DOE/CD-ETEC-012

CERTIFICATION DOCKET

FOR THE RELEASE OF BUILDING T012 AT THE ENERGY TECHNOLOGY ENGINEERING CENTER

November 1997

U.S. DEPARTMENT OF ENERGY
OAKLAND OPERATIONS OFFICE
ENVIRONMENTAL RESTORATION

Forward

The purpose of this docket is to document the successful decontamination & decommissioning of Building T012 at the Energy Technology Engineering Center (ETEC) at the Santa Susana Field Laboratory, Area IV, for unrestricted use. The material in this docket consists of documents supporting the DOE certification that conditions at ETEC, Building T012, are in compliance with applicable DOE and proposed Environmental Protection Agency and Nuclear Regulatory Commission standards and criteria established to protect human health, safety, and the environment. A notice of certification of the radiological condition of the property was published in the federal register on October 8, 1997. A copy of the notice, official correspondence, release criteria, project report, radiological surveys, and an independent verification report are compiled in this docket.

CONTENTS

EXHIBIT I

DOCUMENTS SUPPORTING THE CERTIFICATION FOR THE UNRESTRICTED USE OF BUILDING T012 AT THE ENERGY TECHNOLOGY ENGINEERING CENTER

DOE F 1325.8
(08-93)

United States Government **Department of Energy**

memorandum

DATE: OCT 1 6 1997

REPLY TO ATTN OF: EM-44 (D. Williams, 301-903-8173)

SUBJECT: Release of Decontaminated Building T012 without Radiological Restrictions at the Energy Technology Engineering Center

TO: R. Liddle, Oakland Operations Office

We have completed our review of all documents related to the remediation, final survey, certification, release limits, and independent verification of Building T012 at the Energy Technology Engineering Center. We have determined that decontamination of this property has been completed in compliance with the established criteria and standards as required by Department of Energy (DOE) guidelines and Orders, is consistent with other appropriate Nuclear Regulatory Commission guidelines, and is protective of public health and the environment. Therefore, approval is granted to release subject property to Boeing North American without radiological controls pursuant to DOE Order 5400.5, Chapter IV. This property should be removed from the DOE Real Property Inventory in accordance with DOE Order 4300.

In accordance with DOE Order 5820.2A, Section V, the data package compiled for this project must be retained permanently in the Oakland Operations Office (OAK) files. A Certification Docket similar to one prepared for Energy Technology Engineering Center facilities 023, 028, and 029 should be compiled for this project and placed in DOE reading rooms and public libraries as listed in the Federal Register Notice.

We recommend that a letter be forwarded to Boeing North American requiring prior DOE-OAK notification of any activity which could potentially recontaminate the subject property until final release of the remaining ETEC properties has been completed. Please provide us with a copy of the letter, as well as the distribution list, for our files.

Robert C. Fleming

for Sally A, Robison, Ph.D.
Director
Office of Northwestern Area Programs
Environmental Restoration

DISTRIBUTION:
Subject
Chron
EM-44, L. Staley
EM-40 (2)
Reader

EM-44:WILLIAMS:2-8173:10/15/97:mbn:q:oak\012rlshq.app

Office Secretary: L. Staley

EMCTS#:___________________

EM-44
WILLIAMS
10/16/97

EM-44
FLEMING RCF
10/16/97

EM-44
ROBISON RCF for
10/16/97

DOE F 1325.8
(8-89)

United States Government **Department of Energy**

memorandum

DATE: August 29, 1997

REPLY TO
ATTN OF: DOE Oakland Operations Office/ER

SUBJECT: Release of Decontaminated Building 012 without Radiological Restrictions at the Energy Technology Engineering Center.

TO: Donald Williams, EM-44

The Oakland Operations Office (OAK) has implemented environmental restoration projects at the Energy Technology Engineering Center (ETEC) as part of the Environmental Restoration Program (ERP) per Headquarters Northwestern Area Program Office direction. The objective of the program is to identify and cleanup or otherwise control facilities where residual radioactive contamination remains from activities carried out under contract to the Atomic Energy Commission and the Energy Research and Development Administration during the early years of the Nation's atomic energy program.

The Energy Technology Engineering Center performed testing of equipment, materials, and components for nuclear and energy related programs. These nuclear energy research and development programs began in 1946 and ended in 1995. Numerous buildings and land areas became radiologically contaminated as a result of facility operations and site activities. One such area that has been designated for cleanup under the ERP is Building 012

Building 012 is located in the north-central section of Area IV. Building 012 was constructed in 1962 to perform experiments for the SNAP (Systems for Nuclear Auxiliary Power) program. Clad reactor fuel elements were stored in the facility's fuel storage tubes for the SNAP criticality experiments. Most tests were directed at determining criticality of various configurations and conditions, such as water immersion. These tests continued through 1972, at which time, the facility was deactivated.

The decontamination and decommissioning was performed in two phases, starting in 1986 and ending in 1995. In 1986 the partial demolition of Building 012 began with the removal of the removal of the operations and control rooms and passageway connecting these structures to the concrete portion of the facility. The demolition material was disposed of as non-radioactive waste, with the exception of the exhaust stack. In 1995 decommissioning and decontamination of the remaining portion of the facility was completed.

The Environmental Survey and Site Assessment Program of the Oak Ridge Institute for Science and Education (ORISE) has completed independent verification of the Building decontamination project.

Post remedial action surveys have demonstrated, and the DOE Oakland Operations Office hereby certifies, that the subject property is in compliance with DOE decontamination criteria and standards established to protect members of the general public and occupants of the property.

Final project closeout documents have been submitted to your office under separate cover.

DOE/OAK requests approval for release of this property without radiological restrictions to Boeing North American, Inc., in accordance with the closeout provisions of the contract, and authorization to remove this facility from the DOE/OAK real property records.

Michael Lopez
ETEC PM
Environmental
Restoration Division

STATEMENT OF CERTIFICATION: Energy Technology Engineering Center, Building 012

The U.S. Department of Energy, Oakland Operations Office, Environmental Restoration Division, has reviewed and analyzed the radiological data obtained following decontamination of the Energy Technology Engineering Center Building 012. Based on this analysis of all data collected, the Department of Energy (DOE) certifies that the following property is in compliance with DOE decontamination criteria and standards. This certification of compliance provides assurance that future use of the property will result in no radiological exposure above applicable guidelines established to protect members of the general public or site occupants. Accordingly, the property specified below is released from DOE's Environmental Restoration Program.

Property owned by Rockwell International Corporation:

Building 012, at the Energy Technology Engineering Center, located in a portion of Tract "A" of Rancho Simi, in the County of Ventura, State of California, as per map recorded in Book 3, Page 7 of Miscellaneous Records of Ventura County.

CERTIFICATION:

Hannibal Joma, ETEC Site Manager

8/29/97
Date

Jnited States Government **Department of Energy**

memorandum

DATE: September 17, 1997

REPLY TO
ATTN OF: EM-44 (D. Williams, 903-8173)

SUBJECT: Draft Certification for Building T012 at the Energy Technology Engineering Center

TO: Assistant General Counsel for Environment, GC-51

I am requesting your review and concurrence of the attached package concerning the cleanup of contamination associated with the former Atomic Energy Commission and Energy Research and Development Administration (AEC/ERDA) activities at Building T012 at the Energy Technology Engineering Center (ETEC) near Chatsworth, California.

The Office of Northwestern Area Programs has implemented a decontamination and decommissioning (D&D) project at ETEC as part of the Environmental Restoration Program. The objective of the program is to identify and clean up or otherwise control sites where residual radioactive contamination remains from activities carried out under contract to AEC/ERDA during the early years of the Nation's atomic energy program. In February 1993, Building T012 was formally designated by the Department of Energy (DOE) for cleanup.

ETEC Building T012 was constructed in 1962 to perform experiments for the Systems for Nuclear Auxiliary Power program. Most tests were directed at determining criticality of various configurations and conditions, such as water immersion. These tests continued through 1972 at which time the facility was deactivated. The D&D was performed in two phases: 1) removal in 1986 of the operations and control rooms and passageways connecting these structures to the concrete portion of the facility and 2) D&D of the remaining concrete vault structure of the facility in 1995. Final radiological and independent verification surveys completed in 1996 demonstrated, and DOE's Oakland Operations Office has certified, that the decontamination project resulted in compliance with DOE decontamination criteria and standards established to protect members of the general public and occupants of the building. Further, future use of the property without radiological restrictions will result in no exposure above applicable radiological guidelines to the general public and occupants of the building.

A draft <u>Federal Register</u> Notice has been prepared as part of the certification and will also be transmitted to the Office of Federal Register for approval after we have received your concurrence.

The final Federal Register Notice and Certification Statement will be compiled in final docket form by the Oakland Operations Office and will be made available for public review in DOE Reading Rooms and local libraries.

Sally A. Robison

Sally A. Robison, Ph.D.
Director
Office of Northwestern Area Programs
Environmental Restoration

Attachment

DOE F 1325.8
(08-93)

United States Government **Department of Energy**

memorandum

DATE: September 25, 1997

REPLY TO ATTN OF: EM-44 (Don Williams, 301-903-8173)

SUBJECT: Recommendation for Certification of Cleanup at Building T012 at the Energy Technology Engineering Center

TO: Acting Deputy Assistant Secretary for Environmental Restoration, EM-40

I am attaching for your signature a Federal Register Notice concerning the cleanup of contamination associated with the former Atomic Energy Commission and Energy Research and Development Administration (AEC/ERDA) activities at Building T012, at the Energy Technology Engineering Center (ETEC), near Chatsworth, California.

The Oakland Operations Office has implemented a decontamination and decommissioning (D&D) project at ETEC as part of the Environmental Restoration Program. The objective of the program is to identify and clean up or otherwise control sites where residual radioactive contamination remains from activities carried out under contract to AEC/ERDA during the early years of the Nation's atomic energy program. In February 1993, Building T012 was formally designated by the Department of Energy (DOE) for cleanup under Environmental Restoration.

ETEC Building T012 was constructed in 1962 to perform experiments for the Systems for Nuclear Auxiliary Power program. Most tests were directed at determining criticality of various configurations and conditions, such as water immersion. These tests continued through 1972 at which time the facility was deactivated. The D&D was performed in two phases: 1) removal in 1986 of the operations and control rooms and passageways connecting these structures to the concrete portion of the facility and 2) D&D of the remaining concrete vault structure of the facility in 1995. Final radiological and independent verification surveys completed in 1996 demonstrated, and DOE's Oakland Operations Office has certified, that the decontamination project resulted in compliance with DOE decontamination criteria and standards established to protect members of the general public and occupants of the building. Further, future use of the property without radiological restrictions will result in no exposure above applicable radiological guidelines to the general public and occupants of the building.

I recommend that you sign the attached Federal Register Notice, as well as the transmittal memorandum to the Federal Liaison Officer (Raymond Mosley, GC-75). The documents transmitted with the certification statement and the Federal Register Notice will be compiled in final docket form by the Oakland Operations Office and will be made available for public review in DOE Reading Rooms and local libraries.

Sally A. Robison

Sally A. Robison, Ph.D.
Director
Office of Northwestern Area Programs
Environmental Restoration

Attachment

DOE F 1325.8
(8-89)
EG. (07-90)

United States Government — Department of Energy

memorandum

DATE: September 26, 1997

REPLY TO ATTN OF: EM-44 (D. Williams, 301-903-8173)

SUBJECT: Federal Register Notice for Certification of Cleanup of Building T012 at the Energy Technology Engineering Center

TO: Clara Barley, GC-75

Attached are the original and three copies of the signed Federal Register Notice certifying the completion of remedial action at Building T012 located at the Energy Technology Engineering Center. This surplus building was decontaminated by the Department's Environmental Restoration Program. The attached Notice has been reviewed by and concurred in by the Office of General Counsel (GC-51), and a copy of that concurrence is also attached for your information and use.

Also attached for your signature is the letter to transmit the disk containing the Federal Register Notice to the Office of the Federal Register.

Please forward the attached Notice to the Federal Register for publication.

J Fiore

James J. Fiore
Acting Deputy Assistant Secretary
for Environmental Restoration

3 Attachments

Department of Energy
Washington, DC 20585

Mr. Raymond A. Mosley
Director, Office of the Federal Register
National Archives and Records Administration
Washington, D.C. 20408

Dear Mr. Mosley:

This letter is to certify that the enclosed disk is a true copy of the Certification of the Radiological Condition of Building T012 at the Energy Technology Engineering Center located near Chatsworth, California. The disk should be used by the Government Printing Office in preparing the document for publication in the Federal Register.

Sincerely,

J. Fiore

James J. Fiore
Acting Deputy Assistant Secretary
for Environmental Management

Clara Barley
DOE Federal Register Liaison
Officer

Enclosure

U.S. Department of Energy

DOCKET NO. ETEC-012

Certification of the Radiological Condition of Building T012 at the Energy Technology Engineering Center near Chatsworth, California

AGENCY: U.S. Department of Energy, Office of Environmental Restoration

ACTION: Notice of Certification

SUMMARY: The Department of Energy (DOE) has completed radiological surveys and taken remedial action to decontaminate Building T012 located at the Energy Technology Engineering Center (ETEC) near Chatsworth, California. This property previously was found to contain radioactive materials from activities carried out for the Atomic Energy Commission and the Energy Research and Development Administration (AEC/ERDA), predecessor agencies to DOE. Although DOE owns the majority of the buildings and equipment, a subsidiary of Rockwell International, Rocketdyne, owned the land. Rocketdyne has recently been sold to Boeing North American Incorporated.

