Class Evaluated by NIOSH**

Based on its preliminary research, NIOSH accepted the petitioner-requested class because NIOSH determined that it lacks access to internal radiological exposure data for Canoga Avenue Facility workers from January 1, 1955 through December 31, 1960, which coincides with the time period under evaluation. Therefore, NIOSH defined the following class for further evaluation: All workers employed by North American Aviation who worked in any areas in any job capacity at the Canoga Avenue Facility, Los Angeles, California, from January 1, 1955 through December 31, 1960.

### **3.3 NIOSH-Proposed Class(es) to be Added to the SEC**

Based on its research of the class under evaluation, NIOSH has defined a single class of employees for which NIOSH cannot estimate radiation doses with sufficient accuracy. The NIOSH-proposed class to be added to the SEC includes all employees of the Department of Energy, its predecessor agencies, and its contractors and subcontractors who worked in the Vanowen Building at the Canoga Avenue Facility, Los Angeles, California, from January 1, 1955 through December 31, 1960, 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.

## **4.0 Data Sources Reviewed by NIOSH to Evaluate the Class**

As a standard practice, NIOSH completed an extensive database and Internet search for information regarding the Canoga Avenue Facility. The database search included the DOE Legacy Management Considered Sites database, the DOE Office of Scientific and Technical Information (OSTI) database, the Energy Citations database, the Atomic Energy Technical Report database, and the Hanford Declassified Document Retrieval System. In addition to general Internet searches, the NIOSH Internet search included OSTI OpenNet Advanced searches, OSTI Information Bridge Fielded searches, Nuclear Regulatory Commission (NRC) Agency-wide Documents Access and Management (ADAMS) web searches, the DOE Office of Human Radiation Experiments website, and the DOE-National Nuclear Security Administration-Nevada Site Office-search. Attachment One contains a summary of Canoga Avenue Facility documents. The summary specifically identifies data capture details and general descriptions of the documents retrieved.

In addition to the database and Internet searches listed above, NIOSH identified and reviewed numerous data sources to determine information relevant to determining the feasibility of dose reconstruction for the class of employees under evaluation. This included determining the availability of information on personal monitoring, area monitoring, industrial processes, and radiation source materials. The following subsections summarize the data sources identified and reviewed by NIOSH.

## 4.1 Site Profile Technical Basis Documents (TBDs)

A Site Profile provides specific information concerning the documentation of historical practices at the specified site. Dose reconstructors can use the Site Profile to evaluate internal and external dosimetry data for monitored and unmonitored workers, and to supplement, or substitute for, individual monitoring data. A Site Profile consists of an Introduction and five Technical Basis Documents (TBDs) that provide process history information, information on personal and area monitoring, radiation source descriptions, and references to primary documents relevant to the radiological operations at the site. The Site Profile for a small site may consist of a single document. As part of NIOSH's evaluation detailed herein, it examined the following TBDs for insights into Canoga Avenue Facility operations or related topics/operations at other sites:

- *TBD: Atomics International – Introduction*, ORAUT-TKBS-0038-1; Rev. 01; August 30, 2006; SRDB Ref ID: 30080
- *TBD: Energy Technology Engineering Center – Site Description*, ORAUT-TKBS-0038-2; Rev. 00; February 2, 2006; SRDB Ref ID: 22140
- *TBD: Area IV of the Santa Susana Field Laboratory, the Canoga Avenue Facility (Vanowen Building), the Downey Facility, and the De Soto Avenue Facility (sometimes referred to as Energy Technology Engineering Center [ETEC] or Atomics International) – Occupational Medical Dose*, ORAUT-TKBS-0038-3; Rev. 02; October 31, 2008; SRDB Ref ID: 53184
- *TBD: Area IV of the Santa Susana Field Laboratory, the Canoga Avenue Facility (Vanowen Building), the Downey Facility, and the De Soto Avenue Facility (sometimes referred to as Energy Technology Engineering Center [ETEC] or Atomics International) – Occupational Environmental Dose*, ORAUT-TKBS-0038-4; Rev. 01; March 8, 2007; SRDB Ref ID: 30622
- *TBD: Energy Technology Engineering Center – Occupational Internal Dose*, ORAUT-TKBS-0038-5; Rev. 00; February 22, 2006; SRDB Ref ID: 22287
- *TBD: Atomics International – Occupational External Dose*, ORAUT-TKBS-0038-6; Rev. 01; November 16, 2006; SRDB Ref ID: 30082

## 4.2 ORAU Technical Information Bulletins (OTIBs) and Procedures

An ORAU Technical Information Bulletin (OTIB) is a general working document that provides guidance for preparing dose reconstructions at particular sites or categories of sites. An ORAU Procedure provides specific requirements and guidance regarding EEOICPA project-level activities, including preparation of dose reconstructions at particular sites or categories of sites. NIOSH reviewed the following OTIBs and procedures as part of its evaluation:

- *OTIB: Estimating the Maximum Plausible Dose to Workers at Atomic Weapons Employer Facilities*; ORAUT-OTIB-0004; Rev. 03 PC-2; December 6, 2006; SRDB Ref ID: 29949

- *OTIB: Dose Reconstruction from Occupationally Related Diagnostic X-Ray Procedures*; ORAUT-OTIB-0006; Rev. 03; August 2, 2005; SRDB Ref ID: 19422
- *OTIB: A Standard Complex-Wide Methodology for Overestimating External Doses Measured with Film Badge Dosimeters*; ORAUT-OTIB-0010; Rev. 01; June 5, 2006; SRDB Ref ID: 29953
- *OTIB: Interpretation of Dosimetry Data for Assignment of Shallow Dose*; ORAUT-OTIB-0017; Rev. 00; January 19, 2005; SRDB Ref ID: 19435
- *OTIB: Internal Dose Overestimates for Facilities with Air Sampling Programs*; ORAUT-OTIB-0018; Rev. 01; August 9, 2005; SRDB Ref ID: 19436
- *OTIB: Use of Coworker Dosimetry Data for External Dose Assignment*; ORAUT-OTIB-0020; Rev. 00; December 29, 2004; SRDB Ref ID: 19441
- *OTIB: Application of Internal Doses Based on Claimant-Favorable Assumptions for Processing as Best Estimates*; Rev. 00; ORAUT-OTIB-0033; April 20, 2005; SRDB Ref ID: 19457
- *OTIB: Fission and Activation Product Assignment for Internal Dose-Related Gross Beta and Gross Gamma Analyses*; ORAUT-OTIB-0054; Rev. 00; May 11, 2007; SRDB Ref ID: 31780
- *OTIB: Technical Basis for Conversion from NCRP Report 38 Neutron Quality Factors to ICRP Publication 60 Radiation Weighting Factors for Respective IREP Input Neutron Energy Ranges*; ORAUT-OTIB-0055; Rev. 00; June 5, 2006; SRDB Ref ID: 29980
- *Procedure: Occupational Onsite Ambient Dose Reconstruction for DOE Sites*, ORAUT-PROC-0060; Rev. 01; June 28, 2006; SRDB Ref ID: 29986
- *Procedure: Occupational X-Ray Dose Reconstruction for DOE Sites*, ORAUT-PROC-0061; Rev. 01; July 21, 2006; SRDB Ref ID: 29987

### 4.3 Facility Employees and Experts

To obtain additional information, NIOSH interviewed four former Canoga Avenue Facility employees in addition to the ETEC Medical Director. The interviews were conducted by two ORAU team members.

- Personal Communication, 2005, *Personal Communication with ETEC Medical Director*; Telephone Interview by ORAU Team; December 1, 2005; 12:00 PM EST; SRDB Ref ID: 20534
- Personal Communication, 2009a, *Personal Communication with Hot Cell Mechanic*; Telephone Interview by ORAU Team; December 7, 2009 12:00 PM EST; SRDB Ref ID: 77823
- Personal Communication, 2009b, *Personal Communication with Nuclear Research Technician*; Telephone Interview by ORAU Team; December 7, 2009 1:30 PM EST; SRDB Ref ID: 77824

- Personal Communication, 2009c, *Personal Communication with Chemistry Research Analyst*; Telephone Interview by ORAU Team; December 8, 2009 2:30 PM EST; SRDB Ref ID: 77822
- Personal Communication, 2009d, *Personal Communication with Research Engineer*; Telephone Interview by ORAU Team; December 16, 2009 1:00 PM EST; SRDB Ref ID: 77825

#### 4.4 Previous Dose Reconstructions

NIOSH reviewed its NIOSH OCAS Claims Tracking System (NOCTS) to locate EEOICPA-related dose reconstructions that might provide information relevant to the petition evaluation. Table 4-1 summarizes the results of this review. (NOCTS data available as of December 22, 2009)

<b>Table 4-1: No. of Canoga Avenue Facility Claims Submitted Under the Dose Reconstruction Rule</b>	
<b>Description</b>	<b>Totals</b>
Total number of claims submitted for dose reconstruction	158
Total number of claims submitted for energy employees who meet the definition criteria for the class under evaluation (January 1, 1955 through December 31, 1960)	149
Number of dose reconstructions completed for energy employees who meet the definition criteria for the class under evaluation (i.e., the number of such claims completed by NIOSH and submitted to the Department of Labor for final approval)	113
Number of claims for which internal dosimetry records were obtained for the identified years in the evaluated class definition	7 <sup>a</sup>
Number of claims for which external dosimetry records were obtained for the identified years in the evaluated class definition	33

<sup>a</sup> Uranium urinalyses between 1958 and 1960

NIOSH reviewed each claim to determine whether internal and/or external personal monitoring records could be obtained for the employee. Of the 158 claims on record, 149 meet the criteria for the class under evaluation; 113 have been submitted to the Department of Labor; there were 7 claims for which some internal dosimetry records were found for the period under evaluation; and there were 33 claims identified for which external dosimetry records were found for the period under evaluation.

## 4.5 NIOSH Site Research Database

NIOSH also examined its Site Research Database (SRDB) to locate documents supporting the assessment of the evaluated class. Three hundred twenty-nine (329) documents in this database were identified as pertaining to the Canoga Avenue Facility. These documents were evaluated for their relevance to this petition. The documents include historical background on internal and external monitoring, program descriptions, process materials, process descriptions, dust sampling results, air monitoring data, urinalysis data, as well as information about the radiological control program and medical monitoring.

## 4.6 Documentation and/or Affidavits Provided by Petitioners

In qualifying and evaluating the petition, NIOSH reviewed the following documents in support of the petition:

- *Petition Form B, and supporting documents*; July 27, 2009; OSA Ref ID: 109385 (Petition, 2009)
- *Supporting Document (compiled notebook)*; September 21, 2009; OSA Ref ID: 109795 (Notebook, 2009) Note: The notebook was submitted to NIOSH by an SEC petitioner for a separate site. However, upon discussion of the notebook contents during a public meeting, the SEC00151 petitioner believed the notebook contained valuable information in support of his petition. Therefore, he requested that NIOSH evaluate the notebook for possible support of petition SEC-000151.

## 5.0 Radiological Operations Relevant to the Class Evaluated by NIOSH

The following subsections summarize both radiological operations at the Canoga Avenue Facility from 1955 through December 1960 and the information available to NIOSH to characterize particular processes and radioactive source materials. From available sources NIOSH has gathered process and source descriptions, information regarding the identity and quantities of radionuclides of concern, and information describing both processes through which radiation exposures may have occurred and the physical environment in which they may have occurred. The information included within this evaluation report is intended only to be a summary of the available information.

### 5.1 Canoga Avenue Plant and Process Descriptions

AEC-funded activities at North American Aviation, Inc. (NAA), Canoga Park, California, occurred in the Vanowen Building from approximately 1955 to 1960 (see Figures 5-1 [Canoga Park, 1960] and Figure 5-2 [Canoga Plot, unknown date]). Some of the radiological operations at Vanowen had previously been performed at NAA's Downey Facility in Los Angeles, and were moved to Canoga Avenue at the end of 1955 (ORAUT-TKBS-0038-2).



One such operation was a “hot cave.” The hot cave was constructed of interlocking, high-density concrete blocks that were used to provide radiation shielding. The hot cave was used to conduct uranium fuel reprocessing experiments. The shielding provided by the cave was necessary to minimize radiation exposure from the irradiated fuel slugs. Work in the hot cave was performed remotely using manipulators viewed through leaded glass. The hot cave was originally located at the Downey Facility and was moved to the Vanowen Building in 1955. In 1959, it was moved to Area IV of the Santa Susana Field Laboratory (Personal Communication, 2009b).

At the Vanowen Building, the hot cave was located within a large, radiologically-controlled room. The room also contained glove boxes and hoods. Specific locations for radiological work in this room would be dictated by the relative hazard of the operation. Work with uranium metal would sometimes be conducted on open benchtops. All ventilation from this area passed through HEPA filtration systems. In order to enter this controlled room, one first had to pass through a change room where shoe covers and other PPE would be donned (depending on the operations being conducted). To exit the room, one had to pass through a step-off pad where shoe covers would be removed and monitoring for contamination would take place (Personal Communication, 2009b; Personal Communication, 2009c; Personal Communication, 2009d).

Operations in the Vanowen Building included welding of uranium-containing components, assembly of fuel elements, melting and milling of uranium and thorium metals, chemical analyses of uranium and thorium metals, oxides, and salts, high temperature reprocessing of used reactor fuels, and melting and alloying thorium (Laboratory Status, 1959).

Other work in the Vanowen Building included design, development, and operation of small aqueous fuel reactors, fuel development, and radiochemistry. The reactor activities involved the construction of small (10-watt or less) aqueous uranyl sulfate homogeneous reactors (named L-47 and L-77) for use in training institutions (ORAUT-TKBS-0038-2).

The Vanowen Building was occupied by Atomic International (AI), a division of NAA. The Vanowen Building was the only building at the Canoga Park site where AEC-related operations took place. Other buildings at the Canoga Park location were occupied by Rocketdyne, another division of NAA. Personnel working for the AI and Rocketdyne divisions wore different security badges. Rocketdyne personnel did not frequent the Vanowen Building (Personal Communication, 2009b; Personal Communication, 2009c; Personal Communication, 2009d).

The Vanowen Building is also described as a guarded facility where only authorized personnel were allowed access. (Personal Communication, 2009a; Personal Communication, 2009b; Personal Communication, 2009c; Personal Communication, 2009d)



**Figure 5-1: The Canoga Park Facility in 1960**

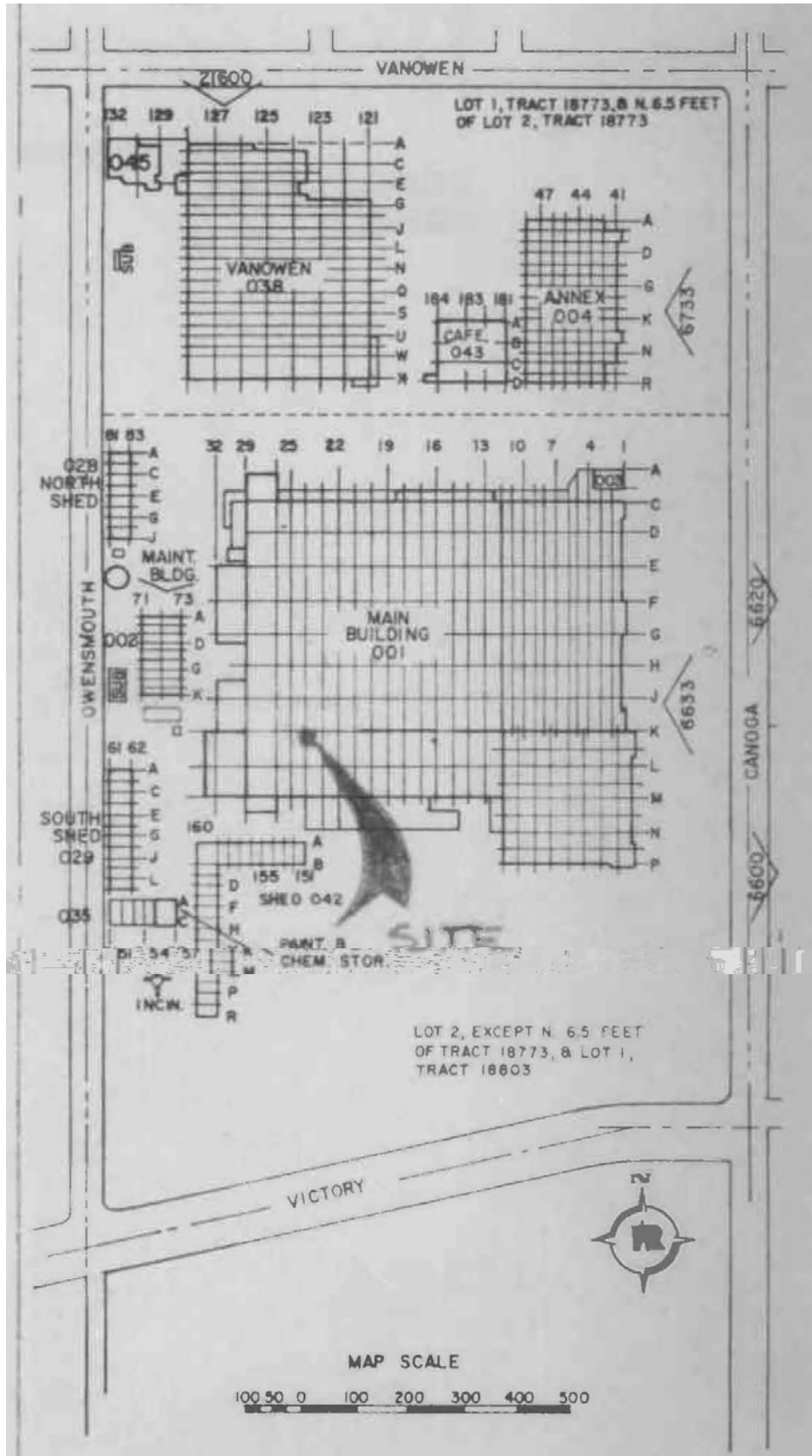


Figure 5-2: Plot Drawing of the Canoga Park Facility

## **5.2 Radiological Exposure Sources from Canoga Ave. Facility Operations**

The following subsections provide an overview of the internal and external exposure sources for the Canoga Avenue Facility class under evaluation.

### **5.2.1 Internal Radiological Exposure Sources from Canoga Ave. Facility Operations**

Operations in the Vanowen Building included reactor design, fuel development/reprocessing, and radiochemistry. There were also two small aqueous uranyl sulfate research reactors (up to 93 % enriched fuel), designated L-47 and L-77, that were designed, developed, and operated in the Vanowen Building. Internal radiation exposure could have occurred during any of these operations. The primary radionuclides of concern are isotopes of uranium (ORAUT-TKBS-0038-2, Table 2-3). Exposure to mixed fission products could also have occurred from the fuel reprocessing experiments.

### **5.2.2 External Radiological Exposure Sources from Canoga Ave. Facility Operations**

The principal sources of exposure were associated with hot cave operations involving uranium fuel reprocessing experiments. Other exposures could have occurred from uranium-handling operations and research conducted with the small 5 and 10 Watt reactors used for training purposes.

#### 5.2.2.1 Photon and Beta

Sources of external photon and beta dose included uranium fuel reprocessing experiments, uranium metal handling, and operation of the small research reactors.

#### 5.2.2.3 Neutron

Neutron exposures could have occurred from operation of the small research reactors.

### **5.2.3 Incidents**

NIOSH has found no evidence of significant radiological incidents occurring at the Canoga Avenue Facility. Of the four interviewed former employees, only one could recall a radiological incident that resulted in contamination outside of the boxes. This was an incident where one drop of what he believed to be a thorium solution fell to the floor when his colleague was cutting a contaminated piece of tubing. The contamination never migrated outside of the radiologically-controlled room. He and his colleague stayed late that evening and made sure everything was cleaned up (Personal Communication, 2009b).

The petitioner requested that NIOSH use as a petition-supporting document a compiled “notebook” that was submitted to NIOSH by the petitioner for a related site. The SEC-00151 petitioner believed that this notebook contained information regarding an incident that took place in the Vanowen Building during the covered period. Upon examination, the notebook information consisted of an account by a former worker who indicated that there was some form of contamination incident in July 1958. No official incident reports were located and additional research into statements made by the same former worker seemed to indicate that this incident consisted of contamination resulting from

nuclear weapons testing fallout that settled outside the plant area. There was no indication that this incident was likely to have resulted in exceptionally high-level exposures (Notebook, 2009).

## **6.0 Summary of Available Monitoring Data for the Class Evaluated by NIOSH**

The following subsections provide an overview of the state of the available internal and external monitoring data for the Canoga Avenue Facility class under evaluation.

NIOSH has obtained only a limited amount of personnel and area monitoring data that can be used for bounding doses for the class under evaluation. These data are summarized in Section 6.1 and its subsections.

### **6.1 Available Canoga Avenue Facility Internal Monitoring Data**

The radionuclides of concern resulting from the operation of the two small research reactors and the uranium fuel slug reprocessing in the “hot cave” were primarily uranium and mixed fission products. *In vitro* data are not available prior to August 1958 and *in vivo* analysis was not available for the entire period under evaluation. Additional documentation available to NIOSH does not describe the air monitoring, work processes, or exposure conditions associated with the research reactors or the hot cave.

Details regarding the various analyses used at the Canoga Avenue Facility (Vanowen Building), and the associated minimum detectable activities, are presented in the *Technical Basis Document for the Energy Technology Engineering Center - Occupational Internal Dose* (ORAUT-TKBS-0038-5).

#### **6.1.1 Internal Urinalysis Data**

NIOSH has identified only limited amounts of internal personnel monitoring data for pre-1959 exposures; this is consistent with its findings that the routine bioassay program that covered the Vanowen Building was not initiated until August 1958 (Kellehar, 1966). After August 1958, routine bioassay was normally in the form of urinalysis at a three-month frequency. Initially, gross alpha or gross beta measurements were made of the samples. Specific radionuclides could be determined “where required” by performing additional radiochemical separations and analyses (Lang, 1960). For the 1959-1960 time frame, limited analyses were available for uranium (both fluorometric and radiometric), mixed fission products, polonium-210, plutonium, strontium-90, tritium, and thorium. Details of these analyses are provided in ORAUT-TKBS-0038-5. Many of these analyses were applicable to operations at Area IV of the SSFL, rather than the Vanowen Building, and NIOSH has found that the data are not in sufficient quantity until 1964 to represent the applicable exposure scenarios for the maximally-exposed work groups at the SSFL complex. Sampling frequency beginning in August 1958 was quarterly, semiannual, and annual - based on the job that personnel were performing. Detection limits and reporting levels are provided in Table 5-3 of ORAUT-TKBS-0038-5).

### **6.1.2 Ambient Environmental Data**

Environmental surveys were conducted around the Canoga Avenue Facility throughout the entire period of its operations, beginning with what appears to be a baseline survey conducted in December 1954. These surveys included gross alpha and gross beta analyses of vegetation and soil samples and air monitoring for gross beta. The results of these monitoring activities are available to NIOSH (Report, 1960; Survey, 1954; Surveys, 1955; Surveys, 1956) and are currently under review for incorporation and refinement of the current environmental exposure approach.

## **6.2 Available Canoga Avenue Facility External Monitoring Data**

The Vanowen Building was covered under the same health physics program as the Area IV SSFL. As with personnel at SSFL, the personnel at the Vanowen Building wore a two-element film badge to measure and account for the photon and beta exposures during the period 1955-1960. For some personnel, it is likely that reported film badge results include doses received at the Vanowen Building and at Area IV of SSFL.

Normally, film badges were worn for monthly periods except where the possibility of exceeding 100 mrem/wk of exposure was expected. In such a case, badges were analyzed more frequently (Lang, 1960). Extremity finger-ring film dosimeters were worn on both hands and individual results were recorded for each hand. It has not been determined when this practice started, but it was in place in the December 31, 1956 dose record (Author unknown, 1956) and included what appear to be the same exchange periods.

NIOSH has access to photon and beta external dosimetry results as well as other supporting data for the entire period under evaluation (all years of site operation). The policy at SSFL, including the Canoga Avenue Facility, was to assign the applicable dosimetry to anyone with the potential for photon or beta radiation; dosimetry was assigned based on job assignments that required exposure to radioactive materials (Badger, 1965-1987; Various authors, 1970-1987; ORAUT-TKBS-0038-6). Details regarding the various analyses used, and the associated minimum detectable activities, are presented in ORAUT-TKBS-0038-6. Although NIOSH does have access to source term information for the reactor operations where neutron exposures were likely (assessed in Section 7.3 of this report), NIOSH has identified no personnel dosimetry or area monitoring data for neutron exposures for the Vanowen Building.

## **7.0 Feasibility of Dose Reconstruction for the Class Evaluated by NIOSH**

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

information for either case, NIOSH would then determine that it would be feasible to conduct dose reconstructions.

In determining feasibility, NIOSH begins by evaluating whether current or completed NIOSH dose reconstructions demonstrate the feasibility of estimating with sufficient accuracy the potential radiation exposures of the class. If the conclusion is one of infeasibility, NIOSH systematically evaluates the sufficiency of different types of monitoring data, process and source or source term data, which together or individually might assure that NIOSH can estimate either the maximum doses that members of the class might have incurred, or more precise quantities that reflect the variability of exposures experienced by groups or individual members of the class as summarized in Section 7.5. This approach is discussed in OCAS's SEC Petition Evaluation Internal Procedures which are available at <http://www.cdc.gov/niosh/ocas>. The next four major subsections of this Evaluation Report examine:

- The sufficiency and reliability of the available data. (Section 7.1)
- The feasibility of reconstructing internal radiation doses. (Section 7.2)
- The feasibility of reconstructing external radiation doses. (Section 7.3)
- The bases for petition SEC-00151 as submitted by the petitioner. (Section 7.4)

## **7.1 Pedigree of Canoga Avenue Facility Data**

This subsection answers questions that need to be asked before performing a feasibility evaluation. Data Pedigree addresses the background, history, and origin of the data. It requires looking at site methodologies that may have changed over time; primary versus secondary data sources and whether they match; and whether data are internally consistent. All these issues form the bedrock of the researcher's confidence and later conclusions about the data's quality, credibility, reliability, representativeness, and sufficiency for determining the feasibility of dose reconstruction. The feasibility evaluation presupposes that data pedigree issues have been settled.

### **7.1.1 Internal Monitoring Data Pedigree Review**

The bioassay program that supported the personnel working in the Vanowen Building was not initiated until August 1958. At that time, the program consisted primarily of gross beta or gross alpha measurements with specific radionuclide determinations made when required. There is information on the early urinalysis methods for the period 1959-1960; however, individual bioassay results are limited. Early results have also been observed to have discrepancies in the minimum measureable concentrations (ORAUT-TKBS-0038-5). Breathing zone air samples and general air sample data have not been located. NIOSH has determined that the quantity and quality of the internal bioassay monitoring data is insufficient to support a pedigree review for this evaluation. Due to the limitations of the occupational internal monitoring data for the evaluated period at Canoga Avenue-Vanowen Building, an exhaustive pedigree review of occupational internal monitoring data has not been performed for this evaluation.

### **7.1.2 External Monitoring Data Pedigree Review**

Since the beginning of nuclear operations at Atomics International, the site used its own dosimeter to monitor photon and beta exposures. When operations began at the Canoga Avenue Facility, the dosimetry program already in place at SSFL Area IV expanded to include monitoring for personnel at the Vanowen Building. The dosimeter design was very similar to the film dosimeters used at the Y-12 plant and the Hanford site, which were based on the design developed by Pardue, Goldstein, and Wollan (Pardue, 1944). During this time period, AI supplemented their film dosimetry with pencil dosimeters, and at SSFL Area IV, with NTA film for monitoring neutron exposures. NIOSH has not identified any neutron monitoring data for personnel at the Canoga Avenue Facility. Both penetrating and non-penetrating doses were documented in personnel records (ORAUT-TKBS-0038-6). Original individual external dosimetry records are available for Vanowen Building workers; workers with the greatest potential for significant radiation exposure were monitored over the class period under evaluation. The exchange frequencies for site personnel were based on the potential to exceed the administrative exposure limits for the applicable period in the radiological program (Lang, 1960; ORAUT-TKBS-0038-6).

As discussed in a mortality study and a comprehensive dose reconstruction methodology study at Rocketdyne/Atomics International (Boice, 2006a; Boice, 2006b), radiation workers (workers routinely assigned to areas where exposure was likely) were assigned a dosimeter. Based on the reviews performed during the studies, it was confirmed that the radiation workers who had the potential to receive routine external radiological exposures were monitored by dosimeters for all years evaluated and for all years of Vanowen Building operations. Therefore, NIOSH has concluded that the available information includes external dosimeter monitoring data for the highest-exposed individuals for the class period under evaluation in this report and that these data are of sufficient quality and quantity to support assessing and bounding the external radiological dose for the class under evaluation. However, due to the limitations of the occupational internal monitoring data for the evaluated period at Canoga Avenue-Vanowen Building, an exhaustive pedigree review of occupational external monitoring data has not been performed for this evaluation.

## **7.2 Evaluation of Bounding Internal Radiation Doses at the Canoga Avenue Facility**

The principal sources of internal radiation doses for members of the class under evaluation were uranium and fission products. The following subsections address the ability to bound internal doses, methods for bounding doses, and the feasibility of internal dose reconstruction.

### **7.2.1 Evaluation of Bounding Process-Related Internal Doses**

Although a bioassay program for personnel at the Vanowen Building was initiated in August 1958, resulting data from this program are insufficient for bounding all potential intakes. NIOSH does not have access to sufficient personnel monitoring, workplace monitoring, or source term data to bound internal doses from uranium, fission products and other radionuclides during the period of operations. Consequently, NIOSH finds that it is not feasible to bound occupational intakes of uranium, fission products, or other radionuclides and the resulting doses for the class under evaluation.



## **7.2.2 Evaluation of Bounding Ambient Environmental Internal Doses**

Historical information indicates that the areas supporting nuclear operations were routinely surveyed for contamination and were monitored for airborne contamination. Shoe covers and step-off pads were used to minimize contamination spread. Air from areas with the potential for airborne contamination passed through HEPA filtration systems. There is no evidence to suggest that the HEPA filtration system was faulty or that contaminants migrated outside of the controlled areas. During interviews, former workers employed at the facility during the entire operational period did not recall any incidents that resulted in radioactive materials escaping controlled areas (Personal Communication, 2009b; Personal Communication, 2009c; Personal Communication, 2009d). No contamination above the limits for unrestricted use was found in a 1995 survey of the facility by the U.S. Nuclear Regulatory Commission (NRC) (Rutherford 2002).

Environmental monitoring data available to NIOSH are summarized in Section 6.1.2. NIOSH believes that these data, in conjunction with available information about site operations, may be used to bound environmental intakes at the Canoga Avenue Facility. The Site Profile for this facility is currently under revision. The Site Profile includes Area IV of the Santa Susana Field Laboratory, the Canoga Avenue Facility, the Downey Facility, and the DeSoto Avenue Facility. The methodology for bounding environmental intakes will be detailed in the revised Site Profile.

## **7.2.3 Methods for Bounding Internal Dose at the Canoga Avenue Facility**

### 7.2.3.1 Methods for Bounding Operational Period Internal Dose

As previously discussed, bioassay data for personnel at the Vanowen Building are unavailable before August 1958. Beyond 1958, these available bioassay data have been determined by NIOSH to be insufficient in quantity and quality to bound internal doses; furthermore, there is limited source term data and a lack of air monitoring data for the class under evaluation. Therefore, NIOSH has concluded that it is unable to bound internal doses for the period under evaluation.

### 7.2.3.2 Methods for Bounding Ambient Environmental Internal Dose

NIOSH has found no evidence to suggest that radioactive contaminants escaped the Vanowen Building. As previously discussed, the methodology for bounding environmental intakes at the Canoga Avenue Facility will be provided in the Site Profile TBD, which is currently under revision.

## **7.2.4 Internal Dose Reconstruction Feasibility Conclusion**

Bioassay data for the personnel at the Vanowen Facility are not available before August 1958 and data beyond that date are insufficient in quantity and quality to bound intakes of all radionuclides for the class under evaluation. Source term and other monitoring are likewise insufficient for purposes of bounding intakes. Therefore, NIOSH has determined that it is unable to bound internal doses at the Vanowen Building for the period 1955-1960.

A methodology for bounding ambient environmental intakes is being developed and will be documented in the Site Profile TBD, which is currently under revision.

### **7.3 Evaluation of Bounding External Radiation Doses at the Canoga Avenue Facility**

The principal sources of external radiation doses for members of the evaluated class were beta and gamma radiation associated with uranium and fission products (ORAUT-TKBS-0038-2). There was some potential for exposure to neutrons in the areas where small-scale reactor research was performed. Pre-employment and periodic X-ray examinations were another source of external radiation dose to personnel at the Canoga Avenue Facility.

The following subsections address the ability to bound external doses, methods for bounding doses, and the feasibility of external dose reconstruction.

#### **7.3.1 Evaluation of Bounding Process-Related External Doses**

External whole-body, skin, and extremity monitoring for beta and photon radiation was performed during the operational period at the Vanowen Building. The resulting data from this monitoring are available to NIOSH and applicable methodologies for bounding external doses have been developed. Specific neutron monitoring results are unavailable for workers in the Vanowen Building.

As previously discussed, NIOSH does have access to source term information for the reactor operations where neutron exposures were likely. Neutron doses to personnel operating the small training reactors (L47 and L77) would have been minimal. This is evident from the detailed information regarding the shielding designs and resulting neutron fluxes for these reactors (Parkins, 1958). An interviewee who worked in the hot cave area as a Hot Cell Mechanic stated that, given the materials that they were working with, he did not believe that neutron radiation was a concern and that there was no monitoring for neutrons (Personal Communication, 2009a). NIOSH has also considered the assessment contained in the Health Physics Journal paper, *A Comprehensive Dose Reconstruction Methodology for Former Rocketdyne/Atomics International Radiation Workers*, that concludes that neutron doses were minimal compared to photon dose, less than 3% (Boice, 2006b). This Rocketdyne/Atomics International evaluation included workers at the SSFL site, where much larger reactors and much higher neutron dose rates were present.