FOR FURTHER INFORMATION CONTACT:

Mike Lopez, Program Manager
Environmental Restoration Division
Oakland Operations Office
U.S. Department of Energy
Oakland, CA 94612-5208

SUPPLEMENTARY INFORMATION:

DOE has implemented environmental restoration projects at ETEC (Ventura County, Map Book 3, Page 7, Miscellaneous Records) as part of DOE's Environmental Restoration Program. One objective of the program is to identify and clean up or otherwise control facilities where residual radioactive contamination remains from activities carried out under contract to AEC/ERDA during the early years of the Nation's atomic energy program.

ETEC is comprised of several facilities and structures located within Administrative Area IV of the Santa Susana Field Laboratory. The work performed for DOE at ETEC consisted primarily of testing equipment, materials, and components for nuclear and energy-related programs. These nuclear energy research and development programs, conducted by Atomics International under contract to AEC/ERDA, began in 1946. Several buildings and land areas became radiologically contaminated as a result of facility operations and site activities. Building T012 is one ETEC area that has been designated for cleanup under the DOE Environmental Restoration Program. Other areas undergoing decontamination will be released as they are completed and are verified to meet established cleanup criteria and standards for release without radiological restrictions as established in DOE Order 5400.5.

Building T012 is located in the north-central section of Area IV. It originally consisted of two sections connected with an enclosed passageway.

Building T012 consisted of a critical cell that was a sealed room with 4-ft. thick concrete walls, lined with a 1/4-in. steel liner, used to test Systems for Nuclear Auxiliary Power (SNAP) critical assemblies. The cell floor is a mat-type concrete foundation. Sealed during operation, this room was designed to withstand the pressure release and to contain radioactive materials in the event of a burst condition from the assemblies.

The equipment room adjacent to the critical cell has 9-in. thick concrete walls and ceiling and a spread concrete foundation. A fuel storage area was located in the west section of the room consisting of a concrete shield wall containing 1 percent boron by weight. Embedded in the wall were 110 cadmium-plated tubes, 3 1/2 in. inside diameter by 20 in. long. The tubes were located on 1-ft. centers, 5 tubes high, and 22 tubes wide.

Operations in Building T012 began with systems for SNAP critical assemblies in 1962. These experiments used three different critical assembly machines: SCA-4A, -4B, and SCA-5. Most tests were directed at determining criticality of various configurations and conditions, such as water immersion, and were performed well below the allowed high power limit of about 100 watts. No significant amounts of induced activity were produced by these operations.

Clad reactor fuel elements (U-ZrH) were stored as shipped in containers and in the fuel storage tubes located in room 109. The SNAP critical experiments continued intermittently through 1968, when the fuel was shipped to the SSN Storage Vault (Building T064), and the facility was placed in a standby mode.

To allow the release of building T012 for use without radiological restriction, all detectable radioactive material/contamination was removed from the facility. This decontamination and decommissioning was performed in two phases: 1) starting in 1986 with the removal of the operations control room and 2) the enclosed passageway connecting those structures to the equipment room and the critical cell.

The second and final stage of decontamination of Building T012 began in February 1995 and required slightly less than five months to complete.

Briefly, the decontamination steps involved in the second stage were to decontaminate and decommission the remaining concrete vault structure of Building T012 sufficiently to permit its use without radiological or chemical contamination restrictions.

The accomplishment of this objective included removal of asbestos containing floor tiles and pipe insulation; removal of eight contaminated fuel storage tubes; removal of light fixtures, conduit, and ventilation systems; paint sampling and removal, and scabbing of the floor, wall, ceiling surfaces; and completion of the "Final Radiological and Chemical Contamination Assessment Survey."

Rockwell/Rocketdyne performed a final radiological survey in 1996. The Environmental Survey and Site Assessment Program of the Oak Ridge Institute for Science and Education performed independent verification of the decontamination work performed by Rockwell/Rocketdyne in 1996. Post-decontamination surveys have demonstrated that Building T012 is in compliance with DOE decontamination criteria and standards for release without radiological restrictions. The State of California Department of Health Services has concurred that the proposed release guidelines provide adequate assurance for release without further radiological restrictions. In the event of property transfer, DOE intends to comply with applicable Federal, State, and local requirements.

None of the engineering or radiation and nuclear safety personnel assigned to the Building T012 decommissioning project received any measurable exposure to ionizing radiation.

Final costs for the decontamination of Building T012 were $389,632.

The certification docket will be available for review between 9:00 a.m. and 4:00 p.m., Monday through Friday (except Federal holidays), in the U.S. DOE Public Reading Room located in Room 1E-190 of the Forrestal Building, 1000 Independence Avenue, S.W., Washington, D.C. Copies of the certification docket will also be available at the following locations: DOE Public Document Room, U.S. Department of Energy, Oakland Operations Office, the Federal Building, 1301 Clay Street, Oakland, California; California State University, Northridge, Urban Archives Center, Oviatt Library, Room 4, 18111 Nordhoff, Northridge, California; Simi Valley Library, 2629 Tapo Canyon Road, Simi Valley, California; and the Platt Branch, Los Angeles Public Library, 23600 Victory Boulevard, Woodland Hills, California.

DOE has issued the following statement of certification:

STATEMENT OF CERTIFICATION

STATEMENT OF CERTIFICATION: Energy Technology Engineering Center, Building T012

The U.S. Department of Energy (DOE), Oakland Operations Office, Environmental Restoration Division, has reviewed and analyzed the radiological data obtained following decontamination of Building T012 at the Energy Technology Engineering Center. Based on analysis of all data collected and the results of the independent verification, DOE certifies that the following property is in compliance with DOE radiological decontamination criteria and standards as established in DOE Order 5400.5. This certification of compliance provides assurance that future use of the property will result in no radiological exposure above applicable guidelines established to protect members of the general public or site occupants. Accordingly, the property specified below is released from DOE's Environmental Restoration Program.

Property owned by Boeing North American Incorporated:

Building T012, at the Energy Technology Center (situated within Area IV of the Santa Susana Field Laboratory), located in a portion of Tract "A" of Rancho Simi, in the County of Ventura, State of California, as per map recorded in Book 3, Page 7 of Miscellaneous Records of Ventura County.

Issued in Washington, D.C., on September 26, 1997.

J Fiore

James J. Fiore
Acting Deputy Assistant Secretary
for Environmental Restoration

DOE F 1325.8
(08-93)

United States Government **Department of Energy**

memorandum

DATE: OCT 16 1997

REPLY TO ATTN OF: EM-44 (D. Williams, 301-903-8173)

SUBJECT: Release of Decontaminated Building T012 without Radiological Restrictions at the Energy Technology Engineering Center

TO: R. Liddle, Oakland Operations Office

We have completed our review of all documents related to the remediation, final survey, certification, release limits, and independent verification of Building T012 at the Energy Technology Engineering Center. We have determined that decontamination of this property has been completed in compliance with the established criteria and standards as required by Department of Energy (DOE) guidelines and Orders, is consistent with other appropriate Nuclear Regulatory Commission guidelines, and is protective of public health and the environment. Therefore, approval is granted to release subject property to Boeing North American without radiological controls pursuant to DOE Order 5400.5, Chapter IV. This property should be removed from the DOE Real Property Inventory in accordance with DOE Order 4300.

In accordance with DOE Order 5820.2A, Section V, the data package compiled for this project must be retained permanently in the Oakland Operations Office (OAK) files. A Certification Docket similar to one prepared for Energy Technology Engineering Center facilities 023, 028, and 029 should be compiled for this project and placed in DOE reading rooms and public libraries as listed in the Federal Register Notice.

We recommend that a letter be forwarded to Boeing North American requiring prior DOE-OAK notification of any activity which could potentially recontaminate the subject property until final release of the remaining ETEC properties has been completed. Please provide us with a copy of the letter, as well as the distribution list, for our files.

Robert C. Fleming

for Sally A. Robison, Ph.D.
Director
Office of Northwestern Area Programs
Environmental Restoration

ADDRESS: Comments, protests or requests to intervene should be addressed as follows: Office of Coal & Power Im/Ex (FE–27), Office of Fossil Energy, U.S. Department of Energy, 1000 Independence Avenue, SW, Washington, DC 20585–0350 (FAX 202–287–5736).

FOR FURTHER INFORMATION CONTACT: Ellen Russell (Program Office) 202–586–5883 or Michael Skinker (Program Attorney) 202–586–6667.

SUPPLEMENTARY INFORMATION: Exports of electricity from the United States to a foreign country are regulated and require authorization under section 202(e) of the Federal Power Act (FPA) (16 U.S.C. § 824a(e)).

The Office of Fossil Energy (FE) of the Department of Energy (DOE) has received applications from the following companies for authorization to export electric energy to Canada, pursuant to section 202(e) of the FPA:

Applicant	Application date	Docket No.
Inland Pacific Resources Inc. (IPRI).	9/16/97	EA–156
Consolidated Edison Company of New York, Inc. (Con Edison).	9/23/97	EA–157

IPRI, a power marketing company, does not own or control any facilities for the generation or transmission of electricity, nor does it have a franchised service area. IPRI proposes to transmit to Canada electric energy purchased from electric utilities and other suppliers within the U.S. Con Edison is a regulated public utility serving customers in the New York City metropolitan area. Con Edison proposes to transmit to Canada electric energy that is excess to its system or purchased from electric utilities or other suppliers within the U.S.

The applicants would arrange for the exported energy to be transmitted to Canada over the international facilities owned by Basin Electric, Bonneville Power Administration, Citizens Utilities, Detroit Edison Company, Eastern Maine Electric Cooperative, Joint Owners of the Highgate Project, Maine Electric Power Company, Maine Public Service Company, Minnesota Power and Light Company, Minnkota Power Cooperative, New York Power Authority, Niagara Mohawk Power Corporation, Northern States Power, and Vermont Electric Transmission Company. Each of the transmission facilities, as more fully described in these applications, has previously been authorized by a Presidential permit issued pursuant to Executive Order 10485, as amended.

Procedural Matters

Any persons desiring to become a party to these proceedings or to be heard by filing comments or protests to these applications should file a petition to intervene, comment or protest at the address provided above in accordance with §§ 385.211 or 385.214 of the FERC's Rules of Practice and Procedures (18 CFR 385.211, 385.214). Fifteen copies of such petitions and protests should be filed with the DOE on or before the date listed above. Comments on IPRI's request to export to Canada should be clearly marked with Docket EA–156. Additional copies are to be filed directly with Edward A. Finklea, Ball Janik LLP, 101 S.W. Main Street, Suite 1100, Portland, Oregon 97204 AND Inland Pacific Resources Inc., c/o Jan Marston, President, Inland Pacific Energy Services Ltd., 1600—1095 West Pender Street, Vancouver, B.C. V6E2M6, Canada. Comments on Con Edison's request to export to Canada should be clearly marked with Docket EA–157. Additional copies are to be filed directly with John F. Gallagher III, Esq., 4 Irving Pace—Rm. 1815 South, Manhattan, NY 10003.

A final decision will be made on these applications after the environmental impacts have been evaluated pursuant to the National Environmental Policy Act of 1969 (NEPA), and a determination is made by the DOE that the proposed actions will not adversely impact on the reliability of the U.S. electric power supply system.

Copies of these applications will be made available, upon request, for public inspection and copying at the address provided above.

Issued in Washington, DC on October 1, 1997.

Anthony J. Como,

Manager, Electric Power Regulation, Office of Coal & Power Im/Ex, Office of Coal & Power Systems, Office of Fossil Energy.

[FR Doc. 97–26634 Filed 10–7–97; 8:45 am]

BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

[Docket No. ETEC–012]

Certification of the Radiological Condition of Building T012 at the Energy Technology Engineering Center Near Chatsworth, California

AGENCY: U.S. Department of Energy, Office of Environmental Restoration.

ACTION: Notice of Certification.

SUMMARY: The Department of Energy (DOE) has completed radiological surveys and taken remedial action to decontaminate Building T012 located at the Energy Technology Engineering Center (ETEC) near Chatsworth, California. This property previously was found to contain radioactive materials from activities carried out for the Atomic Energy Commission and the Energy Research and Development Administration (AEC/ERDA), predecessor agencies to DOE. Although DOE owns the majority of the buildings and equipment, a subsidiary of Rockwell International, Rocketdyne, owned the land. Rocketdyne has recently been sold to Boeing North American Incorporated.

FOR FURTHER INFORMATION CONTACT: Mike Lopez, Program Manager, Environmental Restoration Division, Oakland Operations Office, U.S. Department of Energy, Oakland, CA 94612–5208.

SUPPLEMENTARY INFORMATION: DOE has implemented environmental restoration projects at ETEC (Ventura County, Map Book 3, Page 7, Miscellaneous Records) as part of DOE's Environmental Restoration Program. One objective of the program is to identify and clean up or otherwise control facilities where residual radioactive contamination remains from activities carried out under contract to AEC/ERDA during the early years of the Nation's atomic energy program.

ETEC is comprised of several facilities and structures located within Administrative Area IV of the Santa Susana Field Laboratory. The work performed for DOE at ETEC consisted primarily of testing equipment, materials, and components for nuclear and energy-related programs. These nuclear energy research and development programs, conducted by Atomics International under contract to AEC/ERDA, began in 1946. Several buildings and land areas became radiologically contaminated as a result of facility operations and site activities. Building T012 is one ETEC area that has been designated for cleanup under the DOE Environmental Restoration Program. Other areas undergoing decontamination will be released as they are completed and are verified to meet established cleanup criteria and standards for release without radiological restrictions as established in DOE Order 5400.5.