Given the limitations on the ability to bound internal doses for the NIOSH-proposed class, and the lack of neutron exposure potential in the areas outside of the Vanowen Building, an exhaustive analysis of the neutron exposures has not been performed for this evaluation.

#### **7.3.2 Evaluation of Bounding Ambient Environmental External Doses**

Environmental monitoring data are unavailable for the time period under evaluation. However, environmental dose is accounted for, and bounded by, existing external personnel monitoring data. Based on knowledge of the source term, process controls, and physical layout of the facility, NIOSH has concluded that it is not required to account for a contribution from neutrons to the ambient environmental external dose at the Canoga Avenue Facility. Given the available environmental monitoring data and available external dose reconstruction approaches defined for the SSFL sites, NIOSH concludes that there is sufficient information and data to support its ability to bound external

dose for those workers who worked outside of the Vanowen Building at the Canoga Avenue Facility during the evaluated time period.

### **7.3.3 Canoga Avenue Facility Occupational X-Ray Examinations**

There are indications that AI personnel were required to have medical X-ray examinations (Garcia, 1970). Dose from occupationally-required medical X-rays should therefore be assumed to have occurred in the absence of data to the contrary.

### **7.3.4 Methods for Bounding External Dose at the Canoga Avenue Facility**

There is an established protocol for assessing external exposure when performing dose reconstructions (these protocol steps are discussed in the following subsections):

- Photon Dose
- Beta Dose
- Neutron Dose
- Medical X-ray Dose

#### 7.3.4.1 Methods for Bounding Operational Period External Dose

##### Photon Dose

External personnel dosimetry data are available for use in bounding operational photon dose to workers at the Vanowen Building. Methodologies for interpreting these data and for assigning dose to any workers are detailed in the Site Profile TBD, *Atomics International – Occupational External Dose* (ORAUT-TKBS-0038-6), and the external co-worker study, *External Coworker Dosimetry Data for Area IV of the Santa Susana Field Laboratory, the Canoga Avenue Facility (Vanowen Building and the DeSoto Avenue Facility (sometimes referred to as Energy Technology Engineering Center[ETEC] or Atomics International)* (ORAUT-OTIB-0077).

##### Beta Dose

External personnel dosimetry data are available for use in bounding operational beta dose to workers at the Vanowen Building. Methodologies for interpreting these data and for assigning dose to any workers are detailed in the Site Profile TBD, *Atomics International – Occupational External Dose* (ORAUT-TKBS-0038-6).

### Neutron Dose

Based on the known radiological operations at the Vanowen Building, the potential for worker exposure to neutrons was considered minimal and Vanowen Building workers were therefore not monitored for neutrons. However, although NIOSH recognizes that neutron doses were believed to have been minimal, neutrons should be considered on a case-by-case basis for partial dose reconstructions on individual claims. Therefore, NIOSH intends to use all available information and neutron dose reconstruction methodologies, including any that may not yet be fully developed, to support partial dose reconstructions for Vanowen Building workers.

### Medical X-ray Dose

Medical dose for AI workers can be bounded using the assumptions and applicable protocols in the complex-wide Technical Information Bulletin, *Dose Reconstruction from Occupationally Related Diagnostic X-Ray Procedures*, ORAUT-OTIB-0006.

### **7.3.5 External Dose Reconstruction Feasibility Conclusion**

Since NIOSH has found that it is unable to bound internal dose, an exhaustive evaluation of feasibility of external dose reconstruction for Vanowen Building workers was not performed for the purposes of this report. However, NIOSH will complete partial dose reconstructions using available personnel monitoring data methodologies described in ORAUT-TKBS-0038-6. In addition, the available external monitoring data and dose reconstruction approaches support the ability to bound ambient environmental dose for the Canoga Avenue Facility. NIOSH also finds that dose from medical exams may be bounded using the methodologies outlined in ORAUT-OTIB-0006.

## **7.4 Evaluation of Petition Basis for SEC-00151**

The petitioner made certain assertions on behalf of petition SEC-00151 for the Canoga Avenue Facility. The petition bases were identified as follows:

*(F.3) I/We have attached a report from a health physicist or other individual with expertise in radiation dose reconstruction documenting the limitations of existing DOE or AWE records on radiation exposures at the facility, as relevant to the petition. The report specifies the basis for believing these documented limitations might prevent the completion of dose reconstructions for members of the class under 42 CFR Part 82 and related NIOSH technical implementation guidelines.*

*(F.4) I/We have attached a scientific or technical report, issued by a government agency of the Executive Branch of Government or the General Accounting Office, the Nuclear Regulatory Commission, or the Defense Nuclear Facilities Safety Board, or published in a peer-reviewed journal, that identifies dosimetry and related information that are unavailable (due to either a lack of monitoring or the destruction or loss of records) for estimating the radiation doses of employees covered by this petition.*

In the original petition and in the petitioner's response to the consultation call letter, the petitioner referenced:

- *SEC Petition Evaluation Report, Petition SEC-00093, Santa Susana Field Laboratory-Area IV, dated February 6, 2008. The excerpts from the February 6, 2008 version used in the support of the petition bases are in the petition file (Petition, 2009). [Note: The February 6, 2008 version has been superseded by Rev. 1 dated April 28, 2009.]*
- *Environmental, Internal, and External Technical Basis Documents for the Santa Susana Field Laboratory (SSFL)-Area IV, Canoga Avenue Facility (Vanowen Building), the Downey Facility, and the Desoto Avenue Facility (ETEC or Atomics International) (ORAUT-TKBS-0038-4; ORAUT-TKBS-0038-5; ORAUT-TKBS-0038-6).*
- *Review of the Santa Susana Field Laboratory (SSFL) Area IV Special Exposure Cohort (SEC) Petition-00093 and the NIOSH SEC Petition Evaluation Report, prepared by S. Cohen & Associates (SC&A, Technical Support for the Advisory Board on Radiation and Worker Health); Draft: January 30, 2009. The draft used in the support of the petition bases is in the petition file (Petition, 2009). [Note: The draft January 30, 2009 version has been superseded by an October 2009 draft].*

The following subsections evaluate statements the petitioner made regarding the above-listed documents (petitioner statements are in italics followed by NIOSH's responses based on this evaluation.).

#### **7.4.1 Similarity of Monitoring**

SEC-00151: *The radiation monitoring data collected by Atomics International, a division of North American Aviation, as reported in Ref 6-a through 6-h, include both the SSFL/Area IV site and SSFL/Area IV – Canoga Facility site. These reports provide similar types of measured radiation data (or lack thereof) for both sites. It is inconceivable to believe that a site such as the Vanowen building in the SSFL/Area IV-Canoga Facilities site (or other buildings at this site), would be monitored differently than the SSFL/Area IV site, or that monitoring data would have been collected, recorded or maintained differently.*

NIOSH agrees that monitoring at the Canoga Avenue Facility was similar to monitoring at SSFL Area IV and that monitoring data was collected, recorded, and maintained in a similar manner at both locations. NIOSH further agrees that such monitoring data are insufficient to bound all potential radiation doses to personnel in the Vanowen Building at the Canoga Avenue Facility.

#### **7.4.2 Insufficiency of Monitoring**

SEC-00151: *Nothing is found in these three documents to suggest that the radiation monitoring programs, in any aspect, for the SSFL/Area IV site and Canoga Park Vanowen building site were conducted differently, or had different objectives, or used differing technologies, or were recorded differently. To the contrary, most of the statements in the three documents ties the monitoring programs at the SSFL/Area IV site and the Canoga Park Vanowen building site together.*

NIOSH agrees that radiation monitoring programs at SSFL Area IV and the Canoga Avenue Facility were conducted similarly, with similar objectives and the same technologies, and were recorded similarly. NIOSH further agrees that such monitoring data are insufficient to bound all radiation doses to personnel in the Vanowen Building at the Canoga Avenue Facility.

#### **7.4.3 Insufficiency of Data**

SEC-00151: In reference to the SC&A review of the SEC00093 ER (which included some SC&A reviews of the site TBDs), the petitioner noted: *All of these comments directly reflect on the ability of anyone to establish, or bound, the radiation exposure doses, internal or external, to which North American Aviation employees at the SSFL/Area IV – Canoga Facility site may have been exposed.*

NIOSH agrees that available data are insufficient to bound all radiation doses to personnel in the Vanowen Building at the Canoga Avenue Facility.

## 7.5 Summary of Feasibility Findings for Petition SEC-00151

This report evaluates the feasibility for completing dose reconstructions for employees at the Canoga Avenue Facility from January 1, 1955 through December 31, 1960. NIOSH found that the available monitoring records, process descriptions and source term data available are not sufficient to complete dose reconstructions for a part of the evaluated class of employees.

Although NIOSH finds it feasible to reconstruct all aspects of internal and external doses to Canoga Avenue Facility workers outside of the Vanowen Building, it finds that it is not feasible to reconstruct operational internal doses to workers inside the Vanowen Building. Table 7-1 summarizes the results of the feasibility findings at the Canoga Avenue Facility – Vanowen Building for each exposure source during the time period January 1955 through December 1960.

<b>Table 7-1: Summary of Feasibility Findings for SEC-00151</b> January 1955 through December 1960				
<b>Source of Exposure</b>	<b>Canoga Avenue Facility (outside the Vanowen Building)</b>		<b>Vanowen Building</b>	
	<b>Reconstruction Feasible</b>	<b>Reconstruction Not Feasible</b>	<b>Reconstruction Feasible</b>	<b>Reconstruction Not Feasible</b>
<b>Internal</b>	<b>X</b>			<b>X<sup>1</sup></b>
Operational	N/A	N/A		X
Ambient Environmental	X		X	
<b>External</b>	<b>X</b>		<b>X<sup>2</sup></b>	
- Gamma	X		X	
- Beta	X		X	
- Neutron	N/A	N/A	* <sup>2</sup>	
- Occupational Medical X-ray	X		X	

### PARTIAL DOSE RECONSTRUCTION INFORMATION:

<sup>1</sup> INTERNAL: For cases where individual internal monitoring data are available, these data may be used for purposes of partial dose reconstruction.

<sup>2</sup> EXTERNAL: For partial dose reconstructions, NIOSH intends to use all available information and neutron dose reconstruction methodologies, including any that may not yet be fully developed, to support partial dose reconstruction for Vanowen Building workers.

As of December 22, 2009, a total of 158 claims have been submitted to NIOSH for individuals who worked at the Canoga Avenue Facility and are covered by the class definition evaluated in this report. Dose reconstructions have been completed for 113 individuals (~72%).

## **8.0 Evaluation of Health Endangerment for Petition SEC-00151**

The health endangerment determination for the class of employees covered by this evaluation report is governed by both EEOICPA and 42 C.F.R. § 83.13(c)(3). Under these requirements, if it is not feasible to estimate with sufficient accuracy radiation doses for members of the class, NIOSH must also determine that there is a reasonable likelihood that such radiation doses may have endangered the health of members of the class. Section 83.13 requires NIOSH to assume that any duration of unprotected exposure may have endangered the health of members of a class when it has been established that the class may have been exposed to radiation during a discrete incident likely to have involved levels of exposure similarly high to those occurring during nuclear criticality incidents. If the occurrence of such an exceptionally high-level exposure has not been established, then NIOSH is required to specify that health was endangered for those workers who were employed for a number of work days aggregating at least 250 work days within the parameters established for the class or in combination with work days within the parameters established for one or more other classes of employees in the SEC.

NIOSH has determined that it lacks sufficient internal monitoring data for the period from January 1, 1955 through December 31, 1960, which prevents evaluating internal dose with sufficient accuracy for the members of the proposed class during this period. NIOSH's evaluation determined that it is not feasible to estimate radiation dose for some members of the NIOSH-evaluated class with sufficient accuracy based on the sum of information available from available resources. Modification of the class definition regarding health endangerment and minimum required employment periods, therefore, is required.

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, evidence indicates that some workers in the proposed class may have accumulated substantial chronic exposures through episodic intakes of radionuclides, combined with external exposures to gamma, beta, and neutron radiation. Consequently, NIOSH is specifying that health was endangered for those workers covered by this evaluation who were employed for a number of work days aggregating at least 250 work days within the parameters established for this class or in combination with work days within the parameters established for one or more other classes of employees in the SEC (excluding aggregate work day requirements).

## **9.0 Class Conclusion for Petition SEC-00151**

Based on its full research of the class under evaluation, NIOSH has defined a single class of employees for which NIOSH cannot estimate radiation doses with sufficient accuracy. The NIOSH-proposed class to be added to the SEC includes all employees of the Department of Energy, its predecessor agencies, and its contractors and subcontractors who worked in the Vanowen Building at the Canoga Avenue Facility, Los Angeles, California, from January 1, 1955 through December 31, 1960, 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. The class under evaluation was modified because NIOSH has



determined that the AEC radiologically-related work performed by Atomics International employees was performed only at the Vanowen Building.

NIOSH has carefully reviewed all material sent in by the petitioner, including the specific assertions stated in the petition, and has responded herein (see Section 7.4). NIOSH has also reviewed available technical resources and many other references, including the Site Research Database (SRDB), for information relevant to SEC-00151. In addition, NIOSH reviewed its NOCTS dose reconstruction database to identify EEOICPA-related dose reconstructions that might provide information relevant to the petition evaluation.

These actions are based on existing, approved NIOSH processes used in dose reconstruction for claims under EEOICPA. NIOSH's guiding principle in conducting these dose reconstructions is to ensure that the assumptions used are fair, consistent, and well-grounded in the best available science. Simultaneously, uncertainties in the science and data must be handled to the advantage, rather than to the detriment, of the petitioners. When adequate personal dose monitoring information is not available, or is very limited, NIOSH may use the highest reasonably possible radiation dose, based on reliable science, documented experience, and relevant data to determine the feasibility of reconstructing the dose of an SEC petition class. NIOSH contends that it has complied with these standards of performance in determining the feasibility or infeasibility of reconstructing dose for the class under evaluation.

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## Attachment 1: Data Capture Synopsis

NOTE: This data capture summary is for all SSFL sites. Data capture took place simultaneously for all SSFL-related sites because all documents at the site are in the same location today, and all FRC/NARA documents are classified by operator history rather than site location.

<b>Table A1-1: Data Capture Synopsis for Canoga Ave. Facility</b>			
<b>Data Capture Information</b>	<b>General Description of Documents Captured</b>	<b>Date Completed</b>	<b>Uploaded</b>
<u>Primary Site/Company Name:</u> Canoga Avenue Facility; DOE 1955-1960 De Soto Avenue Facility; DOE 1959-1995; DOE Remediation 1998 Downey Facility; DOE 1948-1955 <u>Other Site Names:</u> Rocketdyne Atomics International North American Aviation North American Rockwell Rockwell International Boeing	Boeing has possession of the company-maintained records for the Canoga Avenue Facility, De Soto Avenue Facility, and Downey Facility at the Santa Susana Field Laboratory (SSFL). Data Captures have been conducted at SSFL in December 2007, November 2008, September 2009, and November 2009. 21 documents from the September and November 2009 data captures are still undergoing sensitivity and legal reviews. The summary for documents received from SSFL is under SSFL below.	Ongoing	See SSFL below.
<u>State Contacted:</u> Gonzalo Perez, California Department of Public Health, Radiologic Health Branch Judy Hardy, California Department of Public Health, Public Records Coordinator	The state has copied and forwarded California Radioactive Material License 0015, including the original issue and all subsequent amendments. The document package, which includes ancillary information such as Boeing financial reports, is undergoing review for relevant data.	Ongoing	0
Cincinnati Operations Center Library	The design and operational characteristics of a portable instrument calibrator containing 3 mCi of Sr-90 and environmental monitoring following waste disposal at sea.	09/11/2009	2
Cincinnati Public Library	North American Aviation research reports and articles including the disposal of organic moderated reactor wastes by burning, plutonium recycling, processing uranium and thorium fuels, a discussion regarding potential reactor scram techniques, a method for U-238 activation analysis, reports on the L-88 reactor, thorium-uranium fuel for the Sodium Reactor Experiment, the low decontamination method for processing metallic reactor fuels containing thorium, and a review of three cohort studies of cancer mortality among Rocketdyne workers.	10/28/2009	13
DOE Legacy Management - Grand Junction Office	Correspondence regarding 6% enriched uranium sent to Atomics International in 1958 and a 1987 update on FUSRAP actions.	11/15/2008	3

<b>Table A1-1: Data Capture Synopsis for Canoga Ave. Facility</b>			
<b>Data Capture Information</b>	<b>General Description of Documents Captured</b>	<b>Date Completed</b>	<b>Uploaded</b>
DOE Legacy Management - MoundView (Fernald Holdings, includes Fernald Legal Database)	DOE correspondence regarding potential mixed waste shipments to the Nevada Test Site, operating procedure for a Fernald production run of slugs for North American Aviation, the nationwide survey of normal uranium scrap, and a New Brunswick Laboratory proposed work program for 1953-1954 which includes analyzing the boron concentration in heavy water for North American Aviation.	05/21/2008	7
DOE Office of Scientific and Technical Information (OSTI)	A 1961 survey of irradiation facilities. The results of the OSTI search of their non-publicly available holdings for the Downey Facility has been forwarded to Objective 4. The OSTI search did not turn up documents for the Canoga Avenue and De Soto Avenue Facilities.	Ongoing	1
Federal Records Center, San Bruno	A 1984 environmental report, appraisals of the occupational medical program, a report of radiation exposures during chest x-rays, and a 1969 appraisal of the industrial hygiene program.	09/15/2009	9
Internet - DOE Comprehensive Epidemiologic Data Resource (CEDR)	The executive summary from and appendices to the Rocketdyne worker health study, a brief publication explaining the study, and an article from <u>Radiation Research</u> which presented the Boice study.	11/10/2009	3
Internet - DOE Hanford Declassified Document Retrieval System (DDRS)	A 1956 report which indicates that Hanford was testing sodium for the Sodium Reactor Experiment.	11/10/2009	1 Added through site association review.
Internet - DOE OpenNet	AEC reports to Congress.	11/10/2009	2 Added through site association review.
Internet - DOE OSTI Energy Citations	A test of NTA film to fast neutrons, gamma and neutron streaming from the Sodium Reactor Experiment, 1960 environmental report, 1992 hot lab decommissioning report, pathway analysis for soil remediation, and testing of the Hallam reactor core components for releases during maintenance.	11/10/2009	7



<b>Table A1-1: Data Capture Synopsis for Canoga Ave. Facility</b>			
<b>Data Capture Information</b>	<b>General Description of Documents Captured</b>	<b>Date Completed</b>	<b>Uploaded</b>
Internet - DOE OSTI Information Bridge	The summary of FY 1964 AEC radioisotope shipments, hot lab decommissioning annual reports, the verification survey of Building 4059, reports on sodium-graphite reactor technology, sodium component test installation reports, Organic Moderated Reactor reports, Sodium-Graphite Reactor fuel test reports, uranium-molybdenum studies for the Hallam reactor, SNAP reactor studies, and shielding and coolant system maintenance studies for the Sodium Reactor Experiment.	11/14/2009	116
Internet - ETEC Website	A UCLA epidemiologic study and environmental reports.	09/03/2009	4
Internet - Google	An aerial radiological survey, a dose reconstruction methodology, histories of the Canoga Avenue, De Soto Avenue, and Downey Facilities, a survey of the De Soto gamma irradiation facility, environmental reports, federal facility review, incident reports, news articles, verification survey reports, progress reports, an NRC inspection report, depleted uranium waste disposal alternatives, a DOE press release summarizing the State of California epidemiologic study, and an article which describes and summarizes the UCLA epidemiologic study.	11/14/2009	90
Internet - National Academies Press (NAP)	No relevant data identified.	11/10/2009	0
Internet - National Nuclear Security Administration (NNSA) - Nevada Site Office	No relevant data identified.	11/10/2009	0
Internet - NRC Agencywide Document Access and Management (ADAMS)	Special Nuclear Materials Licenses SNM-21 and SNM-33 with correspondence, byproduct material licenses and applications, the list of documents provided in response to FOIA request FOIA/PA-207-0262, and the feasibility report for the manufacture of 164 19% enriched pins for the Sodium Reactor Experiment test program.	11/14/2009	23
Internet - Washington State University (U.S. Transuranium and Uranium Registries)	A poster session regarding the longevity of workers exposed to plutonium.	11/10/2009	1
NARA Atlanta	A 1952 request for one kilogram of UF <sub>4</sub> from Oak Ridge National Laboratory.	05/20/2008	1

<b>Table A1-1: Data Capture Synopsis for Canoga Ave. Facility</b>			
<b>Data Capture Information</b>	<b>General Description of Documents Captured</b>	<b>Date Completed</b>	<b>Uploaded</b>
Santa Susana Field Laboratory (SSFL)	Environmental reports, annual reviews of radiation controls, radiation survey reports, effluent monitoring reports, radiation surveys of the Canoga diagnostic x-ray facility, routine room surveys, access controls for the x-ray cells, California Radioactive Material License 0273-59, the wound monitoring procedure, facility maps, urinalysis results, annual radiation exposure reports, waste operations procedures, radiological controls manual and procedures, some amendments from California Radioactive Material License 0015, Building 001 plan, radiation safety reviews, L-77 Reactor surveys, air sample data, and raw environmental data.	12/22/2009, pending the delivery of the remaining 21 documents undergoing review.	160
<b>TOTAL</b>			<b>443</b>

<b>Table A1-2: Database Searches for Canoga Ave. Facility</b>			
<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
DOE CEDR <a href="http://cedr.lbl.gov/">http://cedr.lbl.gov/</a> COMPLETED 11/10/2009	"North American Aviation" Rocketdyne "Atomics International" "North American Rockwell" "Rockwell International" "United Technologies" Downey (Key Word) De Soto (Key Word)	13	3
DOE Hanford DDRS <a href="http://www2.hanford.gov/declass/">http://www2.hanford.gov/declass/</a> COMPLETED 11/10/2009	"North American Aviation" 01/01/1955 - 08/21/2009 "Rocketdyne" +Canoga 01/01/1955 - 08/21/2009 "Atomics International" "North American Rockwell" 01/01/1955 - 08/23/2009 "Rockwell International" 01/01/1955 - 08/28/2009 "United Technologies" 01/01/1955 - 08/28/2010 "Rocketdyne" +"Vanowen" 01/01/1955 - 08/28/2010 Downey or "De Soto" (Simple Search)	0	0

<b>Table A1-2: Database Searches for Canoga Ave. Facility</b>			
<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
DOE OpenNet <a href="http://www.osti.gov/opennet/advancedsearch.jsp">http://www.osti.gov/opennet/advancedsearch.jsp</a> COMPLETED 11/10/2009	"North American Aviation" +"Canoga" 01/01/1955 - 08/15/2009 "North American Aviation" +Vanowen 01/01/1955 - 08/21/2009 "Rocketdyne" +Canoga 01/01/1955 - 08/21/2009 "Rocketdyne" +Vanowen 01/01/1955 - 08/21/2009 "Atomics International" +Canoga 01/01/1955 - 08/23/2009 "Atomics International" +Vanowen 01/01/1955 - 08/23/2009 "North American Rockwell" +Canoga 01/01/1955 - 08/23/2009 "North American Rockwell" +Vanowen 01/01/1955 - 08/23/2009 "Rockwell International" +"Canoga" 01/01/1955 - 08/28/2009 "Rockwell International" +"Vanowen" 01/01/1955 - 08/28/2009 "United Technologies" +"Canoga" 01/01/1955 - 08/28/2010 "United Technologies" +"Vanowen" 01/01/1955 - 08/28/2010 Downey or "De Soto" (Full Text)	154	0
DOE OSTI Energy Citations <a href="http://www.osti.gov/energycitations/">http://www.osti.gov/energycitations/</a> COMPLETED 11/10/2009	"North American Aviation" +"Canoga" 01/01/1955 - 08/09/2009 "North American Aviation" +Vanowen 01/01/1955 - 08/21/2009 "Rocketdyne" +Canoga 01/01/1955 - 08/21/2009 "Rocketdyne" +Vanowen 01/01/1955 - 08/21/2009 "Atomics International" +Canoga 01/01/1955 - 08/22/2009 "Atomics International" +Vanowen 01/01/1955 - 08/23/2009 "North American Rockwell" +Canoga 01/01/1955 - 08/23/2009 "North American Rockwell" +Vanowen 01/01/1955 - 08/23/2009 "Rockwell International" +"Canoga" 01/01/1955 - 08/28/2009 "Rockwell International" +"Vanowen" 01/01/1955 - 08/28/2009 "United Technologies" +"Canoga" 01/01/1955 - 08/28/2010 "United Technologies" +"Vanowen" 01/01/1955 - 08/28/2010 Downey or "De Soto" (all fields)	10,442	7
DOE OSTI Information Bridge <a href="http://www.osti.gov/bridge/advancedsearch.jsp">http://www.osti.gov/bridge/advancedsearch.jsp</a> COMPLETED 11/14/2009	"North American Aviation" +"Canoga" 01/01/1955 - 08/09/2009 "North American Aviation" +Vanowen 01/01/1955 - 08/21/2009 "Rocketdyne" +Canoga 01/01/1955 - 08/21/2009 "Rocketdyne" +Vanowen 01/01/1955 - 08/21/2009 "Atomics International" +Canoga 01/01/1955 - 08/21/2009 "Atomics International" +Vanowen 01/01/1955 - 08/23/2009 "North American Rockwell" +Canoga 01/01/1955 - 08/23/2009 "North American Rockwell" +Vanowen 01/01/1955 - 08/23/2009 "Rockwell International" +"Canoga" 01/01/1955 - 08/28/2009 "Rockwell International" +"Vanowen" 01/01/1955 - 08/28/2009	2,319	116

<b>Table A1-2: Database Searches for Canoga Ave. Facility</b>			
<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
DOE OSTI Information Bridge (cont.)	"United Technologies" +"Canoga" 01/01/1955 - 08/28/2010 "United Technologies" +"Vanowen" 01/01/1955 - 08/28/2010 Downey or "De Soto" (all fields)		
Google http://www.google.com COMPLETED 11/14/2009	"North American Aviation" "Canoga" OR "Vanowen" "americium OR Am241 OR Am-241 OR Am 241 OR 241Am OR 241-Am OR "241 Am" OR ionium OR Th230 OR Th-230 OR "Th 230" OR 230Th OR 230-Th OR "230 Th"  "North American Aviation" "Canoga" OR "Vanowen" "neptunium OR Np237 OR Np-237 OR "Np 237" OR 237Np OR 237-Np OR "237 Np" OR palm OR palmolive OR polonium OR Po210 OR Po-210 OR "Po 210" OR 210Po OR 210-Po OR "210 Po"  "North American Aviation" "Canoga" OR "Vanowen" "thorium OR thoria OR Th232 OR Th-232 OR "Th 232" OR 232Th OR 232-Th OR "232 Th" OR "Z metal" OR Z-metal OR myrnalloy OR "chemical 10-66" OR "chemical 1066" OR "chemical 10 66"  "North American Aviation" "Canoga" OR "Vanowen" "chemical 18-12" OR "chemical 1812" OR "chemical 18 12" OR "chemical 10-12" OR "chemical 1012" OR "chemical 10 12" OR UX1 OR UX2"  "North American Aviation" "Canoga" OR "Vanowen" "Th-234 OR Th234 OR "Th 234" OR 234-Th OR 234Th OR "234 Th" OR tritium OR H3 OR H-3 OR mint OR HTO"  "North American Aviation" "Canoga" OR "Vanowen" "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 OR 235U OR "235 U"  "North American Aviation" "Canoga" OR "Vanowen" "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 "black oxide" OR "brown oxide" OR "green salt" OR "orange oxide" OR "yellow cake"	2,183,873	90

Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>"North American Aviation" "Canoga" OR "Vanowen" "UO2 OR UO3 OR UF4 OR UF6 OR C-216 OR C-616 OR C-65 OR C-211 OR U3O8 OR "uranium extraction" OR "uranium dioxide" OR "uranium hexafluoride" OR "uranium tetrafluoride" OR "uranium trioxide"</p> <p>"North American Aviation" "Canoga" OR "Vanowen" "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"</p> <p>"North American Aviation" "Canoga" OR "Vanowen" "239 Pu" OR 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"</p> <p>"North American Aviation" "Canoga" OR "Vanowen" "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" OR radon OR Rn-222 OR Rn222 OR "Rn 222" OR 222Rn OR 222-Rn"</p> <p>"North American Aviation" "Canoga" OR "Vanowen" "222 Rn" OR thoron OR Rn-220 OR Rn220 OR "Rn 220" OR 220Rn OR 220-Rn OR "220 Rn" OR protactinium OR Pa-234m OR Pa234m OR "Pa 234m" OR 234mPa OR 234m-Pa OR "234m Pa"</p> <p>"North American Aviation" "Canoga" OR "Vanowen" strontium OR Sr-90 OR Sr90 OR "Sr 90" OR 90-Sr OR 90Sr OR "90 Sr" OR oralloys OR postum OR tuballoy OR "uranyl nitrate hexahydrate" OR UNH OR K-65 OR "sump cake"</p> <p>"North American Aviation" "Canoga" OR "Vanowen" accident OR "air count" OR "air dust" OR "air filter" OR "airborne test" OR alpha OR "belgian congo ore" OR beta OR bioassay OR bio-assay OR breath OR "breathing zone" OR BZ</p>		

Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>"North American Aviation" "Canoga" OR "Vanowen" "body burden" OR calibration OR "chest count" OR columnation OR contamination OR curie OR denitration OR "denitration pot" OR derby OR regulus OR "derived air concentration" OR DAC OR dose OR dosimeter</p> <p>"North American Aviation" "Canoga" OR "Vanowen" dosimetric OR dosimetry OR electron OR environment OR "Ether-Water Project" OR exposure OR "exposure investigation" OR "radiation exposure" OR external OR "F machine" OR fecal OR "feed material"</p> <p>"North American Aviation" "Canoga" OR "Vanowen" femptocurie OR film OR fission OR fluoroscopy OR "Formerly Utilized Sites Remedial Action Program" OR FUSRAP OR gamma-ray OR "gamma ray" OR "gas proportional" OR "gaseous diffusion" OR health</p> <p>"North American Aviation" "Canoga" OR "Vanowen" "health instrument" OR "health physics" OR H.I. OR HI OR HP OR "highly enriched uranium" OR HEU OR hydrofluorination OR "in vitro" OR "in vivo"</p> <p>"North American Aviation" "Canoga" OR "Vanowen" incident OR ingestion OR inhalation OR internal OR investigation OR isotope OR isotopic OR "isotopic enrichment" OR "JS Project" OR Landauer OR "liquid scintillation"</p> <p>"North American Aviation" "Canoga" OR "Vanowen" log OR "log sheet" OR "log book" OR "low enriched uranium" OR LEU OR "lung count" OR "maximum permissible concentration" OR MPC OR metallurgy OR microcurie OR millicurie</p> <p>"North American Aviation" "Canoga" OR "Vanowen" "mixed fission product" OR MFP OR monitor OR "air monitoring" OR nanocurie OR "nasal wipe" OR neutron OR "nose wipe" OR nuclear OR Chicago-Nuclear OR "nuclear fuels" OR "nuclear track emulsion type A"</p>		

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<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
	<p>"North American Aviation" "Canoga" OR "Vanowen" NTA OR "occupational radiation exposure" OR occurrence OR "ore concentrate" OR "PC Project" OR permit OR "radiation work permit" OR "safe work permit" OR "special work permit" OR RWP OR SWP</p> <p>"North American Aviation" "Canoga" OR "Vanowen" "phosphate research" OR photon OR picocurie OR pitchblende OR "pocket ion chamber" OR PIC OR problem OR procedure OR radeco OR radiation OR radioactive OR radioactivity OR radiograph OR radiological</p> <p>"North American Aviation" "Canoga" OR "Vanowen" "Radiological Survey Data Sheet" OR RSDS OR radionuclide OR raffinate OR reactor OR respiratory OR "retention schedules" OR roentgen OR sample OR "air sample" OR "dust sample"</p> <p>"North American Aviation" "Canoga" OR "Vanowen" "general area air sample" OR sampling OR "air sampling" OR "dust sampling" OR "general area air sampling" OR "solvent extraction" OR source OR "sealed source" OR spectra OR spectrograph</p> <p>"North American Aviation" "Canoga" OR "Vanowen" spectroscopy OR spectrum OR standard OR operating OR processing OR survey OR "building survey" OR "routine survey" OR "special survey" OR "technical basis" OR "thermal diffusion"</p> <p>"North American Aviation" "Canoga" OR "Vanowen" "thermoluminescent dosimeter" OR TLD OR "Tiger Team" OR "tolerance dose" OR urinalysis OR urine OR "whole body count" OR WBC OR "working level" OR WL OR X-ray OR "X ray" OR Xray</p> <p>"North American Rockwell" "Canoga" OR "Vanowen" americium OR Am241 OR Am-241 OR "Am 241" OR "241Am" OR 241-Am OR "241 Am" OR ionium OR Th230 OR Th-230 OR "Th 230" OR 230Th OR 230-Th OR "230 Th"</p>		