Building T012 is located in the north-central section of Area IV. It originally consisted of two sections connected with an enclosed passageway.

Building T012 consisted of a critical cell that was a sealed room with 4-ft. thick concrete walls, lined with a 1/4-in. steel liner, used to test Systems for Nuclear Auxiliary Power (SNAP) critical assemblies. The cell floor is a mat-type concrete foundation. Sealed during operation, this room was designed to withstand the pressure release and to contain radioactive materials in the event of a burst condition from the assemblies.

The equipment room adjacent to the critical cell has 9-in. thick concrete walls and ceiling and a spread concrete foundation. A fuel storage area was located in the west section of the room consisting of a concrete shield wall containing 1 percent boron by weight. Embedded in the wall were 110 cadmium-plated tubes, 3½ in. inside diameter by 20 in. long. The tubes were located on 1-ft. centers, 5 tubes high, and 22 tubes wide.

Operations in Building T012 began with systems for SNAP critical assemblies in 1962. These experiments used three different critical assembly machines: SCA–4A, –4B, and SCA–5. Most tests were directed at determining criticality of various configurations and conditions, such as water immersion, and were performed well below the allowed high power limit of about 100 watts. No significant amounts of induced activity were produced by these operations.

Clad reactor fuel elements (U–ZrH) were stored as shipped in containers and in the fuel storage tubes located in room 109. The SNAP critical experiments continued intermittently through 1968, when the fuel was shipped to the SSN Storage Vault (Building T064), and the facility was placed in a standby mode.

To allow the release of building T012 for use without radiological restriction, all detectable radioactive material/contamination was removed from the facility. This decontamination and decommissioning was performed in two phases: (1) starting in 1986 with the removal of the operations control room and (2) the enclosed passageway connecting those structures to the equipment room and the critical cell.

The second and final stage of decontamination of Building T012 began in February 1995 and required slightly less than five months to complete.

Briefly, the decontamination steps involved in the second stage were to decontaminate and decommission the remaining concrete vault structure of Building T012 sufficiently to permit its use without radiological or chemical contamination restrictions.

The accomplishment of this objective included removal of asbestos containing floor tiles and pipe insulation; removal of eight contaminated fuel storage tubes; removal of light fixtures, conduit, and ventilation systems; paint sampling and removal, and scabbing of the floor, wall, ceiling surfaces; and completion of the "Final Radiological and Chemical Contamination Assessment Survey."

Rockwell/Rocketdyne performed a final radiological survey in 1996. The Environmental Survey and Site Assessment Program of the Oak Ridge Institute for Science and Education performed independent verification of the decontamination work performed by Rockwell/Rocketdyne in 1996. Post-decontamination surveys have demonstrated that Building T012 is in compliance with DOE decontamination criteria and standards for release without radiological restrictions. The State of California Department of Health Services has concurred that the proposed release guidelines provide adequate assurance for release without further radiological restrictions. In the event of property transfer, DOE intends to comply with applicable Federal, State, and local requirements.

None of the engineering or radiation and nuclear safety personnel assigned to the Building T012 decommissioning project received any measurable exposure to ionizing radiation.

Final costs for the decontamination of Building T012 were $389,632.

The certification docket will be available for review between 9:00 a.m. and 4:00 p.m., Monday through Friday (except Federal holidays), in the U.S. DOE Public Reading Room located in Room 1E–190 of the Forrestal Building, 1000 Independence Avenue, S.W., Washington, D.C. Copies of the certification docket will also be available at the following locations: DOE Public Document Room, U.S. Department of Energy, Oakland Operations Office, the Federal Building, 1301 Clay Street, Oakland, California; California State University, Northridge, Urban Archives Center, Oviatt Library, Room 4, 18111 Nordhoff, Northridge, California; Simi Valley Library, 2629 Tapo Canyon Road, Simi Valley, California; and the Platt Branch, Los Angeles Public Library, 23600 Victory Boulevard, Woodland Hills, California.

DOE has issued the following statement of certification:

Statement of Certification—Energy Technology Engineering Center, Building T012

The U.S. Department of Energy (DOE), Oakland Operations Office, Environmental Restoration Division, has reviewed and analyzed the radiological data obtained following decontamination of Building T012 at the Energy Technology Engineering Center. Based on analysis of all data collected and the results of the independent verification, DOE certifies that the following property is in compliance with DOE radiological decontamination criteria and standards as established in DOE Order 5400.5. This certification of compliance provides assurance that future use of the property will result in no radiological exposure above applicable guidelines established to protect members of the general public or site occupants. Accordingly, the property specified below is released from DOE's Environmental Restoration Program.

Property owned by Boeing North American Incorporated:

Building T012, at the Energy Technology Center (situated within Area IV of the Santa Susana Field Laboratory), located in a portion of Tract "A" of Rancho Simi, in the County of Ventura, State of California, as per map recorded in Book 3, Page 7 of Miscellaneous Records of Ventura County.

Issued in Washington, D.C., on September 26, 1997.

James J. Fiore,

Acting Deputy Assistant Secretary for Environmental Restoration.

Statement of Certification: Energy Technology Engineering Center, Building 012

The U.S. Department of Energy, Oakland Operations Office, Environmental Restoration Division, has reviewed and analyzed the radiological data obtained following decontamination of the Energy Technology Engineering Center Building 012. Based on this analysis of all data collected, the Department of Energy (DOE) certifies that the following property is in compliance with DOE decontamination criteria and standards. This certification of compliance provides assurance that future use of the property will result in no radiological exposure above applicable guidelines established to protect members of the general public or site occupants. Accordingly, the property specified below is released from DOE's Environmental Restoration Program.

Property owned by Rockwell International Corporation:

Building 012, at the Energy Technology Engineering Center, located in a portion of Tract "A" of Rancho Simi, in the County of Ventura, State of California, as per map recorded in Book

3, Page 7 of Miscellaneous Records of Ventura County.

Certification:

Dated: August 29, 1997

Hannibal Joma,

ETEC Site Manager.

[FR Doc. 97–26635 Filed 10–7–97; 8:45 am]

BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

[Docket No. RP97–5–000]

Algonquin Gas Transmission Company; Notice of Request for Extension of Waiver

October 2, 1997.

Take notice that on September 15, 1997, Algonquin Gas Transmission Company, (Algonquin) in compliance with the March 13, 1997 [1] and May 21, 1997 [2] orders of the Commission in the captioned docket tendered for filing a request for an extension of the six month waiver previously granted by the Commission with respect to compliance with the data elements and formatting as adopted by the Commission in Order No. 587.

Algonquin states that under the waiver, it was required to submit its requests for changes to the data elements to the Gas Industry Standards Board (GISB). Algonquin states that it has implemented the changes already approved by GISB, but requests an extension of the waiver until the Commission adopts the next version of the GISB standards. With respect to those requests still pending at GISB, Algonquin requests an additional six month extension of time.

Any person desiring to protest said filing should file a protest with the Federal Energy Regulatory Commission, 888 First Street, N.E., Washington, D.C. 20426, in accordance with Section 385.211 of the Commission's Regulations. All such protests should comply with principles set forth in the Commission's May 21, 1997 order and must be filed by October 14, 1997. Protests will be considered by the Commission in determining the appropriate action to be taken, but will not serve to make protestants parties to the proceedings. Copies of this filing are on file with the Commission and are available for public inspection.

Lois D. Cashell,

Secretary.

[FR Doc. 97–26592 Filed 10–7–97; 8:45 am]

BILLING CODE 6717–01–M

[1] Algonquin Gas Transmission Company, 78 FERC ¶ 61,281 (1997).

[2] Texas Eastern Transmission Corporation 79 FERC ¶ 61,223 (1997).

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

[Docket No. RP97–171–010]

ANR Pipeline Company; Notice of Proposed Changes In FERC Gas Tariff

October 2, 1997.

Take notice that, on September 30, 1997, ANR Pipeline Company (ANR) tendered for filing as part of its FERC Gas Tariff, Second Revised Volume No. 1, tariff sheets in compliance with the Commission's June 26, 1997 order accepting subject to certain modifications to ANR's May 1, 1997 filing to comply with the GISB standards adopted in Order No. 587–C.

ANR states that copies of the filing have been mailed to all affected customers and state regulatory commissions.

Any person desiring to protest this filing should file a protest with the Federal Energy Regulatory Commission, 888 First Street, N.E., Washington, D.C. 20426, in accordance with Section 385.211 of the Commissions Rules and Regulations. All such protests must be filed as provided in Section 154.210 of the Commission's Regulations. Protests will be considered by the Commission in determining the appropriate action to be taken, but will not serve to make protestants parties to the proceeding. Copies of this filing are on file with the Commission and are available for public inspection in the Public Reference Room.

Lois D. Cashell,

Secretary.

[FR Doc. 97–26598 Filed 10–7–97; 8:45 am]

BILLING CODE 6717–01–M

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

[Docket No. TM97–2–48–000]

ANR Pipeline Company; Notice of Informal Technical Conference

October 2, 1997.

On February 28, 1997, ANR Pipeline Company (ANR) tendered revised tariff sheets reflecting its annual redetermination of the levels of its Transporter's Fuel Use (%) as required by ANR's currently effective tariff. By order issued March 26, 1997, [1] the Commission accepted and suspended the tariff sheets subject to refund, to be effective April 1, 1997, and requested that the parties file additional comments within 20 days of the order, with reply comments to follow 10 days later. By letter dated August 19, 1997, Staff requested additional data from ANR.

Upon review of the filing herein, the additional comments and data responses, staff has determined that it will hold an informal technical conference on this matter.

Take notice that the technical conference will therefore be held at 10:00 a.m., on Tuesday, October 14, 1997, and continuing the following day, Wednesday, October 15, if necessary, in a room to be designated at the offices of the Federal Energy Regulatory Commission, 888 First Street, N.E., Washington D.C. 20426.

All interested parties and Staff are permitted to attend. The parties should be prepared to support their conclusions with specific references to the work papers and information that has been provided to the Commission. Questions about this conference should be directed to Bob Keegan, (202) 208–0158, or Louis Lieb, (202) 208–0012.

Lois D. Cashell,

Secretary.

[FR Doc. 97–26604 Filed 10–7–97; 8:45 am]

BILLING CODE 6717–01–M

[1] 78 FERC ¶ 61,328 (1997).

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

[Project Nos. 1417 and 1835]

Central Nebraska Public Power and Irrigation District Nebraska Public Power District; Notice of Informal Settlement Conference, October 2, 1997

An informal settlement conference will be convened on Wednesday, November 5, 1997 at 8 a.m. at the Denver Federal Center, Third Floor Conference Room, located at 134 Union Blvd., Lakewood, Colorado. The purpose of this off-the-record meeting is to explore the possible settlement of any contested issue. Any person appearing at the conference in a representative capacity must be authorized to negotiate and, to the extent authorized by law, settle matters addressed at the conference.

EXHIBIT II

SITEWIDE RELEASE CRITERIA FOR REMEDIATION OF FACILITIES AT THE SANTA SUSANA FIELD LABORATORY (INCLUDES ENERGY TECHNOLOGY ENGINEERING CENTER) AND ASSOCIATED DOCUMENTATION

(8-89)

United States Government **Department of Energy**

memorandum

DATE: 0 5 SEP 1996

REPLY TO ATTN OF: DOE Oakland Operations Office(ERD)

SUBJECT: Radiological Site Release Criteria for ETEC

TO: Sally Robison, EM-44

I am requesting the approval of the radiation site release criteria for the Energy Technology Engineering Center. The release criteria are a critical component in the DOE process for releasing facilities for unrestricted use. The California Department of Health Services has approved the site release criteria in a letter dated August 9 (see attachment 1).

The proposed limits were developed in the following way:

1) Annual exposure dose. Rocketdyne proposes to use a dose limit of 15 mrem/yr to comply with the 100 mrem plus ALARA as required by DOE 5400.5). This limit is also consistent with the anticipated rules of the NRC and EPA.

2) Ambient exposure rate. The proposed limit of 5μR/hr above natural background complies with the limit of 20μR/hr, plus ALARA, as stated in DOE Order 5400.5. This proposed limit is consistent with NRC limits for Rocketdyne facilities at the Santa Susana Field Laboratory. This limit would be imposed for accessible, or potentially accessible, structures and land.

3) Surface contamination. Surface contamination limits comply with DOE Order 5400.5 and specify the potential contaminants present in the Rocketdyne facilities.

4) Generic Limits for Soil and Water. The generic limits for soil and water were established using the DOE pathway analysis code RESRAD.

09/16/96

The proposed site release criteria are included in "Proposed Sitewide Release Criteria for Remediation of Facilities at the SSFL", Revision A, N001SRR140127.

Your approval is requested by September 16,1996.

Laurence McEwen
Acting Director
Environmental
Restoration Division

Attachments

cc: R. Liddle, ESO
M. Lopez, ERD
D. Williams, EM-443

96-ER-095/

DOE F 1325.8
(08-93)

United States Government | Department of Energy

memorandum

DATE: SEP 17 1996

REPLY TO
ATTN OF: EM-44 (D. Williams, 903-8173)

SUBJECT: Sitewide Limits for Release of Facilities Without Radiological Restriction

TO: R. Liddle, Oakland Operations Office

We have reviewed Rocketdyne's proposed sitewide limits for release of facilities at the Santa Susana Field Laboratory (SSFL) without radiological restriction and are satisfied that our previous concerns and comments have been addressed.