<b>Table A1-2: Database Searches for Canoga Ave. Facility</b>			
<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
	<p>"North American Rockwell" "Canoga" OR "Vanowen" neptunium OR Np237 OR Np-237 OR "Np 237" OR 237Np OR 237-Np OR "237 Np" OR palm OR palmolive OR polonium OR Po210 OR Po-210 OR "Po 210" OR 210Po OR 210-Po OR "210 Po"</p> <p>"North American Rockwell" "Canoga" OR "Vanowen" thorium OR thoria OR Th232 OR Th-232 OR "Th 232" OR 232Th OR 232-Th OR "232 Th" OR "Z metal" OR Z-metal OR myrnalloy OR "chemical 10-66" OR "chemical 1066" OR "chemical 10 66"</p> <p>"North American Rockwell" "Canoga" OR "Vanowen" "chemical 18-12" OR "chemical 1812" OR "chemical 18 12" OR "chemical 10-12" OR "chemical 1012" OR "chemical 10 12" OR UX1 OR UX2</p> <p>"North American Rockwell" "Canoga" OR "Vanowen" Th-234 OR Th234 OR "Th 234" OR 234-Th OR 234Th OR "234 Th" OR tritium OR H3 OR H-3 OR mint OR HTO</p> <p>"North American Rockwell" "Canoga" OR "Vanowen" 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 OR 235U OR "235 U"</p> <p>"North American Rockwell" "Canoga" OR "Vanowen" 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 "black oxide" OR "brown oxide" OR "green salt"</p> <p>"North American Rockwell" "Canoga" OR "Vanowen""orange oxide" OR "yellow cake"</p> <p>"North American Rockwell" "Canoga" OR "Vanowen" femptocurie OR film OR fission OR fluoroscopy OR "Formerly Utilized Sites Remedial Action Program" OR FUSRAP OR gamma-ray OR "gamma ray" OR "gas proportional" OR "gaseous diffusion" OR health</p>		



<b>Table A1-2: Database Searches for Canoga Ave. Facility</b>			
<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
	<p>"North American Rockwell" "Canoga" OR "Vanowen" "health instrument" OR "health physics" OR H.I. OR HI OR HP OR "highly enriched uranium" OR HEU OR hydrofluorination OR "in vitro" OR "in vivo"</p> <p>"North American Rockwell" "Canoga" OR "Vanowen" incident OR ingestion OR inhalation OR internal OR investigation OR isotope OR isotopic OR "isotopic enrichment" OR "JS Project" OR Landauer OR "liquid scintillation"</p> <p>"North American Rockwell" "Canoga" OR "Vanowen" log OR "log sheet" OR "log book" OR "low enriched uranium" OR LEU OR "lung count" OR "maximum permissible concentration" OR MPC OR metallurgy OR microcurie OR millicurie</p> <p>"North American Rockwell" "Canoga" OR "Vanowen" "mixed fission product" OR MFP OR monitor OR "air monitoring" OR nanocurie OR "nasal wipe" OR neutron OR "nose wipe" OR nuclear OR Chicago-Nuclear OR "nuclear fuels" OR "nuclear track emulsion type A"</p> <p>"North American Rockwell" "Canoga" OR "Vanowen" NTA OR "occupational radiation exposure" OR occurrence OR "ore concentrate" OR "PC Project" OR permit OR "radiation work permit" OR "safe work permit" OR "special work permit" OR RWP OR SWP</p> <p>"North American Rockwell" "Canoga" OR "Vanowen" "phosphate research" OR photon OR picocurie OR pitchblende OR "pocket ion chamber" OR PIC OR problem OR procedure OR radeco OR radiation OR radioactive OR radioactivity OR radiograph OR radiological</p> <p>"North American Rockwell" "Canoga" OR "Vanowen" "Radiological Survey Data Sheet" OR RSDS OR radionuclide OR raffinate OR reactor OR respiratory OR "retention schedules" OR roentgen OR sample OR "air sample" OR "dust sample"</p>		

Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>"North American Rockwell" "Canoga" OR "Vanowen" "general area air sample" OR sampling OR "air sampling" OR "dust sampling" OR "general area air sampling" OR "solvent extraction" OR source OR "sealed source" OR spectra OR spectrograph</p> <p>"North American Rockwell" "Canoga" OR "Vanowen" spectroscopy OR spectrum OR standard OR operating OR processing OR survey OR "building survey" OR "routine survey" OR "special survey" OR "technical basis" OR "thermal diffusion"</p> <p>"North American Rockwell" "Canoga" OR "Vanowen" "thermoluminescent dosimeter" OR TLD OR "Tiger Team" OR "tolerance dose" OR urinalysis OR urine OR "whole body count" OR WBC OR "working level" OR WL OR X-ray OR "X ray" OR Xray</p> <p>"Rocketdyne" "Canoga" OR "Vanowen"americium OR Am241 OR Am-241 OR "Am 241" OR "241Am" OR 241-Am OR "241 Am" OR ionium OR Th230 OR Th-230 OR "Th 230" OR 230Th OR 230-Th OR "230 Th"</p> <p>"Rocketdyne" "Canoga" OR "Vanowen"neptunium OR Np237 OR Np-237 OR "Np 237" OR 237Np OR 237-Np OR "237 Np" OR palm OR palmolive OR polonium OR Po210 OR Po-210 OR "Po 210" OR 210Po OR 210-Po OR "210 Po"</p> <p>"Rocketdyne" "Canoga" OR "Vanowen"thorium OR thoria OR Th232 OR Th-232 OR "Th 232" OR 232Th OR 232-Th OR "232 Th" OR "Z metal" OR Z-metal OR myrnalloy OR "chemical 10-66" OR "chemical 1066" OR "chemical 10 66"</p> <p>"Rocketdyne" "Canoga" OR "Vanowen""chemical 18-12" OR "chemical 1812" OR "chemical 18 12" OR "chemical 10-12" OR "chemical 1012" OR "chemical 10 12" OR UX1 OR UX2</p>		

Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>"Rocketdyne" "Canoga" OR "Vanowen"Th-234 OR Th234 OR "Th 234" OR 234-Th OR 234Th OR "234 Th" OR tritium OR H3 OR H-3 OR mint OR HTO</p> <p>"Rocketdyne" "Canoga" OR "Vanowen"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 OR 235U OR "235 U"</p> <p>"Rocketdyne" "Canoga" OR "Vanowen"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 "black oxide" OR "brown oxide" OR "green salt" OR "orange oxide" OR "yellow cake"</p> <p>"Rocketdyne" "Canoga" OR "Vanowen"UO2 OR UO3 OR UF4 OR UF6 OR C-216 OR C-616 OR C-65 OR C-211 OR U308 OR "uranium extraction" OR "uranium dioxide" OR "uranium hexafluoride" OR "uranium tetrafluoride" OR "uranium trioxide"</p> <p>"Rocketdyne" "Canoga" OR "Vanowen"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</p> <p>"Rocketdyne" "Canoga" OR "Vanowen" "239 Pu" OR 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"</p> <p>"Rocketdyne" "Canoga" OR "Vanowen"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" OR radon OR Rn-222 OR Rn222 OR "Rn 222" OR 222Rn OR 222-Rn</p> <p>"Rocketdyne" "Canoga" OR "Vanowen""222 Rn" OR thoron OR Rn-220 OR Rn220 OR "Rn 220" OR 220Rn OR 220-Rn OR "220 Rn" OR protactinium OR Pa-234m OR Pa234m OR "Pa 234m" OR 234mPa OR 234m-Pa OR "234m Pa"</p>		

Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>"Rocketdyne" "Canoga" OR "Vanowen"strontium OR Sr-90 OR Sr90 OR "Sr 90" OR 90-Sr OR 90Sr OR "90 Sr" OR oralloy OR postum OR tuballoy OR "uranyl nitrate hexahydrate" OR UNH OR K-65 OR "sump cake"</p> <p>"Rocketdyne" "Canoga" OR "Vanowen"accident OR "air count" OR "air dust" OR "air filter" OR "airborne test" OR alpha OR "belgian congo ore" OR beta OR bioassay OR bio-assay OR breath OR "breathing zone" OR BZ</p> <p>"Rocketdyne" "Canoga" OR "Vanowen""body burden" OR calibration OR "chest count" OR columnation OR contamination OR curie OR denitration OR "denitration pot" OR derby OR regulus OR "derived air concentration" OR DAC OR dose OR dosimeter</p> <p>"Rocketdyne" "Canoga" OR "Vanowen"dosimetric OR dosimetry OR electron OR environment OR "Ether-Water Project" OR exposure OR "exposure investigation" OR "radiation exposure" OR external OR "F machine" OR fecal OR "feed material"</p> <p>"Rocketdyne" "Canoga" OR "Vanowen"femptocurie OR film OR fission OR fluoroscopy OR "Formerly Utilized Sites Remedial Action Program" OR FUSRAP OR gamma-ray OR "gamma ray" OR "gas proportional" OR "gaseous diffusion" OR health</p> <p>"Rocketdyne" "Canoga" OR "Vanowen""health instrument" OR "health physics" OR H.I. OR HI OR HP OR "highly enriched uranium" OR HEU OR hydrofluorination OR "in vitro" OR "in vivo"</p> <p>"Rocketdyne" "Canoga" OR "Vanowen" incident OR ingestion OR inhalation OR internal OR investigation OR isotope OR isotopic OR "isotopic enrichment" OR "JS Project" OR Landauer OR "liquid scintillation"</p>		

Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>"Rocketdyne" "Canoga" OR "Vanowen"og OR "log sheet" OR "log book" OR "low enriched uranium" OR LEU OR "lung count" OR "maximum permissible concentration" OR MPC OR metallurgy OR microcurie OR millicurie</p> <p>"Rocketdyne" "Canoga" OR "Vanowen""mixed fission product" OR MFP OR monitor OR "air monitoring" OR nanocurie OR "nasal wipe" OR neutron OR "nose wipe" OR nuclear OR Chicago-Nuclear OR "nuclear fuels" OR "nuclear track emulsion type A"</p> <p>"Rocketdyne" "Canoga" OR "Vanowen"NTA OR "occupational radiation exposure" OR occurrence OR "ore concentrate" OR "PC Project" OR permit OR "radiation work permit" OR "safe work permit" OR "special work permit" OR RWP OR SWP</p> <p>"Rocketdyne" "Canoga" OR "Vanowen""phosphate research" OR photon OR picocurie OR pitchblende OR "pocket ion chamber" OR PIC OR problem OR procedure OR radeco OR radiation OR radioactive OR radioactivity OR radiograph OR radiological</p> <p>"Rocketdyne" "Canoga" OR "Vanowen""Radiological Survey Data Sheet" OR RSDS OR radionuclide OR raffinate OR reactor OR respiratory OR "retention schedules" OR roentgen OR sample OR "air sample" OR "dust sample"</p> <p>"Rocketdyne" "Canoga" OR "Vanowen""general area air sample" OR sampling OR "air sampling" OR "dust sampling" OR "general area air sampling" OR "solvent extraction" OR source OR "sealed source" OR spectra OR spectrograph</p> <p>"Rocketdyne" "Canoga" OR "Vanowen"spectroscopy OR spectrum OR standard OR operating OR processing OR survey OR "building survey" OR "routine survey" OR "special survey" OR "technical basis" OR "thermal diffusion"</p>		

Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
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Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>"Atomics International" "Canoga" OR "Vanowen" 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 "black oxide" OR "brown oxide" OR "green salt" OR "orange oxide" OR "yellow cake"</p> <p>"Atomics International" "Canoga" OR "Vanowen" UO2 OR UO3 OR UF4 OR UF6 OR C-216 OR C-616 OR C-65 OR C-211 OR U308 OR "uranium extraction" OR "uranium dioxide" OR "uranium hexafluoride" OR "uranium tetrafluoride" OR "uranium trioxide"</p> <p>"Atomics International" "Canoga" OR "Vanowen" 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</p> <p>"Atomics International" "Canoga" OR "Vanowen" "239 Pu" OR 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"</p> <p>"Atomics International" "Canoga" OR "Vanowen" 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" OR radon OR Rn-222 OR Rn222</p> <p>"Atomics International" "Canoga" OR "Vanowen" "Rn 222" OR 222Rn OR 222-Rn</p> <p>"Atomics International" "Canoga" OR "Vanowen" "222 Rn" OR thoron OR Rn-220 OR Rn220 OR "Rn 220" OR 220Rn OR 220-Rn OR "220 Rn" OR protactinium OR Pa-234m OR Pa234m OR "Pa 234m" OR 234mPa OR 234m-Pa OR "234m Pa"</p> <p>"Atomics International" "Canoga" OR "Vanowen" strontium OR Sr-90 OR Sr90 OR "Sr 90" OR 90-Sr OR 90Sr OR "90 Sr" OR oralloy OR postum OR tuballoy OR "uranyl nitrate hexahydrate" OR UNH OR K-65 OR "sump cake"</p>		

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Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>"Rockwell International" "Canoga" OR "Vanowen"UO2 OR UO3 OR UF4 OR UF6 OR C-216 OR C-616 OR C-65 OR C-211 OR U3O8 OR "uranium extraction" OR "uranium dioxide" OR "uranium hexafluoride" OR "uranium tetrafluoride" OR "uranium trioxide"</p> <p>"Rockwell International" "Canoga" OR "Vanowen"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</p> <p>"Rockwell International" "Canoga" OR "Vanowen""239 Pu" OR 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"</p> <p>"Rockwell International" "Canoga" OR "Vanowen"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" OR radon OR Rn-222 OR Rn222 OR "Rn 222" OR 222Rn OR 222-Rn</p> <p>"Rockwell International" "Canoga" OR "Vanowen""222 Rn" OR thoron OR Rn-220 OR Rn220 OR "Rn 220" OR 220Rn OR 220-Rn OR "220 Rn" OR protactinium OR Pa-234m OR Pa234m OR "Pa 234m" OR 234mPa OR 234m-Pa OR "234m Pa"</p> <p>"Rockwell International" "Canoga" OR "Vanowen"strontium OR Sr-90 OR Sr90 OR "Sr 90" OR 90-Sr OR 90Sr OR "90 Sr" OR oralloys OR postum OR tuballoy OR "uranyl nitrate hexahydrate" OR UNH OR K-65 OR "sump cake"</p> <p>"Rockwell International" "Canoga" OR "Vanowen"accident OR "air count" OR "air dust" OR "air filter" OR "airborne test" OR alpha OR "belgian congo ore" OR beta OR bioassay OR bio-assay OR breath OR "breathing zone" OR BZ</p>		

Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>"Rockwell International" "Canoga" OR "Vanowen""body burden" OR calibration OR "chest count" OR columnation OR contamination OR curie OR denitration OR "denitration pot" OR derby OR regulus OR "derived air concentration" OR DAC OR dose OR dosimeter</p> <p>"Rockwell International" "Canoga" OR "Vanowen"dosimetric OR dosimetry OR electron OR environment OR "Ether-Water Project" OR exposure OR "exposure investigation" OR "radiation exposure" OR external OR "F machine" OR fecal OR "feed material"</p> <p>"Rockwell International" "Canoga" OR "Vanowen"femptocurie OR film OR fission OR fluoroscopy OR "Formerly Utilized Sites Remedial Action Program" OR FUSRAP OR gamma-ray OR "gamma ray" OR "gas proportional" OR "gaseous diffusion" OR health</p> <p>"Rockwell International" "Canoga" OR "Vanowen""health instrument" OR "health physics" OR H.I. OR HI OR HP OR "highly enriched uranium" OR HEU OR hydrofluorination OR "in vitro" OR "in vivo"</p> <p>"Rockwell International" "Canoga" OR "Vanowen"incident OR ingestion OR inhalation OR internal OR investigation OR isotope OR isotopic OR "isotopic enrichment" OR "JS Project" OR Landauer OR "liquid scintillation"</p> <p>"Rockwell International" "Canoga" OR "Vanowen"log OR "log sheet" OR "log book" OR "low enriched uranium" OR LEU OR "lung count" OR "maximum permissible concentration" OR MPC OR metallurgy OR microcurie OR millicurie</p> <p>"Rockwell International" "Canoga" OR "Vanowen""mixed fission product" OR MFP OR monitor OR "air monitoring" OR nanocurie OR "nasal wipe" OR neutron OR "nose wipe" OR nuclear OR Chicago-Nuclear OR "nuclear fuels" OR "nuclear track emulsion type A"</p>		

Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>"Rockwell International" "Canoga" OR "Vanowen"NTA OR "occupational radiation exposure" OR occurrence OR "ore concentrate" OR "PC Project" OR permit OR "radiation work permit" OR "safe work permit" OR "special work permit" OR RWP OR SWP</p> <p>"Rockwell International" "Canoga" OR "Vanowen""phosphate research" OR photon OR picocurie OR pitchblende OR "pocket ion chamber" OR PIC OR problem OR procedure OR radeco OR radiation OR radioactive OR radioactivity OR radiograph OR radiological</p> <p>"Rockwell International" "Canoga" OR "Vanowen""Radiological Survey Data Sheet" OR RSDS OR radionuclide OR raffinate OR reactor OR respiratory OR "retention schedules" OR roentgen OR sample OR "air sample" OR "dust sample"</p> <p>"Rockwell International" "Canoga" OR "Vanowen""general area air sample" OR sampling OR "air sampling" OR "dust sampling" OR "general area air sampling" OR "solvent extraction" OR source OR "sealed source" OR spectra OR spectrograph</p> <p>"Rockwell International" "Canoga" OR "Vanowen"spectroscopy OR spectrum OR standard OR operating OR processing OR survey OR "building survey" OR "routine survey" OR "special survey" OR "technical basis" OR "thermal diffusion"</p> <p>"Rockwell International" "Canoga" OR "Vanowen""thermoluminescent dosimeter" OR TLD OR "Tiger Team" OR "tolerance dose" OR urinalysis OR urine OR "whole body count" OR WBC OR "working level" OR WL OR X-ray OR "X ray" OR Xray</p> <p>"United Technologies" "Canoga" OR "Vanowen"americium OR Am241 OR Am-241 OR "Am 241" OR "241Am" OR 241-Am OR "241 Am" OR ionium OR Th230 OR Th-230 OR "Th 230" OR 230Th OR 230-Th OR "230 Th"</p>		

Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>"United Technologies" "Canoga" OR "Vanowen"neptunium OR Np237 OR Np-237 OR "Np 237" OR 237Np OR 237-Np OR "237 Np" OR palm OR palmolive OR polonium OR Po210 OR Po-210 OR "Po 210" OR 210Po OR 210-Po OR "210 Po"</p> <p>"United Technologies" "Canoga" OR "Vanowen"thorium OR thoria OR Th232 OR Th-232 OR "Th 232" OR 232Th OR 232-Th OR "232 Th" OR "Z metal" OR Z-metal OR myrnalloy OR "chemical 10-66" OR "chemical 1066" OR "chemical 10 66"</p> <p>"United Technologies" "Canoga" OR "Vanowen""chemical 18-12" OR "chemical 1812" OR "chemical 18 12" OR "chemical 10-12" OR "chemical 1012" OR "chemical 10 12" OR UX1 OR UX2</p> <p>"United Technologies" "Canoga" OR "Vanowen"Th-234 OR Th234 OR "Th 234" OR 234-Th OR 234Th OR "234 Th" OR tritium OR H3 OR H-3 OR mint OR HTO</p> <p>"United Technologies" "Canoga" OR "Vanowen"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 OR 235U OR "235 U"</p> <p>"United Technologies" "Canoga" OR "Vanowen"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 "black oxide" OR "brown oxide" OR "green salt" OR "orange oxide" OR "yellow cake"</p> <p>"United Technologies" "Canoga" OR "Vanowen"UO2 OR UO3 OR UF4 OR UF6 OR C-216 OR C-616 OR C-65 OR C-211 OR U3O8 OR "uranium extraction" OR "uranium dioxide" OR "uranium hexafluoride" OR "uranium tetrafluoride" OR "uranium trioxide"</p>		

Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>"United Technologies" "Canoga" OR "Vanowen"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</p> <p>"United Technologies" "Canoga" OR "Vanowen""239 Pu" OR 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"</p> <p>"United Technologies" "Canoga" OR "Vanowen"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" OR radon OR Rn-222 OR Rn222 OR "Rn 222" OR 222Rn OR 222-Rn</p> <p>"United Technologies" "Canoga" OR "Vanowen""222 Rn" OR thoron OR Rn-220 OR Rn220 OR "Rn 220" OR 220Rn OR 220-Rn OR "220 Rn" OR protactinium OR Pa-234m OR Pa234m OR "Pa 234m" OR 234mPa OR 234m-Pa OR "234m Pa"</p> <p>"United Technologies" "Canoga" OR "Vanowen"strontium OR Sr-90 OR Sr90 OR "Sr 90" OR 90-Sr OR 90Sr OR "90 Sr" OR or alloy OR postum OR tuballoy OR "uranyl nitrate hexahydrate" OR UNH OR K-65 OR "sump cake"</p> <p>"United Technologies" "Canoga" OR "Vanowen"accident OR "air count" OR "air dust" OR "air filter" OR "airborne test" OR alpha OR "belgian congo ore" OR beta OR bioassay OR bio-assay OR breath OR "breathing zone" OR BZ</p> <p>"United Technologies" "Canoga" OR "Vanowen""body burden" OR calibration OR "chest count" OR columnation OR contamination OR curie OR denitration OR "denitration pot" OR derby OR regulus OR "derived air concentration" OR DAC OR dose OR dosimeter</p>		

<b>Table A1-2: Database Searches for Canoga Ave. Facility</b>			
<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
	<p>"United Technologies" "Canoga" OR "Vanowen"dosimetric OR dosimetry OR electron OR environment OR "Ether-Water Project" OR exposure OR "exposure investigation" OR "radiation exposure" OR external OR "F machine" OR fecal OR "feed material"</p> <p>"United Technologies" "Canoga" OR "Vanowen"femtpocurie OR film OR fission OR fluoroscopy OR "Formerly Utilized Sites Remedial Action Program" OR FUSRAP OR gamma-ray OR "gamma ray" OR "gas proportional" OR "gaseous diffusion" OR health</p> <p>"United Technologies" "Canoga" OR "Vanowen""health instrument" OR "health physics" OR H.I. OR HI OR HP OR "highly enriched uranium" OR HEU OR hydrofluorination OR "in vitro" OR "in vivo"</p> <p>"United Technologies" "Canoga" OR "Vanowen"incident OR ingestion OR inhalation OR internal OR investigation OR isotope OR isotopic OR "isotopic enrichment" OR "JS Project" OR Landauer OR "liquid scintillation"</p> <p>"United Technologies" "Canoga" OR "Vanowen"log OR "log sheet" OR "log book" OR "low enriched uranium" OR LEU OR "lung count" OR "maximum permissible concentration" OR MPC OR metallurgy OR microcurie OR millicurie</p> <p>"United Technologies" "Canoga" OR "Vanowen""mixed fission product" OR MFP OR monitor OR "air monitoring" OR nanocurie OR "nasal wipe" OR neutron OR "nose wipe" OR nuclear OR Chicago-Nuclear OR "nuclear fuels" OR "nuclear track emulsion type A"</p> <p>"United Technologies" "Canoga" OR "Vanowen"NTA OR "occupational radiation exposure" OR occurrence OR "ore concentrate" OR "PC Project" OR permit OR "radiation work permit" OR "safe work permit" OR "special work permit" OR RWP OR SWP</p>		



Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>"United Technologies" "Canoga" OR "Vanowen""phosphate research" OR photon OR picocurie OR pitchblende OR "pocket ion chamber" OR PIC OR problem OR procedure OR radeco OR radiation OR radioactive OR radioactivity OR radiograph OR radiological</p> <p>"United Technologies" "Canoga" OR "Vanowen""Radiological Survey Data Sheet" OR RSDS OR radionuclide OR raffinate OR reactor OR respiratory OR "retention schedules" OR roentgen OR sample OR "air sample" OR "dust sample"</p> <p>"United Technologies" "Canoga" OR "Vanowen""general area air sample" OR sampling OR "air sampling" OR "dust sampling" OR "general area air sampling" OR "solvent extraction" OR source OR "sealed source" OR spectra OR spectrograph</p> <p>"United Technologies" "Canoga" OR "Vanowen"spectroscopy OR spectrum OR standard OR operating OR processing OR survey OR "building survey" OR "routine survey" OR "special survey" OR "technical basis" OR "thermal diffusion"</p> <p>"United Technologies" "Canoga" OR "Vanowen""thermoluminescent dosimeter" OR TLD OR "Tiger Team" OR "tolerance dose" OR urinalysis OR urine OR "whole body count" OR WBC OR "working level" OR WL OR X-ray OR "X ray" OR Xray</p> <p>neptunium OR Np237 OR Np-237 OR "Np 237" OR 237Np OR 237-Np OR "237 Np" OR palm OR palmolive OR polonium OR Po210 OR Po-210 OR "Po 210" OR 210Po OR 210-Po OR "210 Po" Downey OR De-Soto "North American Aviation"</p> <p>thorium OR thoria OR Th232 OR Th-232 OR "Th 232" OR 232Th OR 232-Th OR "232 Th" OR "Z metal" OR Z-metal OR myrnalloy OR "chemical 10-66" OR "chemical 1066" OR "chemical 10 66" Downey OR De-Soto "North American Aviation"</p>		

Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>"chemical 18-12" OR "chemical 1812" OR "chemical 18 12" OR "chemical 10-12" OR "chemical 1012" OR "chemical 10 12" OR UX1 OR UX2 Downey OR De-Soto "North American Aviation"</p> <p>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 OR 235U OR "235 U" Downey OR De-Soto "North American Aviation"</p> <p>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" Downey OR De-Soto "North American Aviation"</p> <p>"black oxide" OR "brown oxide" OR "green salt" OR "orange oxide" OR "yellow 5cake" Downey OR De-Soto "North American Aviation"</p> <p>UO2 OR UO3 OR UF4 OR UF6 OR C-216 OR C-616 OR C-65 OR C-211 OR U3O8 OR "uranium extraction" Downey OR De-Soto "North American Aviation"</p> <p>"uranium dioxide" OR "uranium hexafluoride" OR "uranium tetrafluoride" OR "uranium trioxide" Downey OR De-Soto "North American Aviation"</p> <p>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 Downey OR De-Soto "North American Aviation"</p> <p>"239 Pu" OR 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" Downey OR De-Soto "North American Aviation"</p> <p>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 Downey OR De-Soto "North American Aviation"</p>		

Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>228-Ra OR "228 Ra" OR radon OR Rn-222 OR Rn222 OR "Rn 222" OR 222Rn OR 222-Rn Downey OR De-Soto "North American Aviation"</p> <p>"222 Rn" OR thoron OR Rn-220 OR Rn220 OR "Rn 220" OR 220Rn OR 220-Rn OR "220 Rn" OR protactinium OR Pa-234m OR Pa234m OR "Pa 234m" OR 234mPa OR 234m-Pa OR "234m Pa" Downey OR De-Soto "North American Aviation"</p> <p>strontium OR Sr-90 OR Sr90 OR "Sr 90" OR 90-Sr OR 90Sr OR "90 Sr" OR oralloy OR postum OR tuballoy OR "uranyl nitrate hexahydrate" OR UNH OR K-65 OR "sump cake" Downey OR De-Soto "North American Aviation"</p> <p>accident OR "air count" OR "air dust" OR "air filter" OR "airborne test" OR alpha OR "belgian congo ore" OR beta OR bioassay OR bio-assay OR breath OR "breathing zone" OR BZ Downey OR De-Soto "North American Aviation"</p> <p>"body burden" OR calibration OR "chest count" OR columnation OR contamination OR curie OR denitration OR "denitration pot" Downey OR De-Soto "North American Aviation"</p> <p>derby OR regulus OR "derived air concentration" OR DAC OR dose OR dosimeter Downey OR De-Soto "North American Aviation"</p> <p>dosimetric OR dosimetry OR electron OR environment OR "Ether-Water Project" OR exposure OR "exposure investigation" Downey OR De-Soto "North American Aviation"</p> <p>"radiation exposure" OR external OR "F machine" OR fecal OR "feed material" Downey OR De-Soto "North American Aviation"</p> <p>femtocurie OR film OR fission OR fluoroscopy OR "Formerly Utilized Sites Remedial Action Program" OR FUSRAP Downey OR De-Soto "North American Aviation"</p>		

<b>Table A1-2: Database Searches for Canoga Ave. Facility</b>			
<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
	<p>gamma-ray OR "gamma ray" OR "gas proportional" OR "gaseous diffusion" OR health Downey OR De-Soto "North American Aviation"</p> <p>"health instrument" OR "health physics" OR H.I. OR HI OR HP OR "highly enriched uranium" OR HEU OR hydrofluorination OR "in vitro" OR "in vivo" Downey OR De-Soto "North American Aviation"</p> <p>incident OR ingestion OR inhalation OR internal OR investigation OR isotope OR isotopic OR "isotopic enrichment" OR "JS Project" OR Landauer OR "liquid scintillation" Downey OR De-Soto "North American Aviation"</p> <p>log OR "log sheet" OR "log book" OR "low enriched uranium" OR LEU OR "lung count" OR "maximum permissible concentration" OR MPC OR metallurgy OR microcurie OR millicurie Downey OR De-Soto "North American Aviation"</p> <p>"mixed fission product" OR MFP OR monitor OR "air monitoring" OR nanocurie OR "nasal wipe" OR neutron OR "nose wipe" Downey OR De-Soto "North American Aviation"</p> <p>nuclear OR Chicago-Nuclear OR "nuclear fuels" OR "nuclear track emulsion type A" Downey OR De-Soto "North American Aviation"</p> <p>NTA OR "occupational radiation exposure" OR occurrence OR "ore concentrate" OR "PC Project" OR permit OR "radiation work permit" Downey OR De-Soto "North American Aviation"</p> <p>"safe work permit" OR "special work permit" OR RWP OR SWP Downey OR De-Soto "North American Aviation"</p> <p>"phosphate research" OR photon OR picocurie OR pitchblende OR "pocket ion chamber" OR PIC OR problem OR procedure Downey OR De-Soto "North American Aviation"</p>		

<b>Table A1-2: Database Searches for Canoga Ave. Facility</b>			
<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
	radeco OR radiation OR radioactive OR radioactivity OR radiograph OR radiological Downey OR De-Soto "North American Aviation"  "Radiological Survey Data Sheet" OR RSDS OR radionuclide OR raffinate OR reactor OR respiratory OR "retention schedules" OR roentgen OR sample OR "air sample" OR "dust sample" Downey OR De-Soto "North American Aviation"  "general area air sample" OR sampling OR "air sampling" OR "dust sampling" OR "general area air sampling" OR "solvent extraction" OR source OR "sealed source" OR spectra Downey OR De-Soto "North American Aviation"  spectrograph OR spectroscopy OR spectrum OR standard OR operating OR processing OR survey OR "building survey" OR "routine survey" OR "special survey" OR "technical basis" Downey OR De-Soto "North American Aviation"  "thermal diffusion" OR "thermoluminescent dosimeter" OR TLD OR "Tiger Team" OR "tolerance dose" OR urinalysis OR urine Downey OR De-Soto "North American Aviation"  "whole body count" OR WBC OR "working level" OR WL OR X-ray OR "X ray" OR Xray Downey OR De-Soto "North American Aviation"  americium OR Am241 OR Am-241 OR "Am 241" OR "241Am" OR 241-Am OR "241 Am" OR ionium OR Th230 OR Th-230 OR "Th 230" OR 230Th OR 230-Th OR "230 Th" Downey OR De-Soto "Rocketdyne"  "chemical 18-12" OR "chemical 1812" OR "chemical 18 12" OR "chemical 10-12" OR "chemical 1012" OR "chemical 10 12" OR UX1 OR UX2 Downey OR De-Soto "Rocketdyne"		

Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>Th-234 OR Th234 OR "Th 234" OR 234-Th OR 234Th OR "234 Th" OR tritium OR H3 OR H-3 OR mint OR HTO Downey OR De-Soto "Rocketdyne"</p> <p>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 OR 235U OR "235 U" Downey OR De-Soto "Rocketdyne"</p> <p>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" Downey OR De-Soto "Rocketdyne"</p> <p>"black oxide" OR "brown oxide" OR "green salt" OR "orange oxide" OR "yellow 5cake" Downey OR De-Soto "Rocketdyne"</p> <p>UO2 OR UO3 OR UF4 OR UF6 OR C-216 OR C-616 OR C-65 OR C-211 OR U3O8 OR "uranium extraction" Downey OR De-Soto "Rocketdyne"</p> <p>"uranium dioxide" OR "uranium hexafluoride" OR "uranium tetrafluoride" OR "uranium trioxide" Downey OR De-Soto "Rocketdyne"</p> <p>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 Downey OR De-Soto "Rocketdyne"</p> <p>"239 Pu" OR 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" Downey OR De-Soto "Rocketdyne"</p> <p>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 Downey OR De-Soto "Rocketdyne"</p>		

<b>Table A1-2: Database Searches for Canoga Ave. Facility</b>			
<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
	<p>228-Ra OR "228 Ra" OR radon OR Rn-222 OR Rn222 OR "Rn 222" OR 222Rn OR 222-Rn Downey OR De-Soto "Rocketdyne"</p> <p>"222 Rn" OR thoron OR Rn-220 OR Rn220 OR "Rn 220" OR 220Rn OR 220-Rn OR "220 Rn" OR protactinium OR Pa-234m OR Pa234m OR "Pa 234m" OR 234mPa OR 234m-Pa OR "234m Pa" Downey OR De-Soto "Rocketdyne"</p> <p>strontium OR Sr-90 OR Sr90 OR "Sr 90" OR 90-Sr OR 90Sr OR "90 Sr" OR oralloid OR postum OR tuballoy OR "uranyl nitrate hexahydrate" OR UNH OR K-65 OR "sump cake" Downey OR De-Soto "Rocketdyne"</p> <p>"body burden" OR calibration OR "chest count" OR columnation OR contamination OR curie OR denitration OR "denitration pot" Downey OR De-Soto "Rocketdyne"</p> <p>derby OR regulus OR "derived air concentration" OR DAC OR dose OR dosimeter Downey OR De-Soto "Rocketdyne"</p> <p>dosimetric OR dosimetry OR electron OR environment OR "Ether-Water Project" OR exposure OR "exposure investigation" Downey OR De-Soto "Rocketdyne"</p> <p>"radiation exposure" OR external OR "F machine" OR fecal OR "feed material" Downey OR De-Soto "Rocketdyne"</p> <p>femtocurie OR film OR fission OR fluoroscopy OR "Formerly Utilized Sites Remedial Action Program" OR FUSRAP Downey OR De-Soto "Rocketdyne"</p> <p>gamma-ray OR "gamma ray" OR "gas proportional" OR "gaseous diffusion" OR health Downey OR De-Soto "Rocketdyne"</p>		