The proposed limits are consistent with the Department of Energy (DOE) Order 5400.5 requirement for a Total Effective Dose Equivalent limit of 100 mrem/yr plus As low As Reasonably Achievable (ALARA) for future occupants, the Nuclear Regulatory Commission proposed a radiological guideline of 15 mrem/yr ALARA, and the Environmental Protection Agency proposed a guideline of 15 mrem/yr for release of properties.

Corrective actions taken by Rocketdyne for the sampling and statistical approach to final survey data validation for DOE projects are now comparable to methodologies or standard practices used at other DOE sites and the requirements of Nuclear Regulatory Commission Nuclear Regulation (NUREG)/CR-5489 (Manual for Conducting Radiological Surveys in Support of License Termination).

We also received a copy of the letter from the California Department of Health Services stating concurrence with the proposed release guidelines and the intent to incorporate these guidelines into Rocketdyne's California Radioactive Material License.

Based upon the above information, the proposed sitewide release criteria for remediation of facilities at the SSFL are hereby approved for use.

If you have any questions, please call Mr. Don Williams of my staff at 301-903-8173.

Sally A. Robison, Ph.D.
Director
Office of Northwestern Area Programs
Environmental Restoration

3SEP96

STATE OF CALIFORNIA—HEALTH AND WELFARE AGENCY

PETE WILSON, *Governor*

DEPARTMENT OF HEALTH SERVICES
4/744 P STREET
P.O. BOX 942732
SACRAMENTO, CA 94234-7320

(916) 323-2759

96ETEC-DRF-0455

August 9, 1996

Ms. Majelle Lee, Program Manager
Environmental Management
Rocketdyne Division
Rockwell International Corporation
P. O. Box 7930
Canoga Park, CA 91309-7930

Subject: Authorized Sitewide Radiological Guidelines for Release of Unrestricted Use

Dear Ms. Lee:

This letter is to acknowledge the receipt of your letter dated June 28, 1996 requesting concurrence of the above subject. The above mentioned letter and its attachments have been reviewed by the staff of this office. The Radiologic Health Branch (RHB) concurs that the proposed release guidelines provide adequate assurance for the release of the facilities and properties at Rocketdyne's Santa Susana Field Laboratory (SSFL) and DeSoto sites without further radiological restrictions. Your letter dated June 28, 1996 with attachments will be incorporated into Rocketdyne's California Radioactive Material License # 0015-70 upon receipt of a commitment letter signed by Mr. Phil Rutherford.

If you have any questions concerning this matter, please feel free to call Mr. Stephen Hsu of this office at (916) 322-4797.

Sincerely,

Gerard Wong

Gerard Wong, Ph.D., Chief
Radioactive Material Licensing Section
Radiologic Health Branch

Rockwell International
Rocketdyne Division

SUPPORTING DOCUMENT

GO NO.	S/A NO.	PAGE 1 OF	TOTAL PAGES	REV LTR/CHG NO. SEE SUMMARY OF CHG	NUMBER
96469	69100	25	26	A	N001SRR140127

PROGRAM TITLE
Radiological Remediation

DOCUMENT TITLE
Proposed Sitewide Release Criteria for Remediation of Facilities at the SSFL

DOCUMENT TYPE
Safety Review Report

KEY NOUNS
Release, Criteria, Guidelines, Soil, Contamination

ORIGINAL ISSUE DATE: 3-11-96
REL. DATE: 8-22-96 MAC

APPROVALS / DATE
P. D. Rutherford 3/7/96
M. E. Lee 3/8/96
C. M. Jones 3/11/96

PREPARED BY/DATE	DEPT	MAIL ADDR
B. M. Oliver 3/7/96	641	T100
R. J. Tuttle	641	T100

IR&D PROGRAM? YES ☐ NO ☒
IF YES, ENTER TPA NO.

DISTRIBUTION

*	NAME	MAIL ADDR
*	G. G. Gaylord	AA24
*	P. H. Horton	T038
*	G. Subbaraman	T038
*	S. R. Lafflam	AA24
*	R. A. Marshall	T038
*	R. M. Moore	T038
*	B. M. Oliver (2)	T100
*	R. J. Tuttle	T100
*	F. C. Dahl	T100
*	P. S. Olson	T038
*	P. D. Rutherford	T387
*	M. E. Lee	T038
*	C. M. Jones	FA68
*	Rad. Rem. Library	T100
*		
*		
*		
*		
*		
*		
*		
*		
*		
*		
*		

* COMPLETE DOCUMENT
NO ASTERISK, TITLE PAGE/SUMMARY OF CHANGE PAGE ONLY

ABSTRACT

At several locations at the Santa Susana Field Laboratory (SSFL), low levels of radioactive contamination in buildings and in soil have occurred and have been or will be cleaned up for eventual release for use without radiological restrictions. For this purpose, a complete set of proposed guideline values for approval by DOE for DOE facilities at the SSFL has been developed, and are presented in this report. The various categories of release guidelines include; 1) annual expected dose, 2) soil and water concentration guidelines, 3) surface contamination guidelines, and 4) ambient gamma exposure rate. The proposed guidelines were obtained from regulatory values where available. Where not available, for example for soil, guidelines were calculated by use of the DOE computer code, RESRAD. For these calculations, the proposed annual dose is 15 mrem/year, which is consistent with proposed EPA and NRC guidelines and ALARA principles. The radionuclide guidelines presented in this report are applicable to DOE-optioned facilities and land and other radiological areas.

RESERVED FOR PROPRIETARY/LEGAL NOTICES

FORM 734-C REV. 12-84

REV	SUMMARY OF CHANGE	APPROVALS AND DATE
A	Section 2: Section reworded to include a reference to ALARA. Dose limit changed to 15 mrem/yr, with new justification. Reference to EPA ALARA analysis included. All references to "without consideration of costs" have been removed. Section 3.2: Reference to topography of region included as additional justification for exclusion of the family farm scenario. Section 3.3 - Shielding Parameter: Shielding calculations revised to reflect a two story residential structure (of the same total floor area), and an effective dose point location midway from the center to the edge of the structure for each story. Residential occupancy realistically apportioned between the first and second stories. Sections 3.4 and 3.5: DOE values for Radium and Thorium are specified instead of the more restrictive RESRAD values. Tables 3 and 4 values have been updated to reflect the new shielding calculations and the 15 mrem/y annual dose limit. Section 6.0: First paragraph revised and combined with second paragraph. Sections 6.1, 6.2, and 6.3: Words added to explain the sampling procedure. Specifically, that sample locations are biased towards areas of known higher readings, or areas of potential contamination. Appendix A: Updated.	B. M. Oliver 8/13/96 R. J. Tuttle 8/14/96 P. D. Rutherford 8/14/96 M. E. Lee 8/14/96 C. M. Jones 8/14/96 MAG Rel: 8-22-96

TABLE OF CONTENTS

LIST OF TABLES

1. INTRODUCTION

At several locations at the Santa Susana Field Laboratory (SSFL), low levels of radiological contamination in buildings and in soil have occurred and have been or will be cleaned up for eventual release for use without radiological restrictions. The DOE requirements for allowable residual radioactivity in sites suitable for release without radiological restrictions ("unrestricted release") are established in DOE Order 5400.5 (Ref. 1). Specific guidelines are given in 5400.5 for surface contamination and for direct gamma exposure. However, except for radium and thorium in soil, no specific guidelines are provided for residual contamination in soil or water. It has become clear that a set of DOE-authorized limits for the SSFL would greatly facilitate the process of determining that a facility is acceptably clean, and verifying this with a confirmatory survey. Approval of such a set of authorized limits is provided for in DOE Order 5400.5, Chapter IV, Section 5, and in draft 10 CFR 834.301(c).

The purpose of this report is to develop a set of proposed guideline values for approval by DOE for the release without radiological restriction of DOE facilities at the SSFL. The various categories of release guidelines include; 1) annual expected dose, 2) soil and water concentration guidelines, 3) surface contamination guidelines, and 4) ambient gamma exposure rate. The guidelines presented in this report are for residual radioactivity above background. When feasible, the local background activity of the suspect radionuclides should be determined and these background values subtracted from the measured release survey data.

The goal for these limits is to provide assurance that reasonable future uses of the property will not result in individual doses exceeding 15 millirem per year. This is consistent with current EPA and NRC guidance, and is supported by a generic cost-benefit analysis presented in Reference 2.

2. ANNUAL DOSE LIMITATION

DOE Order 5400.5 specifies a base Total Effective Dose Equivalent (TEDE) limit of 100 millirem per year for any potential future occupant of a remediated site. The Order also requires the use of the As Low As Reasonably Achievable (ALARA) principle to establish Authorized Limits at a level that is below the base limit. Rocketdyne is proposing to apply a value of 15 millirem per year for the calculation of derived limits for the cleanup of DOE sites at the SSFL, consistent with EPA and NRC guidance. A limit of 15 millirem per year (mrem/year) is adopted to assure that future uses will contribute small doses compared to natural background doses, which are in the range of 250-400 mrem/year (Ref. 3). This limit is considered to be as low as reasonably achievable below the basic DOE dose limit of 100 mrem/year. The 15 mrem/year value corresponds to a calculated increased lifetime cancer risk to a potential future user of the site of 3×10^{-4}.

For any reasonable assigned cost per person-rem, further reduction of anticipated dose due to exposure to residual radioactivity at the site is difficult to justify. For example, the EPA proposed TEDE of 15 mrem/year was arrived at after extensive ALARA analysis of cleanup costs and benefits at sixteen "Reference Sites" representing a wide range of conditions found at contaminated sites throughout the United States. Their analyses assumed a residential use of the decontaminated sites, and their conclusions were that the 15 mrem/year limit represented the most effective value considering all the technical and socio-political issues involved.

Furthermore, at the SSFL, conservative choices in the development, measurement, and interpretation of limits and final surveys provide a firm bias towards overestimation of the remaining risk. These include, 1) a conservative residential scenario for the pathway analyses, 2) use of calibration sources that tend to underestimate the detector efficiency for the likely contaminants, and 3) both qualitative and quantitative tests that provide assurance that the decommissioned facility is suitable for release without radiological restrictions.

3. SOIL AND WATER GUIDELINES

Since there are no federal or state regulatory limits for soil contamination for many of the potential or actual radionuclides of concern at SSFL, site-specific guidelines must be developed. This development is done, as required by the DOE Order, by use of a "pathways" analysis program, which estimates the radiological dose (total effective dose equivalent) that a future user of the property might receive, considering the residual radioactivity and various conditions of use. An effort is made to make these use conditions as reasonable for the use and the local area as can be achieved, without greatly over-estimating or under-estimating potential doses.

To establish these guidelines for cleanup operations at SSFL, the pathways analysis program RESRAD (Ref. 4), developed at Argonne National Laboratory (ANL) for use by DOE, has been used to calculate single radionuclide guidelines for the radionuclides of potential concern at SSFL.

For soil, a dose limit of 15 millirem per year is used. For consideration of radiological contamination in water, which may be collected from wells, sumps, below-grade seepage, or surface water, concentration guidelines were calculated from the Dose Conversion Factors (DCFs) in RESRAD, using the EPA limit of 4 millirem per year for ingested drinking water (Ref. 5), and the EPA assumed intake of water, 2 liters per day. These limits are more restrictive than those imposed on releases from operating facilities, as provided by DOE Order 5400.5 (Ref. 1), NRC (Ref. 6), the State of California (Ref. 7), and EPA for uranium mines and mills (Ref. 8).

3.1 Pathway Analysis

Pathways analysis involves calculating the doses received by a person through several pathways: direct radiation exposure; inhalation of airborne radioactivity; drinking water containing radioactivity; eating foods that have accumulated radioactivity, through uptake of water with radioactivity from the soil, or with airborne radioactivity deposited on the foliage; and ingestion of small amounts of contaminated soil.

The pathways analysis program RESRAD, now in Version 5.61, was developed in the late 1980's for DOE by Argonne National Laboratory for the purpose of performing pathways analysis for a broad range of applications. Considerable flexibility is provided in the program for representing the site-specific conditions of exposure, to permit making the calculation as reasonable for the application as is possible.

Four general types of use may be considered for land for the purpose of calculating dose, other than the obvious zero-dose case of non-use. These may be identified as the industrial scenario, the wilderness scenario (or recreational, such as a park or golf course), the residential scenario, and the family farm scenario. Within these general use scenarios, choices are made for occupancy time (indoors and outdoors), water use, and food sources. Further choices are made to represent the contamination situation, geology, and hydrology. The program comes with a complete set of generally conservative default values, and these may be changed as appropriate to reflect local reality in terms of usage practices and physical conditions, to produce a realistic pathways analysis for the specific site. The default values and the values actually used by the program in the analysis are listed in the output for each calculation, so departures from the default set are well recorded. The printed results from the calculations described in this report are stored in the Environmental Remediation (ER) library file.

The family farm, on which family members spend 100% of their time, drinking water from the surface or from wells, eating vegetables and fruit grown on the land and irrigated with the same water, raising their meat, milk, and fish on that land, is not a reasonable scenario for the site. Although commercial farming is practiced in low-lying valley and coastal areas west of the facility, the rugged nature and topography of the SSFL, combined with poor soil quality, would reasonably preclude a family farm activity on the site. Further, recent land use trends in the area have been to conversion of previous farming property to other non-farming uses. Thus, the industrial, wilderness, and residential scenarios are all perhaps equally probable for the future of the site, and should be the scenarios considered.