<b>Table A1-2: Database Searches for Canoga Ave. Facility</b>			
<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
	<p>"health instrument" OR "health physics" OR H.I. OR HI OR HP OR "highly enriched uranium" OR HEU OR hydrofluorination OR "in vitro" OR "in vivo" Downey OR De-Soto "Rocketdyne"</p> <p>incident OR ingestion OR inhalation OR internal OR investigation OR isotope OR isotopic OR "isotopic enrichment" OR "JS Project" OR Landauer OR "liquid scintillation" Downey OR De-Soto "Rocketdyne"</p> <p>log OR "log sheet" OR "log book" OR "low enriched uranium" OR LEU OR "lung count" OR "maximum permissible concentration" OR MPC OR metallurgy OR microcurie OR millicurie Downey OR De-Soto "Rocketdyne"</p> <p>"mixed fission product" OR MFP OR monitor OR "air monitoring" OR nanocurie OR "nasal wipe" OR neutron OR "nose wipe" Downey OR De-Soto "Rocketdyne"</p> <p>nuclear OR Chicago-Nuclear OR "nuclear fuels" OR "nuclear track emulsion type A" Downey OR De-Soto "Rocketdyne"</p> <p>NTA OR "occupational radiation exposure" OR occurrence OR "ore concentrate" OR "PC Project" OR permit OR "radiation work permit" Downey OR De-Soto "Rocketdyne"</p> <p>"safe work permit" OR "special work permit" OR RWP OR SWP Downey OR De-Soto "Rocketdyne"</p> <p>"phosphate research" OR photon OR picocurie OR pitchblende OR "pocket ion chamber" OR PIC OR problem OR procedure Downey OR De-Soto "Rocketdyne"</p> <p>radeco OR radiation OR radioactive OR radioactivity OR radiograph OR radiological Downey OR De-Soto "Rocketdyne"</p>		



Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>"Radiological Survey Data Sheet" OR RSDS OR radionuclide OR raffinate OR reactor OR respiratory OR "retention schedules" OR roentgen OR sample OR "air sample" OR "dust sample" Downey OR De-Soto "Rocketdyne"</p> <p>"general area air sample" OR sampling OR "air sampling" OR "dust sampling" OR "general area air sampling" OR "solvent extraction" OR source OR "sealed source" OR spectra Downey OR De-Soto "Rocketdyne"</p> <p>spectrograph OR spectroscopy OR spectrum OR standard OR operating OR processing OR survey OR "building survey" OR "routine survey" OR "special survey" OR "technical basis" Downey OR De-Soto "Rocketdyne"</p> <p>"thermal diffusion" OR "thermoluminescent dosimeter" OR TLD OR "Tiger Team" OR "tolerance dose" OR urinalysis OR urine Downey OR De-Soto "Rocketdyne"</p> <p>"whole body count" OR WBC OR "working level" OR WL OR X-ray OR "X ray" OR Xray Downey OR De-Soto "Rocketdyne"</p> <p>americium OR Am241 OR Am-241 OR "Am 241" OR "241Am" OR 241-Am OR "241 Am" OR ionium OR Th230 OR Th-230 OR "Th 230" OR 230Th OR 230-Th OR "230 Th" Downey OR De-Soto "Atomics International"</p> <p>"chemical 18-12" OR "chemical 1812" OR "chemical 18 12" OR "chemical 10-12" OR "chemical 1012" OR "chemical 10 12" OR UX1 OR UX2 Downey OR De-Soto "Atomics International"</p> <p>Th-234 OR Th234 OR "Th 234" OR 234-Th OR 234Th OR "234 Th" OR tritium OR H3 OR H-3 OR mint OR HTO Downey OR De-Soto "Atomics International"</p>		

Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>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 OR 235U OR "235 U" Downey OR De-Soto "Atomics International"</p> <p>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" Downey OR De-Soto "Atomics International"</p> <p>"black oxide" OR "brown oxide" OR "green salt" OR "orange oxide" OR "yellow 5cake" Downey OR De-Soto "Atomics International"</p> <p>UO2 OR UO3 OR UF4 OR UF6 OR C-216 OR C-616 OR C-65 OR C-211 OR U3O8 OR "uranium extraction" Downey OR De-Soto "Atomics International"</p> <p>"uranium dioxide" OR "uranium hexafluoride" OR "uranium tetrafluoride" OR "uranium trioxide" Downey OR De-Soto "Atomics International"</p> <p>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 Downey OR De-Soto "Atomics International"</p> <p>"239 Pu" OR 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" Downey OR De-Soto "Atomics International"</p> <p>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 Downey OR De-Soto "Atomics International"</p> <p>228-Ra OR "228 Ra" OR radon OR Rn-222 OR Rn222 OR "Rn 222" OR 222Rn OR 222-Rn Downey OR De-Soto "Atomics International"</p>		

<b>Table A1-2: Database Searches for Canoga Ave. Facility</b>			
<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
	<p>"222 Rn" OR thoron OR Rn-220 OR Rn220 OR "Rn 220" OR 220Rn OR 220-Rn OR "220 Rn" OR protactinium OR Pa-234m OR Pa234m OR "Pa 234m" OR 234mPa OR 234m-Pa OR "234m Pa" Downey OR De-Soto "Atomics International"</p> <p>strontium OR Sr-90 OR Sr90 OR "Sr 90" OR 90-Sr OR 90Sr OR "90 Sr" OR oralloy OR postum OR tuballoy OR "uranyl nitrate hexahydrate" OR UNH OR K-65 OR "sump cake" Downey OR De-Soto "Atomics International"</p> <p>accident OR "air count" OR "air dust" OR "air filter" OR "airborne test" OR alpha OR "belgian congo ore" OR beta OR bioassay OR bio-assay OR breath OR "breathing zone" OR BZ Downey OR De-Soto "Atomics International"</p> <p>"body burden" OR calibration OR "chest count" OR columnation OR contamination OR curie OR denitration OR "denitration pot" Downey OR De-Soto "Atomics International"</p> <p>derby OR regulus OR "derived air concentration" OR DAC OR dose OR dosimeter Downey OR De-Soto "Atomics International"</p> <p>dosimetric OR dosimetry OR electron OR environment OR "Ether-Water Project" OR exposure OR "exposure investigation" Downey OR De-Soto "Atomics International"</p> <p>"radiation exposure" OR external OR "F machine" OR fecal OR "feed material" Downey OR De-Soto "Atomics International"</p> <p>femtocurie OR film OR fission OR fluoroscopy OR "Formerly Utilized Sites Remedial Action Program" OR FUSRAP Downey OR De-Soto "Atomics International"</p> <p>gamma-ray OR "gamma ray" OR "gas proportional" OR "gaseous diffusion" OR health Downey OR De-Soto "Atomics International"</p>		

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	<p>"health instrument" OR "health physics" OR H.I. OR HI OR HP OR "highly enriched uranium" OR HEU OR hydrofluorination OR "in vitro" OR "in vivo" Downey OR De-Soto "Atomics International"</p> <p>incident OR ingestion OR inhalation OR internal OR investigation OR isotope OR isotopic OR "isotopic enrichment" OR "JS Project" OR Landauer OR "liquid scintillation" Downey OR De-Soto "Atomics International"</p> <p>log OR "log sheet" OR "log book" OR "low enriched uranium" OR LEU OR "lung count" OR "maximum permissible concentration" OR MPC OR metallurgy OR microcurie OR millicurie Downey OR De-Soto "Atomics International"</p> <p>"mixed fission product" OR MFP OR monitor OR "air monitoring" OR nanocurie OR "nasal wipe" OR neutron OR "nose wipe" Downey OR De-Soto "Atomics International"</p> <p>nuclear OR Chicago-Nuclear OR "nuclear fuels" OR "nuclear track emulsion type A" Downey OR De-Soto "Atomics International"</p> <p>NTA OR "occupational radiation exposure" OR occurrence OR "ore concentrate" OR "PC Project" OR permit OR "radiation work permit" Downey OR De-Soto "Atomics International"</p> <p>"safe work permit" OR "special work permit" OR RWP OR SWP Downey OR De-Soto "Atomics International"</p> <p>"phosphate research" OR photon OR picocurie OR pitchblende OR "pocket ion chamber" OR PIC OR problem OR procedure Downey OR De-Soto "Atomics International"</p> <p>radeco OR radiation OR radioactive OR radioactivity OR radiograph OR radiological Downey OR De-Soto "Atomics International"</p>		

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	<p>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 OR 235U OR "235 U" Downey OR De-Soto "North American Rockwell"</p> <p>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" Downey OR De-Soto "North American Rockwell"</p> <p>"black oxide" OR "brown oxide" OR "green salt" OR "orange oxide" OR "yellow 5cake" Downey OR De-Soto "North American Rockwell"</p> <p>UO2 OR UO3 OR UF4 OR UF6 OR C-216 OR C-616 OR C-65 OR C-211 OR U3O8 OR "uranium extraction" Downey OR De-Soto "North American Rockwell"</p> <p>NTA OR "occupational radiation exposure" OR occurrence OR "ore concentrate" OR "PC Project" OR permit OR "radiation work permit" Downey OR De-Soto "United Technologies"</p> <p>"uranium dioxide" OR "uranium hexafluoride" OR "uranium tetrafluoride" OR "uranium trioxide" Downey OR De-Soto "North American Rockwell"</p> <p>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 Downey OR De-Soto "North American Rockwell"</p> <p>"239 Pu" OR 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" Downey OR De-Soto "North American Rockwell"</p> <p>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 Downey OR De-Soto "North American Rockwell"</p>		

<b>Table A1-2: Database Searches for Canoga Ave. Facility</b>			
<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
	<p>228-Ra OR "228 Ra" OR radon OR Rn-222 OR Rn222 OR "Rn 222" OR 222Rn OR 222-Rn Downey OR De-Soto "North American Rockwell"</p> <p>"222 Rn" OR thoron OR Rn-220 OR Rn220 OR "Rn 220" OR 220Rn OR 220-Rn OR "220 Rn" OR protactinium OR Pa-234m OR Pa234m OR "Pa 234m" OR 234mPa OR 234m-Pa OR "234m Pa" Downey OR De-Soto "North American Rockwell"</p> <p>strontium OR Sr-90 OR Sr90 OR "Sr 90" OR 90-Sr OR 90Sr OR "90 Sr" OR oralloy OR postum OR tuballoy OR "uranyl nitrate hexahydrate" OR UNH OR K-65 OR "sump cake" Downey OR De-Soto "North American Rockwell"</p> <p>accident OR "air count" OR "air dust" OR "air filter" OR "airborne test" OR alpha OR "belgian congo ore" OR beta OR bioassay OR bio-assay OR breath OR "breathing zone" OR BZ Downey OR De-Soto "North American Rockwell"</p> <p>"body burden" OR calibration OR "chest count" OR columnation OR contamination OR curie OR denitration OR "denitration pot" Downey OR De-Soto "North American Rockwell"</p> <p>derby OR regulus OR "derived air concentration" OR DAC OR dose OR dosimeter Downey OR De-Soto "North American Rockwell"</p> <p>dosimetric OR dosimetry OR electron OR environment OR "Ether-Water Project" OR exposure OR "exposure investigation" Downey OR De-Soto "North American Rockwell"</p> <p>"radiation exposure" OR external OR "F machine" OR fecal OR "feed material" Downey OR De-Soto "North American Rockwell"</p> <p>femtocurie OR film OR fission OR fluoroscopy OR "Formerly Utilized Sites Remedial Action Program" OR FUSRAP Downey OR De-Soto "North American Rockwell"</p>		

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<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
	<p>radeco OR radiation OR radioactive OR radioactivity OR radiograph OR radiological Downey OR De-Soto "North American Rockwell"</p> <p>"Radiological Survey Data Sheet" OR RSDS OR radionuclide OR raffinate OR reactor OR respiratory OR "retention schedules" OR roentgen OR sample OR "air sample" OR "dust sample" Downey OR De-Soto "North American Rockwell"</p> <p>"general area air sample" OR sampling OR "air sampling" OR "dust sampling" OR "general area air sampling" OR "solvent extraction" OR source OR "sealed source" OR spectra Downey OR De-Soto "North American Rockwell"</p> <p>spectrograph OR spectroscopy OR spectrum OR standard OR operating OR processing OR survey OR "building survey" OR "routine survey" OR "special survey" OR "technical basis" Downey OR De-Soto "North American Rockwell"</p> <p>"thermal diffusion" OR "thermoluminescent dosimeter" OR TLD OR "Tiger Team" OR "tolerance dose" OR urinalysis OR urine Downey OR De-Soto "North American Rockwell"</p> <p>"whole body count" OR WBC OR "working level" OR WL OR X-ray OR "X ray" OR Xray Downey OR De-Soto "North American Rockwell"</p> <p>americium OR Am241 OR Am-241 OR "Am 241" OR "241Am" OR 241-Am OR "241 Am" OR ionium OR Th230 OR Th-230 OR "Th 230" OR 230Th OR 230-Th OR "230 Th" Downey OR De-Soto "Rockwell International"</p> <p>"chemical 18-12" OR "chemical 1812" OR "chemical 18 12" OR "chemical 10-12" OR "chemical 1012" OR "chemical 10 12" OR UX1 OR UX2 Downey OR De-Soto "Rockwell International"</p>		

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<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
	<p>Th-234 OR Th234 OR "Th 234" OR 234-Th OR 234Th OR "234 Th" OR tritium OR H3 OR H-3 OR mint OR HTO Downey OR De-Soto "Rockwell International"</p> <p>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 OR 235U OR "235 U" Downey OR De-Soto "Rockwell International"</p> <p>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" Downey OR De-Soto "Rockwell International"</p> <p>"black oxide" OR "brown oxide" OR "green salt" OR "orange oxide" OR "yellow 5cake" Downey OR De-Soto "Rockwell International"</p> <p>UO2 OR UO3 OR UF4 OR UF6 OR C-216 OR C-616 OR C-65 OR C-211 OR U3O8 OR "uranium extraction" Downey OR De-Soto "Rockwell International"</p> <p>"uranium dioxide" OR "uranium hexafluoride" OR "uranium tetrafluoride" OR "uranium trioxide" Downey OR De-Soto "Rockwell International"</p> <p>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 Downey OR De-Soto "Rockwell International"</p> <p>"239 Pu" OR 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" Downey OR De-Soto "Rockwell International"</p> <p>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 Downey OR De-Soto "Rockwell International"</p>		

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Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>228-Ra OR "228 Ra" OR radon OR Rn-222 OR Rn222 OR "Rn 222" OR 222Rn OR 222-Rn Downey OR De-Soto "Rockwell International"</p> <p>"222 Rn" OR thoron OR Rn-220 OR Rn220 OR "Rn 220" OR 220Rn OR 220-Rn OR "220 Rn" OR protactinium OR Pa-234m OR Pa234m OR "Pa 234m" OR 234mPa OR 234m-Pa OR "234m Pa" Downey OR De-Soto "Rockwell International"</p> <p>strontium OR Sr-90 OR Sr90 OR "Sr 90" OR 90-Sr OR 90Sr OR "90 Sr" OR oralloy OR postum OR tuballoy OR "uranyl nitrate hexahydrate" OR UNH OR K-65 OR "sump cake" Downey OR De-Soto "Rockwell International"</p> <p>accident OR "air count" OR "air dust" OR "air filter" OR "airborne test" OR alpha OR "belgian congo ore" OR beta OR bioassay OR bio-assay OR breath OR "breathing zone" OR BZ Downey OR De-Soto "Rockwell International"</p> <p>"body burden" OR calibration OR "chest count" OR columnation OR contamination OR curie OR denitration OR "denitration pot" Downey OR De-Soto "Rockwell International"</p> <p>derby OR regulus OR "derived air concentration" OR DAC OR dose OR dosimeter Downey OR De-Soto "Rockwell International"</p> <p>dosimetric OR dosimetry OR electron OR environment OR "Ether-Water Project" OR exposure OR "exposure investigation" Downey OR De-Soto "Rockwell International"</p> <p>"radiation exposure" OR external OR "F machine" OR fecal OR "feed material" Downey OR De-Soto "Rockwell International"</p> <p>femptocurie OR film OR fission OR fluoroscopy OR "Formerly Utilized Sites Remedial Action Program" OR FUSRAP Downey OR De-Soto "Rockwell International"</p>		