3.2 Property Usage Scenarios

The basic usage conditions (per year) modeled in these calculations, for each of the three realistic scenarios, are summarized in Table 1. A complete listing of all RESRAD input data, for the three scenarios, is given in Appendix A. Discussion on specific RESRAD input parameters is given below in Section 3.3

Table 1. Property Usage Conditions for Three Realistic Scenarios

	Industrial	Wilderness	Residential
Occupancy, indoors (hours/year)	1752	0	4380
Occupancy, outdoors (hours/year)	350	876	2190
Occupancy, off site (hours/year)	6664	7890	2190
Drinking water (liters/year)	0	0	510
Fruit, vegetables, grain (kg/year)	1.6	1.6	16
Leafy vegetables (kg/year)	0	0	1.4
Cover thickness (meters)	0	0	0
Contamination area (m^2)	10000	10000	10000
Contamination thickness (meters)	1	1	1
Depth to water table (meters)	5	5	5

3.3 RESRAD Input Parameters

Default values provided in RESRAD are considered to be conservative estimates intended for use when no site-specific information is available. Users of the program are encouraged, however, to use input data that most closely reflects actual conditions existing on their site. As part of several earlier efforts at the SSFL, a number of screening evaluations were performed using the RESRAD code to determine which of the approximately 80 input parameters required by RESRAD were of significance to the general SSFL area. These screening evaluations also were useful in determining conservative site-specific values for input to the code, when the default values were not used. In general, changes to most of the parameters were found to have a negligible effect on the final results because certain dose pathways were either not applicable or negligible for the given scenarios.

Contaminated Zone Parameters: Default values for the area of contamination (10,000 m^2) and the length parallel to aquifer flow (100 m) were assumed. For the depth of contamination, a conservative value of 1 meter is assumed. Measurements conducted at the site have indicated historical maximum values ranging from about 0.4 to 0.6 m for this parameter.

Occupancy Parameters: The default RESRAD values for occupancy of a residence on an affected site are 50% of the time spent indoors and 25% of the time spent outdoors, on the site. Thus, 25% of the time the occupancy is assumed to be off site. For the residential scenario, assuming 8,760 hours in a year, this translates into 4,380 hours spent indoors, 2,190 hours spent outdoors on the site, and 2,190 hours spent off site. For the industrial scenario, the corresponding percentages are assumed to be 20%, 4%, and 76% respectively. For the wilderness scenario, the corresponding percentages are 0%, 10%, and 90%.

Shielding Factors: The annual dose estimates calculated by RESRAD from either direct exposure or by inhalation (dust) are functions of two "structural" shielding parameters and the fraction of time an individual is assumed to spend inside a structure built on the site. Both shielding factors range from 0 to 1, and may be changed by the user to more appropriately match actual site conditions. For inhalation, the RESRAD default is 0.4, and this value is assumed for the present evaluations. For direct gamma exposure, the RESRAD default is 0.7, which is a rather conservative estimate of gamma shielding by a structure. For the present calculations, this latter value was adjusted from the default, for both the industrial and residential scenarios, to account for local construction practice which dictate a minimum 4-inch (0.1 m) concrete slab under the structure.

The gamma shielding factor used as input to RESRAD was calculated by modeling a typical two-story residential structure, and a single story industrial structure using the computer code MicroShield[1]. MicroShield is a point-kernel gamma shielding code developed for IBM-compatible personal computers, based on the mainframe code ISOSHLD. For the residential structure, a conservative lower bound footprint (area) value of 93 m^2 (1,000 ft^2) was assumed. For the industrial structure, a 186 m^2 (2,000 ft^2) area was assumed. A circular area was used with MicroShield to obtain maximum code accuracy with minimum computational time.

---

[1] MicroShield, Version 4.0, Grove Engineering, Inc., 15215 Shady Grove Road, Suite 200, Rockville, MD 20850.

Screening calculations indicated no significant differences between the results for circular and square areas of the same volume.

In all cases the contaminated soil was assumed to have a density of 1.5 g/cm^2, and a thickness of 1 meter. Dose calculations were performed for two vertical distances (1m for the ground floor and 3.6 m for the second story) and for three radial distances (center, midpoint, and edge of structure). The isotopic mix input to MicroShield was the same as that used for the present RESRAD calculations, with a concentration of 1 pCi/g for each isotope. Resulting gamma energy groups for this isotope mix ranged from 0.1 to 1.5 MeV. A factor of 0.89 was used to account for gamma shielding from a typical structural wall composed of approximately 1 inch of stucco and 5/8 inch of drywall, and a window area of approximately 10% of the wall area.

Effective gamma shielding factors obtained from the MicroShield calculations are given in Appendix A. For the residential scenario (the most credible), it is assumed that 12 hours are spent inside the structure per day. If it is further assumed that 8 of these hours are spent upstairs in a bedroom, 4 hours are spent downstairs in a family room, and that a person (on average) is located at the midpoint between the center and the edge of the structure, then the effective gamma shielding factor would be: (0.67)(0.61) + (0.33)(0.31) = 0.51. For the industrial scenario, the value is 0.25, which is the shielding value at the midpoint location for the single story structure.

Table 2. Gamma Shielding Factor Calculations for Typical SSFL Structure

	Gamma Shielding Factor	
Radial Location	**1st Floor**	**2nd Floor**
Residential Structure (93 m^2 footprint, two story)		
Center	0.27	0.57
Midpoint[a]	0.31	0.61
Perimeter[b]	0.57	0.71
Industrial Structure (186 m^2 footprint, single story)		
Center	0.22	-
Midpoint[a]	0.25	-
Perimeter[b]	0.58	-

[a]Midpoint between the center and the perimeter of the structure
[b]Edge of the structure.

It should be noted, that these values do not take into account any out-structures such as garages and patios, both of which would result in additional gamma shielding, and both of which would almost certainly be part of any residences built on the site.

Dietary Parameters: Default RESRAD input values for food and water consumption are based on the family farm scenario, where a significant portion of the diet is grown or raised on the site. For the three credible scenarios considered here, these parameters were adjusted as follows: for the residential scenario, it is conservatively assumed that a small fraction (10% of that grown on a family farm) of the fruit and leafy vegetables consumption would be from material grown on site. The values used are 16 kg/year per person and 1.4 kg/year per person, respectively. It was further assumed that water for the residence would be obtained from a well on the site (510 liters/year per person).

For the industrial and wilderness scenarios, it was assumed that no water would be used that was taken from the site; thus, all water pathways were suppressed with the exception of a secondary pathway via plant ingestion. In the industrial case, bottled drinking water is supplied. Since essentially all surface water at present is a result of the current industrial operations, no surface water would be available in the wilderness scenario. It is also assumed that perhaps 1% of the family farm fruit consumption value might be collected from wild sources, thus, 0.14 kg/year is used for these scenarios.

Contaminated Zone Hydrology Data: The SSFL facility is located in the Simi Hills in eastern Ventura County, California. The Simi Hills are in the northern part of the Transverse Range geomorphic province, and are composed primarily of exposures of the Upper Cretaceous Chatsworth Formation. This formation is a marine turbidite sequence of sandstone with interbedded siltstone/mudstone and minor conglomeratic lenses. The Chatsworth Formation is at least 1,800 m thick in locations east and north of the Facility.

The principal geologic units at the SSFL are the Chatsworth Formation and the shallow alluvium which overlies the Chatsworth Formation in some parts of the Facility, notably in Area IV of the SSFL where the decommissioning and decontamination of nuclear sites is taking place. This layer is Quaternary alluvium consisting of mixtures of unconsolidated sand, silt, and clay, and would include the contaminated zone. Drill holes indicate that the layer may be as thick as 6 meters in some locations.

The density of this alluvium layer is approximately 1.5 g/cm^3. The total and effective porosity of the contaminated zone are assumed to be 0.43 and 0.20 based on the average of data for sand, silt, and clay as given in the RESRAD manual. Precipitation at the facility is measured annually by a rain gauge located in the northeastern portion of the SSFL (Ventura County Rain Gauge Number 249). Based on measured data since 1959, the mean annual precipitation at the SSFL is approximately 18.6 inch, or 0.47 meters. In general, the majority of the precipitation occurs during the months of January through March.

Saturated Zone Hydrology Data: There are two groundwater systems at the SSFL: 1) a shallow system in the surficial alluvium and the underlying zones of weathered sandstone and siltstone/claystone, and isolated shallow fracture systems; and 2) a deeper regional system in the fractured Chatsworth Formation. The shallow zone is discontinuous, with depths to groundwater ranging from land surface to over 9 m. For the present study, we assume that this shallow region most conservatively represents the saturated zone, with an average depth to the water table of about 5 m. Hydraulic conductivity in the saturated zone generally ranges from about 30 to 3,000 m/year. Here, the higher value has been assumed.

Typical pumping rates for deep wells in the Chatsworth Formation (rock) range from 60 to 70 m^3/year up to a maximum of about 300 m^3/year. For the shallow (alluvium) region, however, pumping rates are significantly lower, typically about 35 m^3/year. Further, in the shallow region, many wells would be dry for a good fraction of the year as the replenishment rate is generally low. Water table drop rates, therefore, would range up to 10 m as a result of on-site pumping. Without pumping, however, no data is available on any inherent lowering of the water table. For conservatism, therefore, the default value of 0.001 m/year has been assumed.

Radon Pathway: Two default values were modified for the radon pathway. The thickness of the foundation was set at 0.1 m (4 inches) to correspond to the gamma shielding calculations discussed above. Also, the depth below ground surface was also set at 0.1 m, as basement structures are not typical for the local area.

3.4 Calculated Soil and Water Guidelines from RESRAD

The guidelines calculated from the RESRAD code for various single radionuclides are listed in Table 3 for comparison of the three scenarios. Values for each of the scenarios were determined from separate RESRAD calculation runs using the input parameters given in Appendix A: Water guideline values in Table 3 were calculated from the dose conversion factors used in RESRAD for ingestion, using an EPA value of 2 liters/day total water consumption (per person) from the site, and an EPA dose limit of 4 mrem/year (Ref. 5).

For radionuclides specifically regulated by the EPA (and the State of California), the Safe Drinking Water Act (and CCR Title 22) limits were used. These are (in pCi/l):

H-3	20,000
Combined Ra-226 and Ra-228	5
Sr-90	8
Gross alpha (not including radon and uranium)	15
Gross beta	50
Uranium (U-234 + U-235 + U-238)	20

For U-234, U-235, and U-238, DOE imposes the EPA regulations in 40 CFR 192 (and parts 190 and 440). Similarly, for Ra-226, Th-228 and Th-232, DOE imposes the limits in DOE Order 5400.5.

3.5 Proposed Soil and Water Guidelines

Based on the data in Table 3, proposed conservative guidelines, consistent with the several applicable regulations governing residual radioactivity discussed above, are listed in Table 4. With the exception of uranium, radium, and thorium, the proposed soil guidelines are those calculated from RESRAD for the residential use scenario. For uranium, proposed guidelines are those adopted by the NRC (30, 30, and 35 pCi/g for U-234, U-235, and U-238, respectively, see

Table 3. RESRAD-Calculated Single Isotope Guidelines Values

	Soil Guidelines (pCi/g)			
Radionuclide	**Industrial**	**Wilderness**	**Residential**	**Water (pCi/l)[a]**
Am-241	120	162	5.44	1.50
Co-60	10.9	9.83	1.94	204
Cs-134	18.7	16.9	3.33	74.7
Cs-137	51.9	46.7	9.20	110
Eu-152	25.3	22.8	4.51	845
Eu-154	23.0	20.7	4.11	573
Fe-55	2,370,000	4,780,000	629,000	9,020
H-3	129,000	129,000	31,900	85,600[b]
K-40	162	147	27.6	294
Mn-54	34.4	30.9	6.11	1,980
Na-22	13.0	11.7	2.31	476
Ni-59	1,390,000	1,560,000	151,000	26,100
Ni-63	511,000	572,000	55,300	9,490
Pu-238	140	192	37.2	1.71
Pu-239	127	175	33.9	1.55
Pu-240	127	175	33.9	1.55
Pu-241	4,740	6,430	230	79.9
Pu-242	133	183	35.5	1.63
Ra-226	0.520	13.6	0.199	4.12[b]
Sr-90	370	376	36.0	35.8[b]
Th-228	14.8	14.7	2.81	6.78
Th-232	7.94	7.98	1.53	2.01
U-234	519	647	106	19.3[b]
U-235	163	160	32.1	20.5[b]
U-238	399	445	90.9	20.4[b]

[a]Water guidelines calculated from RESRAD ingestion dose conversion factors, assuming the EPA dose limit of 4 mrem/year (see text).

[b]For these radionuclides, the EPA Safe Drinking Water Act or the State of California CCR Title 22 limits should be used (see Table 4).

Table 4. Proposed Soil and Water Guidelines for SSFL Facilities

Radionuclide	Soil Guidelines (pCi/g)	Water (pCi/l)
Am-241	5.44	1.5
Co-60	1.94	200
Cs-134	3.33	75
Cs-137	9.20	110
Eu-152	4.51	840
Eu-154	4.11	570
Fe-55	629,000	9,000
H-3	31,900	20,000[a]
K-40	27.6	290
Mn-54	6.11	2,000
Na-22	2.31	480
Ni-59	151,000	26,000
Ni-63	55,300	9,500
Pu-238	37.2	1.7
Pu-239	33.9	1.6
Pu-240	33.9	1.6
Pu-241	230	80
Pu-242	35.5	1.6
Ra-226	5[c] and 15[c]	4.1
Sr-90	36.0	8[a]
Th-228	5[c] and 15[c]	6.8
Th-232	5[c] and 15[c]	2.0
U-234	30[b]	
U-235	30[b]	total uranium 20[a]
U-238	35[b]	
Gross alpha (not including radon and uranium)		15[a]
Gross beta		50[a]

[a]State of California Maximum Contaminant Levels, CCR Title 22
[b]Generally more conservative NRC limits for uranium isotopes are proposed.
[c]DOE Order 5400.5 limits are proposed (5 pCi/g averaged over first 15 cm of soil depth and 15 pCi/g averaged over 15 cm layers below the top 15 cm).

Ref. 9). For radium and thorium, DOE Order 5400.5 limits are proposed (5 pCi/g averaged over first 15 cm of soil depth and 15 pCi/g averaged over 15 cm layers below the top 15 cm, see Ref. 1). Guidelines established from the residential use scenario are the most restrictive of the three scenarios considered.

The choice of a basic dose limit of 15 mrem/year for all pathways combined leads to lower limits than would result from the use of the dose limits established by the EPA for the uranium fuel cycle (Ref. 10) and by DOE for unrestricted release of contaminated property (Ref. 1). The water guidelines are those calculated from the RESRAD dose conversion factors, using the EPA values for the basic dose limit and daily water intake, with the Maximum Contaminant Levels (MCL) specified for certain radionuclides by the State of California (Ref. 11).

4. SURFACE CONTAMINATION GUIDELINES

Surface contamination limits are specified in Figure IV-1 of Chapter IV in DOE Order 5400.5. For SSFL facilities, these limits have been modified by specifying the potential contaminants present in the Rockwell facilities, and eliminating those that are not pertinent. The proposed guidelines are given in Table 5. As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

Table 5. Proposed Surface Contamination Guidelines for SSFL Facilities

Radionuclide	Average over 1 m^2 (dpm/100 cm^2)	Maximum in 100 cm^2 (dpm/100 cm^2)	Removable (dpm/100 cm^2)
Plutonium, Radium	100	300	20
Thorium	1,000	3,000	200
Uranium	5,000	15,000	1,000
Mixed fission products	5,000	15,000	1,000
Activation products	5,000	15,000	1,000
Tritium	-	-	10,000

As included in Table 5, Pu, Ra, U, Th, mixed fission products, and activation products, refer to those forms of radioactive material that comprise the residual activity at the SSFL. Plutonium is predominately Pu-239; Radium is Ra-226. It is assumed that thorium is sufficiently aged that all daughters are in equilibrium, Th-natural. Uranium will occur in depleted, normal, or enriched forms; U-233 is not present. Mixed fission products include Sr-90 and Cs-137 as components of the mixture. Possible activation products include Co-60, Fe-55, Mn-54, Eu-152, Eu-154, Al-26, and similar radionuclides.

Tritium contamination limits are based on interim guidelines for removable surface contamination (Ref. 12). This level of removable contamination insures that any non-removable or volumetric contamination will not cause unacceptable exposures.

These guidelines would be imposed for accessible (or potentially accessible) surfaces and structures.

5. AMBIENT GAMMA EXPOSURE RATE

A guideline of 5 μR/hr above natural background, measured at 1 meter above the surface, is proposed. This value has been imposed by the NRC for decommissioning research reactors (Ref. 13). It is as low as reasonably measurable, due to variations in background, and is significantly lower than the guideline of 20 μR/hr stated in DOE Order 5400.5, Chapter IV, Section 4.c. This guideline would be imposed for accessible (or potentially accessible) structures and land. Our experience has been that this level can be achieved and verified in facilities that would be suitable for continued use.

6. APPLICATION OF GUIDELINES

The guidelines presented above should be used in planning any decontamination effort at the SSFL. Analytical capability for detection of each radionuclide should be, if possible, less than one-tenth of the guideline values. That is, the Minimum Detectable Activity (MDA, our LLD) should be less than 0.1 x guideline. Field measurements used to direct removal of contaminated soil should be capable of practical measurements below the guideline value. Survey measurements and sample analyses should be corrected for the local background activity of each radionuclide.

6.1 Soil Guidelines

Sample analysis is necessary to demonstrate the successful decontamination of soil areas. A qualitative scan will be performed using gamma-sensitive and/or beta-sensitive detectors to identify any significant areas of residual contamination. Soil samples will be taken from locations based on a 3x3 meter master grid. One sample will be taken from within a 1x1 meter grid location in each 3x3-meter section, based either on the qualitative scan survey indications at the area of maximum readings or, if no noticeable readings were found, at the location most likely to have residual contamination, by the surveyor's judgment. This selection assures a reasonably uniform sampling of the ground areas, at a sample density of approximately 11 samples per 100 m^2.

Results from individual samples will be compared with the limit for hotspots of 9-m^2 area, that is, 3.3 x the adopted concentration limit. Averages of adjacent samples, covering 100 m^2, will be compared with the average limit. The overall average, assuming that the individual and 100-m^2 area averages satisfy the applicable limits, will be used for a RESRAD confirmatory calculation. This calculation will be performed to demonstrate that the maximum expected annual dose for the indicated reasonable use scenario for the facility *does not exceed* the proposed 15 mrem/year guideline value.

For mixtures of radionuclides in soil, the "Sum of Fractions" rule is used. The sum of the ratios of concentration of each radionuclide to the corresponding guideline must not exceed 1. This value must be satisfied when samples are averaged over each 100-m^2 region. For cases in which the relative concentrations are known or assumed, this method is used to generate combined radionuclide guidelines for each radionuclide in the mixture.

The guidelines are not intended to be spot limits, and should not be applied to individual measurements. If the specific sampling provides only (or fewer than) one measurement per 100-m^2 area, each measurement becomes, by default, the "average" for that 100-m^2 area, and the guidelines have the effect of acting as spot limits. In cases where an individual sample exceeds the guideline value, additional samples should be taken from within the same 100-m^2 area, and used to define the average contamination in this area.

The maximum concentrations remaining as "hot spots" must have contamination less than that calculated by the hot-spot rule presented in DOE Order 5400.5, Chapter IV, page 4. The average contamination within any area not exceeding 25 m^2 shall not be greater than $\sqrt{100/A}$ guideline, where A is the area in m^2. Reasonable efforts shall be made to remove any soil with contamination that exceeds 30 x guideline (Ref. 4).

6.2 Surface Contamination Guidelines

The proposed surface contamination guidelines would be applied to all accessible surfaces and structures. This would include ceilings, floors, and walls, and other potentially accessible locations such as attics. Where surface contamination by both alpha- and beta-gamma-emitting radionuclides exists, the guidelines established for alpha- and beta-gamma-emitting radionuclides should apply independently. Measurements of average contamination are averaged over an area of 1 m^2. For objects of less surface area, the average should be derived for each such object. The maximum contamination level applies to an area of not more than 100 cm^2. Surfaces of facilities which are likely to be contaminated, but are inaccessible for purposes of measurement, shall be presumed to be contaminated in excess of the applicable limits.

Following a complete qualitative scan of the facility, quantitative surface contamination measurements will be made over a fraction of the structural surfaces, as determined by the designation of the area as affected or unaffected. Affected areas will be surveyed at a nominal fraction of 11%. Unaffected areas will be surveyed at lesser fractions. Locations for the quantitative survey measurements will be based on a 3x3 meter master grid. One sample will be taken from within a 1x1 meter grid location in each 3x3-meter section, based either on the qualitative scan survey indications at the area of maximum readings or, if no noticeable readings were found, at the location most likely to have residual contamination, by the surveyor's judgment. Results from individual locations will be compared with the applicable limits.

Total surface contamination is measured by use of detectors primarily or exclusively sensitive to alpha or beta-gamma radiation. After a qualitative survey of the surfaces of the entire subject area, quantitative measurements are made on 1-m^2 areas selected uniformly throughout the area. These measurements are made with the detectors connected to a scaler set to accumulate counts for a 5-minute period. The detector is slowly scanned over the 1-m^2 grid location and the numerical result, after correction for background, count time, and detector efficiency, yields the 1-m^2 average surface activity. These detectors are calibrated against Th-230 for alpha activity and Tc-99 for beta activity. The emission energies of these radionuclides is generally less than those radionuclides found as contamination at SSFL. This results in an underestimate of the efficiency of the detectors for the actual contaminant radioactivity and hence an overestimate of the actual measurement.

The amount of removable activity per 100 cm^2 of surface area is determined by wiping an area of that size with dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wiping with an appropriate instrument of known efficiency. Typically at Rocketdyne, a low background gas flow proportional counter is used. When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. It is not necessary to use wiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the guidelines for removable contamination.

Smear methods for tritium detection are similar to that described above, with the exception that a wet swipe or piece of Styrofoam should be used. If the property has been recently decontaminated, a follow-up measurement (smears) should be conducted to ensure that there is no build-up of contamination with time.

6.3 Ambient Gamma Exposure

Measurements of the ambient gamma exposure rate provides a useful determination of residual volumetric radioactivity that may not be as easily detected by surface measurements or sampling and analysis. For the purpose of demonstrating suitability for release, this measurement provides an additional test.

The DOE established a limit of 20 μR/hr above natural background for screening radium-contaminated property. The NRC has imposed a 10μR/hr limit on the decommissioning of radioactive materials licensees, and a 5μR/hr limit on the decommissioning of research reactors. The 5 μR/hr limit above natural background is proposed for use at Rocketdyne. Because of the variability and differences in natural background, the limit of 5 μR/hr is about as low as can be reasonably implemented.

Quantitative measurements of the ambient gamma exposure rate will be made over a fraction of the structural surfaces, as determined by the designation of the area as affected or unaffected. Affected areas will be surveyed at a nominal fraction of 11%. Unaffected areas will be surveyed at lesser fractions. Locations for the quantitative survey measurements will be based on a 3x3-meter master grid. One measurement, covering one 1-m^2 grid location, will be made at each grid location chosen for the surface contamination measurements. Results from individual locations will be compared with the applicable limits.

At Rocketdyne, gamma exposure rate is generally measured by use of a 1x1 inch NaI(Tl) detector/photomultiplier probe, connected to a scaler to provide objective numerical values. The detector is placed 1 meter above the local (ground or floor) surface. This instrument is calibrated by reference to a High Pressure Ion Chamber (HPIC) in a background area.

6.4 Statistical Validation of Survey Data

The statistical approach employed at Rocketdyne/ETEC for establishing that survey data meets guideline values is a method referred to as Sampling Inspection by Variables (Ref. 14). This method has been widely applied in industry and the military and is essential where the lot size is impractically large. Application of this method to the remediation of contaminated sites has been discussed in detail elsewhere (see for example, Ref. 15).

In sampling inspection by variables, the number of data points on which measurements are obtained is first chosen to be large so that the parameters of the distribution are likely to have a normal distribution (i.e., Gaussian). The mean of the distribution, $\bar{x}$, and its standard deviation, s, are then related to a "test statistic", TS, as follows:

$$TS = \bar{x} + ks$$

where $\bar{x}$ = average (arithmetic mean of measured values)
s = observed sample standard deviation
k = tolerance factor calculated from the number of samples to achieve the desired sensitivity for the test

TS and $\bar{x}$ are then compared with an authorized acceptance limit, U, to determine acceptance or other plans of action, including rejection of the area as contaminated and requiring further remediation.

The sample mean and standard deviation are easily calculable quantities; the value of k, the tolerance factor, bears further discussion. Of the various criteria for selecting plans for acceptance sampling by variables, the most appropriate is the method of Lot Tolerance Percent Defective (LTPD), also referred to as the Rejectable Quality Level (RQL). The LTPD is defined as the poorest quality that should be accepted in an individual lot. Associated with the LTPD is a parameter referred to as consumer's risk (β), the risk of accepting a lot of quality equal to or poorer than the LTPD (or 10%). NRC Regulatory Guide 6.6 (Ref. 16) states that the value for the consumer's risk should be 0.10. Conventionally, the value assigned to the LTPD has been 10%.

The State of California, Department of Radiological Health Branch, has stated that the consumer's risk of acceptance (β) at 10% defective (LTPD) must be 0.1 (Ref. 17). For those choices of β and LTPD, $K_\beta = K_2 = 1.282$. The number of samples is n. Values of k for each sample size are calculated in accordance with the following equations:

$$k = \frac{K_2 + \sqrt{K_2^2 - ab}}{a}; \quad a = 1 - \frac{K_\beta}{2(n-1)}; \quad b = K_2^2 - \frac{K_\beta^2}{n}$$

where k = tolerance factor,

K_β = the normal deviate exceeded with probability of β, 0.10 (from tables, $K_2 = 1.282$, see Ref. 18),

K_2 = the normal deviate exceeded with probability equal to the LTPD, 10% (from tables, $K_\beta = 1.282$, see Ref. 18)^2, and

n = number of samples.

The statistical criteria for acceptance of a remediated area are presented below.

a) Acceptance: If the test statistic ($\bar{x}$ + ks) is less than or equal to the guideline (U), accept the area as clean. If any single measured value exceeds 80% of the limit, decontaminate that location to as near background as is possible, but do not change the value in the analysis.

b) Collect additional measurements: If the test statistic ($\bar{x}$ + ks) is greater that the limit (U), but $\bar{x}$ itself is less than U, independently resample and combine all measured values to determine if $\bar{x}$ + ks ≤ = U for the combined set; if so, accept the area as clean. If not, the area is contaminated and must be remediated.

c) Rejection: If the test statistic ($\bar{x}$ + ks) is greater than the limit (U) and $\bar{x}$ > = U, the region is contaminated and must be remediated.