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<b>Table A1-2: Database Searches for Canoga Ave. Facility</b>			
<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
	<p>"Radiological Survey Data Sheet" OR RSDS OR radionuclide OR raffinate OR reactor OR respiratory OR "retention schedules" OR roentgen OR sample OR "air sample" OR "dust sample" Downey OR De-Soto "United Technologies"</p> <p>"general area air sample" OR sampling OR "air sampling" OR "dust sampling" OR "general area air sampling" OR "solvent extraction" OR source OR "sealed source" OR spectra Downey OR De-Soto "United Technologies"</p> <p>spectrograph OR spectroscopy OR spectrum OR standard OR operating OR processing OR survey OR "building survey" OR "routine survey" OR "special survey" OR "technical basis" Downey OR De-Soto "United Technologies"</p> <p>"thermal diffusion" OR "thermoluminescent dosimeter" OR TLD OR "Tiger Team" OR "tolerance dose" OR urinalysis OR urine Downey OR De-Soto "United Technologies"</p> <p>"whole body count" OR WBC OR "working level" OR WL OR X-ray OR "X ray" OR Xray Downey OR De-Soto "United Technologies"</p> <p>americium OR Am241 OR Am-241 OR "Am 241" OR "241Am" OR 241-Am OR "241 Am" OR ionium OR Th230 OR Th-230 OR "Th 230" OR 230Th OR 230-Th OR "230 Th" Downey OR De-Soto "Boeing"</p> <p>"chemical 18-12" OR "chemical 1812" OR "chemical 18 12" OR "chemical 10-12" OR "chemical 1012" OR "chemical 10 12" OR UX1 OR UX2 Downey OR De-Soto "Boeing"</p> <p>Th-234 OR Th234 OR "Th 234" OR 234-Th OR 234Th OR "234 Th" OR tritium OR H3 OR H-3 OR mint OR HTO Downey OR De-Soto "Boeing"</p>		

Table A1-2: Database Searches for Canoga Ave. Facility			
Database/Source	Keywords / Phrases	Hits	Uploaded
	<p>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 OR 235U OR "235 U" Downey OR De-Soto "Boeing"</p> <p>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" Downey OR De-Soto "Boeing"</p> <p>"black oxide" OR "brown oxide" OR "green salt" OR "orange oxide" OR "yellow 5cake" Downey OR De-Soto "Boeing"</p> <p>UO2 OR UO3 OR UF4 OR UF6 OR C-216 OR C-616 OR C-65 OR C-211 OR U308 OR "uranium extraction" Downey OR De-Soto "Boeing"</p> <p>"uranium dioxide" OR "uranium hexafluoride" OR "uranium tetrafluoride" OR "uranium trioxide" Downey OR De-Soto "Boeing"</p> <p>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 Downey OR De-Soto "Boeing"</p> <p>"239 Pu" OR 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" Downey OR De-Soto "Boeing"</p> <p>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 Downey OR De-Soto "Boeing"</p> <p>228-Ra OR "228 Ra" OR radon OR Rn-222 OR Rn222 OR "Rn 222" OR 222Rn OR 222-Rn Downey OR De-Soto "Boeing"</p>		

<b>Table A1-2: Database Searches for Canoga Ave. Facility</b>			
<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
	<p>"222 Rn" OR thoron OR Rn-220 OR Rn220 OR "Rn 220" OR 220Rn OR 220-Rn OR "220 Rn" OR protactinium OR Pa-234m OR Pa234m OR "Pa 234m" OR 234mPa OR 234m-Pa OR "234m Pa" Downey OR De-Soto "Boeing"</p> <p>strontium OR Sr-90 OR Sr90 OR "Sr 90" OR 90-Sr OR 90Sr OR "90 Sr" OR oralloy OR postum OR tuballoy OR "uranyl nitrate hexahydrate" OR UNH OR K-65 OR "sump cake" Downey OR De-Soto "Boeing"</p> <p>accident OR "air count" OR "air dust" OR "air filter" OR "airborne test" OR alpha OR "belgian congo ore" OR beta OR bioassay OR bio-assay OR breath OR "breathing zone" OR BZ Downey OR De-Soto "Boeing"</p> <p>"body burden" OR calibration OR "chest count" OR columnation OR contamination OR curie OR denitration OR "denitration pot" Downey OR De-Soto "Boeing"</p> <p>derby OR regulus OR "derived air concentration" OR DAC OR dose OR dosimeter Downey OR De-Soto "Boeing"</p> <p>dosimetric OR dosimetry OR electron OR environment OR "Ether-Water Project" OR exposure OR "exposure investigation" Downey OR De-Soto "Boeing"</p> <p>"radiation exposure" OR external OR "F machine" OR fecal OR "feed material" Downey OR De-Soto "Boeing"</p> <p>femptocurie OR film OR fission OR fluoroscopy OR "Formerly Utilized Sites Remedial Action Program" OR FUSRAP Downey OR De-Soto "Boeing"</p> <p>gamma-ray OR "gamma ray" OR "gas proportional" OR "gaseous diffusion" OR health Downey OR De-Soto "Boeing"</p>		

<b>Table A1-2: Database Searches for Canoga Ave. Facility</b>			
<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
	<p>"health instrument" OR "health physics" OR H.I. OR HI OR HP OR "highly enriched uranium" OR HEU OR hydrofluorination OR "in vitro" OR "in vivo" Downey OR De-Soto "Boeing"</p> <p>incident OR ingestion OR inhalation OR internal OR investigation OR isotope OR isotopic OR "isotopic enrichment" OR "JS Project" OR Landauer OR "liquid scintillation" Downey OR De-Soto "Boeing"</p> <p>log OR "log sheet" OR "log book" OR "low enriched uranium" OR LEU OR "lung count" OR "maximum permissible concentration" OR MPC OR metallurgy OR microcurie OR millicurie Downey OR De-Soto "Boeing"</p> <p>"mixed fission product" OR MFP OR monitor OR "air monitoring" OR nanocurie OR "nasal wipe" OR neutron OR "nose wipe" Downey OR De-Soto "Boeing"</p> <p>nuclear OR Chicago-Nuclear OR "nuclear fuels" OR "nuclear track emulsion type A" Downey OR De-Soto "Boeing"</p> <p>NTA OR "occupational radiation exposure" OR occurrence OR "ore concentrate" OR "PC Project" OR permit OR "radiation work permit" Downey OR De-Soto "Boeing"</p> <p>"safe work permit" OR "special work permit" OR RWP OR SWP Downey OR De-Soto "Boeing"</p> <p>"phosphate research" OR photon OR picocurie OR pitchblende OR "pocket ion chamber" OR PIC OR problem OR procedure Downey OR De-Soto "Boeing"</p> <p>radeco OR radiation OR radioactive OR radioactivity OR radiograph OR radiological Downey OR De-Soto "Boeing"</p>		

<b>Table A1-2: Database Searches for Canoga Ave. Facility</b>			
<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
	<p>"Radiological Survey Data Sheet" OR RSDS OR radionuclide OR raffinate OR reactor OR respiratory OR "retention schedules" OR roentgen OR sample OR "air sample" OR "dust sample" Downey OR De-Soto "Boeing"</p> <p>"general area air sample" OR sampling OR "air sampling" OR "dust sampling" OR "general area air sampling" OR "solvent extraction" OR source OR "sealed source" OR spectra Downey OR De-Soto "Boeing"</p> <p>spectrograph OR spectroscopy OR spectrum OR standard OR operating OR processing OR survey OR "building survey" OR "routine survey" OR "special survey" OR "technical basis" Downey OR De-Soto "Boeing"</p> <p>"thermal diffusion" OR "thermoluminescent dosimeter" OR TLD OR "Tiger Team" OR "tolerance dose" OR urinalysis OR urine Downey OR De-Soto "Boeing"</p> <p>"whole body count" OR WBC OR "working level" OR WL OR X-ray OR "X ray" OR Xray Downey OR De-Soto "Boeing"</p>		
National Academies Press <a href="http://www.nap.edu/">http://www.nap.edu/</a> COMPLETED 11/10/2009	Downey California De Soto California "North American Aviation" Rocketdyne "Atomics International" "North American Rockwell" "Rockwell International" "United Technologies"	1,083	0
NNSA - Nevada Site Office <a href="http://www.nv.doe.gov/main/search.htm">www.nv.doe.gov/main/search.htm</a> COMPLETED 11/10/2009	"North American Aviation" Rocketdyne "Atomics International" "North American Rockwell" "Rockwell International" "United Technologies" Downey or "De Soto"	0	0

<b>Table A1-2: Database Searches for Canoga Ave. Facility</b>			
<b>Database/Source</b>	<b>Keywords / Phrases</b>	<b>Hits</b>	<b>Uploaded</b>
NRC ADAMS Reading Room http://www.nrc.gov/reading-rm/adams/web-based.html COMPLETED 11/14/2009	"Atomics International" "North American Aviation" "Rocketdyne" "North American Rockwell" "Rockwell International" "United Technologies" Downey or "De Soto" (Advanced Search Boolean)	2,075	23
U.S. Transuranium & Uranium Registries http://www.ustur.wsu.edu/ COMPLETED 11/10/2009	"North American Aviation" Rocketdyne "Rockwell International" "United Technologies" "Atomics International" " North American Rockwell" Downey De Soto	4	1

<b>Table A1-3: OSTI Documents Requested for Canoga Ave. Facility</b>			
<b>Document Number</b>	<b>Document Title</b>	<b>Requested</b>	<b>Received</b>
DOC Number: NA OSTI ID: NA Ref ID: 73068	The Effects Of Internal Radiation Exposure On Cancer Mortality In Nuclear Workers At Rocketdyne/Atomics International. Author(S): Ritz, B., Morgenstern, H., Crawford-Brown, D., Young, B. B. Journal Date: 2001 Journal Name: Environmental Health Perspectives Journal Volume: 108:743-751 BFSID: 1481	09/03/2009	09/03/2009
DOC Number: TID-26442 OSTI ID: 4442347 Ref ID: 73065	Environmental Monitoring. Annual Report, 1972 Creator/Author Moore, J.D. Publication Date 1972 Jan 01	09/03/2009	09/03/2009
DOC Number: AI-77-14 OSTI ID: 7294807 Ref ID: 73073	Atomics International Environmental Monitoring And Facility Effluent Annual Report, 1976 Creator/Author Moore, J.D. Publication Date 1977 Jan 01	09/03/2009	09/03/2009

<b>Table A1-3: OSTI Documents Requested for Canoga Ave. Facility</b>			
<b>Document Number</b>	<b>Document Title</b>	<b>Requested</b>	<b>Received</b>
DOC Number: TID-13863 OSTI ID: 4840693 Ref ID: 73070	Environmental Monitoring Report, January 1, 1961-March 31, 1961 Publication Date 1961 Oct 31	09/03/2009	09/03/2009
DOC Number: NA OSTI ID: NA Ref ID: 73078	Health Bulletin: Mortality Study Of Rocketdyne/Atomics International Workers BFSID: 3522	09/03/2009	09/03/2009
DOC Number: NAA-SR-3989 OSTI ID: 4203423 Ref ID: 73052	Gamma-Ray And Fast Neutron Annular Streaming Evaluation Through Sodium Reactor Experiment (Sre)-Mark Ii Control And Safety Rod Assemblies Creator/Author Anderson, F.D. Publication Date 1959 Oct 15	09/03/2009	09/03/2009
DOC Number: NAA-SR-3990 OSTI ID: 4233098 Ref ID: 73054	Sodium Reactor Experiment (Sre) Shielding Evaluation For Thermal Neutron Streaming At Reactor Vessel Coolant Pipe Penetrations Creator/Author Anderson, F.D. Publication Date 1959 Oct 31	09/03/2009	09/03/2009
DOC Number: NAA-SR-1536 OSTI ID: 358658 Ref ID: 73063	Fast Neutron Monitoring With Nta Film Packets Creator/Author Hart, R.S.; Hale, J.P. Jr. Publication Date 1956 Jul 15	09/03/2009	09/03/2009

<b>Table A1-4: Cincinnati Public Library Documents Ordered for Canoga Ave. Facility</b>			
<b>Document Number</b>	<b>Document Title</b>	<b>Requested</b>	<b>Received</b>
DOC Number: NA OSTI ID: 4748756 Ref ID: 75053	Atomics International's L-88 Nuclear Reactor For Neutron Radiography. Creator/Author Henrie, J.O. Journal Name: Isotopes And Radiation Technology Vol 9: No. 1, 41-4(Fall 1971)	09/10/2009	10/28/2009
DOC Number: A/CONF.15/P/1780 OSTI ID: 4322507 Ref ID: 75059	Methods And Equipment For Low Decontamination Processing Of Metallic Nuclear Fuels Creator/Author Brand, G.E. ; Sinizer, D.I. ; Murbach, E.W. ; Hansen, W.N. ; Foltz, J.R. ; Mattern, K.L. Publication Date 1958 Oct 31	09/10/2009	10/06/2009
DOC Number: NA OSTI ID: 030059777 Ref ID: 73543	The Radiolysis Of Deuterated Biphenyls: Mechanism Of Hydrogen Formation, Journal Of Physical Chemistry, October 1960, Vol. 64(10):1367-1374	09/24/2009	09/30/2009

**Table A1-4: Cincinnati Public Library Documents Ordered for Canoga Ave. Facility**

Document Number	Document Title	Requested	Received
DOC Number: A/CONF.15/P/785 OSTI ID: 4306907 Ref ID: 75060	Thorium-Uranium Fuel Elements For Sre Creator/Author Hayward, B.R. & Corzine, P. Publication Date 1958 Oct 31 Prepared For The Second U.N. International Conference On The Peaceful Uses Of Atomic Energy, 1958	09/10/2009	09/30/2009
DOC Number: NA OSTI ID: NA Ref ID: 75057	Effects Of Radiation And Chemical Exposures On Cancer Mortality Among Rocketdyne Workers: A Review Of Three Cohort Studies. Author(S): Morgenstern, H., Ritz, B. Journal Name: Occupational Medicine: State Of The Art Reviews Journal Volume: 16(2):219-237 Bfsid: 1490 Dated 2001	09/10/2009	09/30/2009
DOC Number: NA OSTI ID: 4000032 Ref ID: 73111	Prepare Thorium-Aluminum Alloys... By Direct Reduction Creator/Author Raleigh, D.O. Publication Date 1961 Jun 01 Journal Name: Industrial And Engineering Chemistry Vol: 53(6):445-448	09/14/2009	09/15/2009
DOC Number: NA OSTI ID: 4211191 Ref ID: 73098	Low-Decontamination-Processing Of Uranium Dioxide By Oxidation And Reduction Creator/Author Strausberg, S. ; Luebben, T.E. ; Rosen, F.D. ; Guon, J. ; Murbach, E.W. Publication Date 1960 Jan 01 Journal Name: Industrial And Engineering Chemistry Vol: 52(1):45-46	09/14/2009	09/15/2009
DOC Number: NA OSTI ID: 4275332 Ref ID: 73084	A Portable Calibrator For Beta/-Gamma Survey Instruments Using Sr90 Creator/Author Nelson, C.T. Publication Date 1959 Mar 01 Health Physics Journal Vol 1 Pp 447-448??	09/11/2009	09/11/2009
DOC Number: NA OSTI ID: 4811731 Ref ID: 73090	Sea Water Monitoring Following Radioactive Waste Disposal Operations Creator/Author Alexander, R.E. Publication Date 1961 Dec 01 Health Physics Journal Vol: 7: Nos. 1 And 2, Pp 106-113	09/11/2009	09/11/2009
DOC Number: NA OSTI ID: 4059901 Ref ID: 73096	Disposal Of Omr High Boiler Fractions By Burning Creator/Author Stiens, R.P. Publication Date 1961 Jun 01 Journal Name: Trans. Am. Nuclear Soc. Vol: 4: No. 1 Pp 41-42;	09/11/2009	09/11/2009
DOC Number: NA OSTI ID: 4089327 Ref ID: 73093	Beta-Gamma Delayed Coincidence Method For U-238 Activation Analysis Creator/Author Beller, L.S. Publication Date 1961 Jun 01 Journal Name: Trans. Am. Nuclear Soc.; Journal Volume: Vol: 4: No. 1 Pp 28-29	09/11/2009	09/11/2009
DOC Number: NA OSTI ID: 4293816 Ref ID: 73118	Pyroprocessing Thorium Fuels Creator/Author Murbach, E.W. ; Hansen, W.N. Publication Date 1959 Feb 01 Journal Name: Industrial And Engineering Chemistry Journal Volume: Vol: 51(2):177-178	09/11/2009	09/11/2009
DOC Number: NA OSTI ID: 4308032 Ref ID: 73120	Special Safety Devices Creator/Author Huston, N.E.; Miller, N.C. Publication Date 1958 May 01 Other Number(S) Nucleonics Vol 16(5):86-87 Dated May 1958	09/10/2009	09/10/2009



**Table A1-4: Cincinnati Public Library Documents Ordered for Canoga Ave. Facility**

<b>Document Number</b>	<b>Document Title</b>	<b>Requested</b>	<b>Received</b>
DOC Number: NA OSTI ID: 4280405 Ref ID: 73115	Processing Re-fabrication Of Metallic-Uranium Fuel Creator/Author Sinizer, D.I.; Mattern, K.L.; Foltz, J.R.; Kendall, E.G. Publication Date 1959 Jan 01 Nucleonics Vol 17(1):50-53 Jan 1959	09/10/2009	09/10/2009
DOC Number: NA OSTI ID: 4325061 Ref ID: 73103	Plutonium Recycling With Molten Uf4 Creator/Author Buyers, A.G. Publication Date 1957 Nov 01 Nucleonics Vol 15(11):100-103 Nov 1957	09/10/2009	09/10/2009