Thus, based on sampling inspection, we are willing to accept the hypothesis that the probability of accepting an area as not being contaminated which is, in fact, 10% or more contaminated is 0.10. Or in other words, the final survey acceptance criteria corresponds to assuring with 90% confidence that 90% of an area has residual contamination below 100% (a 90/90/100 test) of the authorized limit.

7. REFERENCES

1. "RADIATION PROTECTION OF THE PUBLIC AND ENVIRONMENT," DOE Order 5400.5, U. S. Department of Energy, February 8, 1989.

2. "Regulatory Impact Analysis for Radiation Site Cleanup Proposed Rule - Draft", U. S. Environmental Protection Agency, January 17, 1996.

3. "Health Effects of Exposure to Low Levels of Ionizing Radiation -- BEIR V," Committee on the Biological Effects of Ionizing Radiations, Board on Radiation Effects Research, Commission on Life Sciences, National Research Council. National Academy Press, Washington, 1990.

4. "A Manual for Implementing Residual Radioactive Material Guidelines," DOE/CH/8901, U. S. Department of Energy, June 1989.

5. "National Primary Drinking Water Regulations; Radionuclides," 40 CFR 141.15 and .16, U. S. Environmental Protection Agency, July 18, 1991.

6. "STANDARDS FOR PROTECTION AGAINST RADIATION," 10 CFR 20, U. S. Nuclear Regulatory Commission.

7. "CALIFORNIA RADIATION CONTROL REGULATIONS," CCR 17, State of California Department of Health Services.

8. "ORE MINING AND DRESSING POINT SOURCE CATEGORY," Subpart C--Uranium, Radium and Vanadium Ores Subcategory, 40 CFR 440, U. S. Environmental Protection Agency.

9. "Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations," Federal Register . Vol. 46, No. 205, pp. 52061-52063, Friday, October 23, 1981. U. S. Nuclear Regulatory Commission.

10. "ENVIRONMENTAL PROTECTION STANDARDS FOR NUCLEAR POWER OPERATIONS," 40 CFR 190, U. S. Environmental Protection Agency.

11. "Environmental Health, Radioactivity," CCR 22, Article 5. State of California Department of Health Services.

12. "Application of DOE 5400.5 Requirements for Release and Control of Property Containing Residual Radioactive Material", DOE Memorandum, DOE-OAK, January 5, 1996.

13. "Order Authorizing Dismantling of Facility and Disposition of Component Parts", Docket No. 50-375, Enclosure to NRC Letter dated February 22, 1983, D. Eisenhut to M. Remley.

14. DOE/CH/8901, A Manual for Implementing Residual Radioactive Material Guidelines, T. L. Gilbert, et al., June 1989.

15. "Statistical Treatment of Radiological Survey Data for Cleanup Decisions and Regulatory Compliance", Proc. Spectrum '92 Conference, Boise, Idaho, August 23 - 27, 1992.

16. "Acceptance Sampling Procedures for Exempted and Generally Licensed Items Containing By-Product Material", U. S. Nuclear Regulatory Commission Guide 6.6, dated June 1974.

17. DECON-1, State of California for Decontaminating Facilities and Equipment Prior to Release for Unrestricted Use, dated June 1977.

18. MIL-STD-414, Sampling Procedures and Tables for Inspection by Variables for Percent Defective, June 11, 1957.

Appendix A

Input Parameters for RESRAD Calculations (Sheet 1 of 3)

Parameter	Value Used for Scenario			RESRAD
	Industrial	Wilderness	Residential	Default
Area of contaminated zone (m^2)	1.000E+04	1.000E+04	1.000E+04	1.000E+04
Thickness of contaminated zone (m)	1.000E+00	2.000E+00	1.000E+00	2.000E+00
Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	1.000E+02	1.000E+02
Basic radiation dose limit (mrem/yr)	1.500E+01	1.500E+01	1.500E+01	3.000E+01
Time since placement of material (yr)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Times for calculations (yr)	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Times for calculations (yr)	3.000E+00	3.000E+00	3.000E+00	3.000E+00
Times for calculations (yr)	1.000E+01	1.000E+01	1.000E+01	1.000E+01
Times for calculations (yr)	3.000E+01	3.000E+01	3.000E+01	3.000E+01
Times for calculations (yr)	1.000E+02	1.000E+02	1.000E+02	1.000E+02
Times for calculations (yr)	3.000E+02	3.000E+02	3.000E+02	3.000E+02
Times for calculations (yr)	1.000E+03	1.000E+03	1.000E+03	1.000E+03
Times for calculations (yr)	3.000E+03	0.000E+00	3.000E+03	0.000E+00
Times for calculations (yr)	1.000E+04	0.000E+00	1.000E+04	0.000E+00
Cover depth (m)	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Density of cover material (g/cm^3)	not used	not used	not used	1.500E+00
Cover depth erosion rate (m/yr)	not used	not used	not used	1.000E-03
Density of contaminated zone (g/cm^3)	1.500E+00	1.500E+00	1.500E+00	1.500E+00
Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	1.000E-03	1.000E-03
Contaminated zone total porosity	4.300E-01	4.300E-01	4.300E-01	4.000E-01
Contaminated zone effective porosity	2.000E-01	2.000E-01	2.000E-01	2.000E-01
Contaminated zone hydraulic conductivity (m/yr)	3.000E+03	3.000E+03	3.000E+03	1.000E+01
Contaminated zone b parameter	5.300E+00	5.300E+00	5.300E+00	5.300E+00
Humidity in air (g/cm^3)	8.000E+00	8.000E+00	8.000E+00	8.000E+00
Evapotranspiration coefficient	5.000E-01	5.000E-01	5.000E-01	5.000E-01
Precipitation (m/yr)	4.700E-01	4.700E-01	4.700E-01	1.000E+00
Irrigation (m/yr)	2.000E-01	2.000E-01	2.000E-01	2.000E-01
Irrigation mode	overhead	overhead	overhead	overhead
Runoff coefficient	2.000E-01	2.000E-01	2.000E-01	2.000E-01
Watershed area for nearby stream or pond (m^2)	1.000E+06	1.000E+06	1.000E+06	1.000E+06
Accuracy for water/soil computations	1.000E-03	1.000E-03	1.000E-03	1.000E-03
Density of saturated zone (g/cm^3)	1.500E+00	1.500E+00	1.500E+00	1.500E+00
Saturated zone total porosity	4.300E-01	4.300E-01	4.300E-01	4.000E-01
Saturated zone effective porosity	2.000E-01	2.000E-01	2.000E-01	2.000E-01
Saturated zone hydraulic conductivity (m/yr)	3.000E+03	3.000E+03	3.000E+03	1.000E+02
Saturated zone hydraulic gradient	2.000E-02	2.000E-02	2.000E-02	2.000E-02
Saturated zone b parameter	5.300E+00	5.300E+00	5.300E+00	5.300E+00
Water table drop rate (m/yr)	1.000E-03	1.000E-03	1.000E-03	1.000E-03
Well pump intake depth (m below water table)	1.000E+01	1.000E+01	1.000E+01	1.000E+01

Input Parameters for RESRAD Calculations (Sheet 2 of 3)

Parameter	Value Used for Scenario			RESRAD
	Industrial	Wilderness	Residential	Default
Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	ND	ND
Well pumping rate (m^3/yr)	not used	not used	7.000E+01	2.500E+02
Number of unsaturated zone strata	1	1	1	1
Unsat. zone 1, thickness (m)	4.000E+00	4.000E+00	4.000E+00	4.000E+00
Unsat. zone 1, soil density (g/cm^3)	1.500E+00	1.500E+00	1.500E+00	1.500E+00
Unsat. zone 1, total porosity	4.300E-01	4.300E-01	4.300E-01	4.000E-01
Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	2.000E-01	2.000E-01
Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	5.300E+00	5.300E+00
Unsat. zone 1, hydraulic conductivity (m/yr)	3.000E+03	3.000E+03	3.000E+03	1.000E+01
Inhalation rate (m^3/yr)	8.400E+03	8.400E+03	8.400E+03	8.400E+03
Mass loading for inhalation (g/m^3)	2.000E-04	2.000E-04	2.000E-04	2.000E-04
Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	3.000E+00	3.000E+00
Exposure duration	3.000E+01	3.000E+01	3.000E+01	3.000E+01
Shielding factor, inhalation	4.000E-01	4.000E-01	4.000E-01	4.000E-01
Shielding factor, external gamma	2.500E-01	7.000E-01	5.100E-01	7.000E-01
Fraction of time spent indoors	2.000E-01	0.000E+00	5.000E-01	5.000E-01
Fraction of time spent outdoors (on site)	4.000E-02	1.000E-01	2.500E-01	2.500E-01
Shape factor flag, external gamma	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Fruits, vegetables and grain consumption (kg/yr)	1.600E+00	1.600E+00	1.600E+01	1.600E+02
Leafy vegetable consumption (kg/yr)	0.000E+00	0.000E+00	1.400E+00	1.400E+01
Milk consumption (L/yr)	not used	not used	not used	9.200E+01
Meat and poultry consumption (kg/yr)	not used	not used	not used	6.300E+01
Fish consumption (kg/yr)	not used	not used	not used	5.400E+00
Other seafood consumption (kg/yr)	not used	not used	not used	9.000E-01
Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	3.650E+01	3.650E+01
Drinking water intake (L/yr)	not used	not used	5.100E+02	5.100E+02
Contamination fraction of drinking water	not used	not used	1.000E+00	1.000E+00
Contamination fraction of household water	1.000E+00	0.000E+00	1.000E+00	1.000E+00
Contamination fraction of livestock water	not used	0.000E+00	not used	1.000E+00
Contamination fraction of irrigation water	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Contamination fraction of aquatic food	not used	not used	not used	5.000E-01
Contamination fraction of plant food	-1	-1	-1	-1
Contamination fraction of meat	not used	not used	not used	-1
Contamination fraction of milk	not used	not used	not used	-1
Livestock fodder intake for meat (kg/day)	not used	not used	not used	6.800E+01
Livestock fodder intake for milk (kg/day)	not used	not used	not used	5.500E+01
Livestock water intake for meat (L/day)	not used	not used	not used	5.000E+01
Livestock water intake for milk (L/day)	not used	not used	not used	1.600E+02
Livestock soil intake (kg/day)	not used	not used	not used	5.000E-01
Mass loading for foliar deposition (g/m^3)	1.000E-04	1.000E-04	1.000E-04	1.000E-04
Depth of soil mixing layer (m)	1.500E-01	1.500E-01	1.500E-01	1.500E-01
Depth of roots (m)	9.000E-01	9.000E-01	9.000E-01	9.000E-01

Input Parameters for RESRAD Calculations (Sheet 3 of 3)

Parameter	Value Used for Scenario			RESRAD
	Industrial	Wilderness	Residential	Default
Drinking water fraction from ground water	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Household water fraction from ground water	not used	not used	1.000E+00	1.000E+00
Livestock water fraction from ground water	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Irrigation fraction from ground water	not used	not used	not used	1.000E+00
C-12 concentration in water (g/cm^3)	not used	not used	not used	2.000E-05
C-12 concentration in contaminated soil (g/g)	not used	not used	not used	3.000E-02
Fraction of vegetation carbon from soil	not used	not used	not used	2.000E-02
Fraction of vegetation carbon from air	not used	not used	not used	9.800E-01
C-14 evasion layer thickness in soil (m)	not used	not used	not used	3.000E-01
C-14 evasion flux rate from soil (1/sec)	not used	not used	not used	7.000E-07
C-12 evasion flux rate from soil (1/sec)	not used	not used	not used	1.000E-10
Fraction of grain in beef cattle feed	not used	not used	not used	8.000E-01
Fraction of grain in milk cow feed	not used	not used	not used	2.000E-01
Storage times of contaminated foodstuffs (days):				
Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	1.400E+01	1.400E+01
Leafy vegetables	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Milk	not used	not used	not used	1.000E+00
Meat and poultry	not used	not used	not used	2.000E+01
Fish	not used	not used	not used	7.000E+00
Crustacea and mollusks	not used	not used	not used	7.000E+00
Well water	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Surface water	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Livestock fodder	not used	not used	not used	4.500E+01
Thickness of building foundation (m)	1.000E-01	not used	1.000E-01	1.500E-01
Bulk density of building foundation (g/cm)	2.400E+00	not used	2.400E+00	2.400E+00
Total porosity of the cover material	not used	not used	not used	4.000E-01
Total porosity of the building foundation	1.000E-01	not used	1.000E-01	1.000E-01
Volumetric water content of the cover material	not used	not used	not used	5.000E-02
Volumetric water content of the foundation	3.000E-02	not used	3.000E-02	3.000E-02
Diffusion coefficient for radon gas (m/sec):				
in cover material	not used	not used	not used	2.000E-06
in foundation material	3.000E-07	not used	3.000E-07	3.000E-07
in contaminated zone soil	2.000E-06	not used	2.000E-06	2.000E-06
Radon vertical dimension of mixing (m)	2.000E+00	not used	2.000E+00	2.000E+00
Average annual wind speed (m/sec)	2.000E+00	not used	2.000E+00	2.000E+00
Average building air exchange rate (1/hr)	5.000E-01	not used	5.000E-01	5.000E-01
Height of the building (room) (m)	2.500E+00	not used	2.500E+00	2.500E+00
Building interior area factor	0.000E+00	not used	0.000E+00	0.000E+00
Building depth below ground surface (m)	1.000E-01	not used	1.000E-01	-1.000E+00
Emanating power of Rn-222 gas	2.500E-01	not used	2.500E-01	2.500E-01
Emanating power of Rn-220 gas	not used	not used	not used	1.500E-01

EXHIBIT III

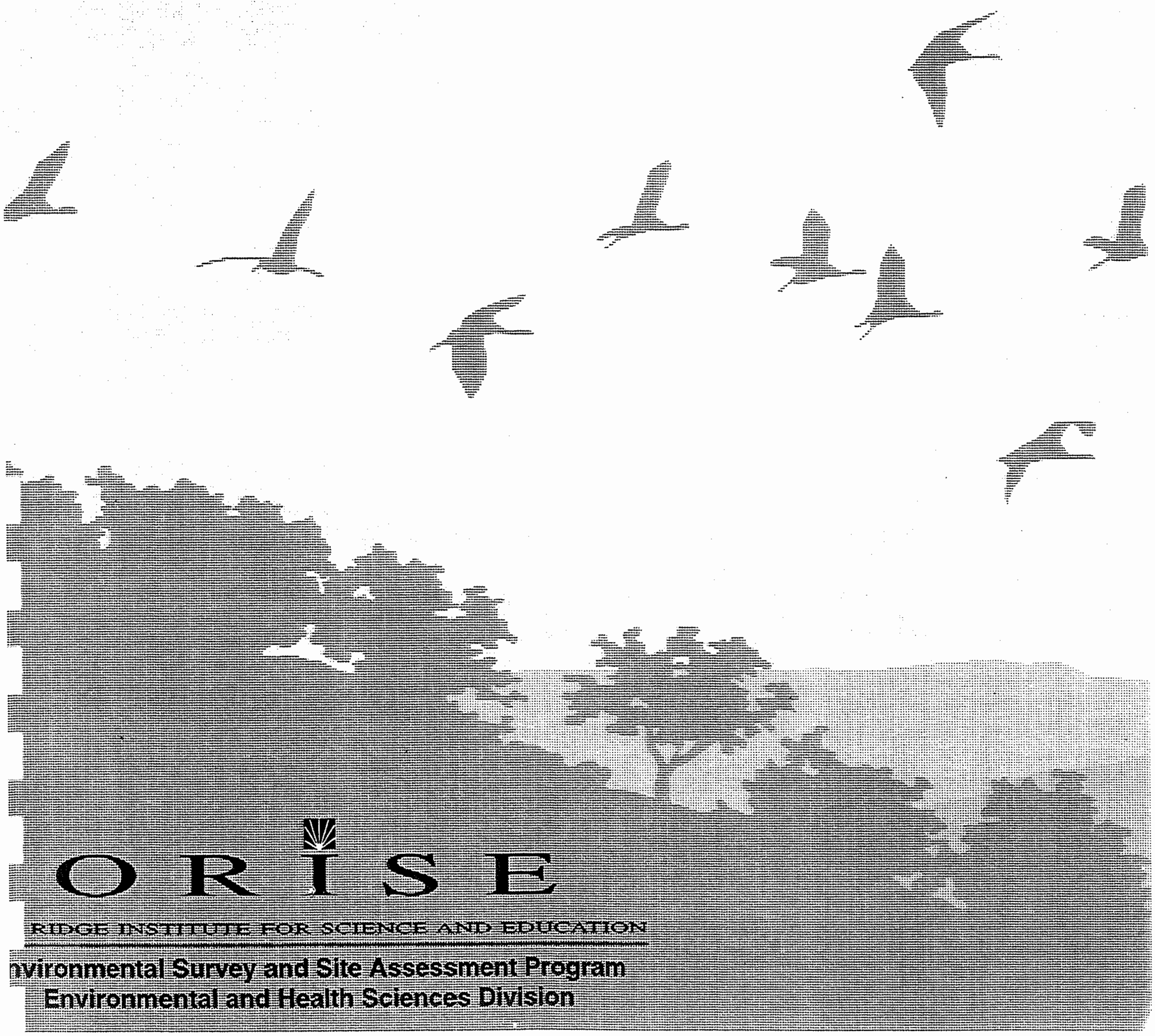
INDEPENDENT VERIFICATION DOCUMENTATION OF THE RADIOLOGICAL CONDITION OF BUILDING T012 AT THE ENERGY TECHNOLOGY ENGINEERING CENTER AFTER DECONTAMINATION AND DECOMMISSIONING

·RIFICATION SURVEY

·ILDING T012
·NTA SUSANA FIELD LABORATORY
·CKWELL INTERNATIONAL
·NTURA COUNTY, CALIFORNIA

. VITKUS AND J. R. MORTON

ıred for the
:e of Environmental Restoration
Department of Energy



ORISE

RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

nvironmental Survey and Site Assessment Program
Environmental and Health Sciences Division

ORISE 96-0869

VERIFICATION SURVEY OF BUILDING T012 SANTA SUSANA FIELD LABORATORY ROCKWELL INTERNATIONAL VENTURA COUNTY, CALIFORNIA

Prepared by

T. J. Vitkus and J. R. Morton

Environmental Survey and Site Assessment Program
Environmental and Health Sciences Division
Oak Ridge Institute for Science and Education
Oak Ridge, Tennessee 37831-0117

Prepared for the

Office of Environmental Restoration
U.S. Department of Energy

FINAL REPORT

OCTOBER 1996

This report is based on work performed under contract number DE-AC05-76OR00033 with the U.S. Department of Energy.

VERIFICATION SURVEY
OF
BUILDING T012
SANTA SUSANA FIELD LABORATORY
ROCKWELL INTERNATIONAL
VENTURA COUNTY, CALIFORNIA

Prepared by: Ray Morton Date: 10/24/96
J. R. Morton, Health Physics Technician
Environmental Survey and Site Assessment Program

Prepared by: Timothy J. Vitkus Date: 10/29/96
T. J. Vitkus, Survey Projects Manager
Environmental Survey and Site Assessment Program

Reviewed by: R. Dale Condra Date: 11/6/96
R. D. Condra, Technical Resources Manager
Environmental Survey and Site Assessment Program

Reviewed by: Ann T Payne Date: 11/1/96
A. T. Payne, Administrative Services Manager,
Quality Assurance/Health & Safety Manager
Environmental Survey and Site Assessment Program

Reviewed by: Eric W. Abelquist Date: 11/4/96
E. W. Abelquist, Assistant Program Director
Environmental Survey and Site Assessment Program

Reviewed by: W L Beck Date: 11/6/96
W. L. Beck, Program Director
Environmental Survey and Site Assessment Program

ACKNOWLEDGMENTS

The authors would like to acknowledge the significant contributions of the following staff members:

FIELD STAFF

T. L. Bright

LABORATORY STAFF

R. D. Condra
J. S. Cox
M. J. Laudeman

CLERICAL STAFF

D. K. Ash
T. S. Fox
K. E. Waters

ILLUSTRATOR

T. D. Herrera

TABLE OF CONTENTS

PAGE

LIST OF FIGURES

PAGE

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

μR/h	microroentgens per hour
AEC	Atomic Energy Commission
BKG	background
cm	centimeter
cm^2	square centimeter
cpm	counts per minute
D&D	Decontamination and Decommissioning
DOE	Department of Energy
dpm/100 cm^2	disintegrations per minute per 100 square centimeters
EM	Environmental Restoration and Waste Management
EML	Environmental Measurements Laboratory
EPA	Environmental Protection Agency
ERDA	Energy Research and Development Administration
ESSAP	Environmental Survey and Site Assessment Program
ETEC	Energy Technology Engineering Center
ft	feet
ha	hectare
HMRFSR	Heavy Metal Reflected Fast Spectrum Reactor
m	meter
m^2	square meter
M&O	Management and Operation
MDC	minimum detectable concentration
NaI	sodium iodide
NIST	National Institute of Standards and Technology
ORISE	Oak Ridge Institute for Science and Education
PIC	pressurized ionization chamber
SNAP	Systems for Nuclear and Auxiliary Power
SRE	Sodium Reactor Experiment
SSFL	Santa Susana Field Laboratory
ZnS	zinc sulfide

VERIFICATION SURVEY
OF
BUILDING T012
SANTA SUSANA FIELD LABORATORY
ROCKWELL INTERNATIONAL
VENTURA COUNTY, CALIFORNIA

INTRODUCTION

Rockwell International's Rocketdyne Division operates the Santa Susana Field Laboratory (SSFL). The Energy Technology Engineering Center (ETEC) is that portion of the SSFL, operated for the Department of Energy (DOE), which performs testing of equipment, materials, and components for nuclear and energy related programs. Contract work for the Atomic Energy Commission (AEC) and the Energy Research and Development Administration (ERDA), predecessor agencies to the DOE, began in the early 1950's. Specific programs conducted for AEC/ERDA/DOE involved the engineering, development, testing, and manufacturing operations of nuclear reactor systems and components. Other SSFL activities have also been conducted for the National Aeronautics and Space Administration, the Department of Defense, and other government related or affiliated organizations and agencies. Some activities have been licensed by both the Nuclear Regulatory Commission and by the State of California Radiological Health Branch of the Department of Health Services.

Numerous buildings and land areas became radiologically contaminated as a result of the various operations which included ten reactors, seven criticality test facilities, fuel fabrication, reactor and fuel disassembly, laboratory work, and on-site storage of nuclear material. Potential radioactive contaminants identified at the site are uranium (in natural and enriched isotopic abundances), plutonium, Am-241, fission products (primarily Cs-137, and Sr-90 present as mixed fission products that have not been separated), activation products (tritium [H-3], Co-60, Eu-152, Eu-154, Ni-63, Pm-147, and Ta-182). Chemical contaminants, mainly chlorinated organic solvents, have also been identified in groundwater, primarily as a result of rocket engine testing.

Decontamination and decommissioning (D&D) of contaminated facilities began in the late 1960's and continues as the remaining DOE program operations at ETEC have been terminated, effective September 30, 1995. As part of this D&D program, Rockwell/Rocketdyne performed decommissioning and final status surveys of a number of the facilities that supported the various nuclear-related ETEC operations conducted during the latter part of the 1950's and continued through to the present. Environmental management of DOE contaminated properties continues under the termination clause of the existing Management and Operation (M&O) contract. Surplus sodium facilities have been included in the current Environmental Restoration and Waste Management (EM) Program for stabilization and eventual clean-up.

Most recently, D&D activities and final status surveys have been completed for Building T012. Operations began in Building T012 in 1962. Experiments were conducted using three Systems for Nuclear and Auxiliary Power (SNAP) critical assembly machines. A majority of the tests were directed at determining criticality of various configurations and conditions. Clad reactor fuel elements were stored in the fuel storage tubes within Room 109 and operations continued intermittently until 1968, when the fuel was shipped to the Source and Special Nuclear Material Storage Vault (T064) and the Building T012 facility was placed in stand-by mode. Later operations included modifications of the critical assembly machine for use in the Heavy Metal Reflected Fast Spectrum Reactor (HMRFSR) project during 1969 and 1970. Critical experiments were performed using fabrications of highly enriched uranium rods and foil used to simulate reactor fuel elements. Fuel materials were stored and assembled in the critical test cell. These fuel materials were later returned to the original supplier in 1972 and the facility was deactivated. From 1979 to 1992, a modification allowed the facility to be used by ETEC Quality Assurance in performance of x-ray machine and source radiography. Rockwell performed a radiological survey of Building T012 and its surrounding areas in 1985. Subsequent D&D efforts were performed and a final status survey was completed in 1996 (Rockwell 1996).

DOE's Office of Environmental Restoration, Northwestern Area Programs is responsible for oversight of a number of remedial actions that have been or will be conducted at the SSFL. It is the policy of DOE to perform independent (third party) verification of remedial action activities conducted within Office of Environmental Restoration programs. The purpose of these independent verifications is to confirm that remedial actions have been effective in meeting established and supplemental guidelines and that the documentation accurately and adequately describes the radiological conditions at the site.

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) was designated as the organization responsible for this task at SSFL, and was requested to verify the current radiological status of Building T012.

SITE DESCRIPTION

The SSFL is located in the Simi Hills of southeastern Ventura County, California, approximately 47 kilometers (29 miles) northwest of downtown Los Angeles (Figure 1). The site is comprised of approximately 1,090 hectares (ha [2,700 acres]) and is divided into four administrative areas (Areas I through IV) and a Buffer Zone. DOE operations were conducted in Rockwell International-owned facilities located within the 117 ha Area IV. The ETEC portion of Area IV consists of government-owned buildings occupying 36 ha.

Building T012, located on B Street, has 120 square meters (m^2) of floor space (Figure 2). In 1986, an unattached operations and control building and the connecting walkway that were considered part of the complex were demolished in order to allow for adjacent construction. The remaining structure has a single floor and consists of three rooms. The critical cell (Room 110) has four-foot thick walls with a 1/4-inch steel liner and a mat-type concrete floor and the equipment room has concrete walls and a concrete floor. Located in the west section of the equipment room is the fuel storage area, which is bounded by a concrete shield containing 1% boron by weight. Within the shield there are 110 cadmium-plated tubes. Figure 3 shows the building's floor plan.

OBJECTIVES

The objectives of the verification survey were to provide independent document reviews and measurement and sampling data for use by the DOE in determining the radiological status of the facility and whether or not the facility meets the guideline requirements for release without radiological restrictions.

DOCUMENT REVIEW

ESSAP reviewed Rockwell's final radiological status survey report (Rockwell 1996). Procedures and methods used were reviewed for adequacy and appropriateness. Final status survey data were reviewed for accuracy, completeness, and compliance with guidelines. Additional review of procedures and supporting documentation referenced in the survey report was performed at SSFL at the time of the verification survey.

PROCEDURES

During the period of July 29 through 31, 1996, ESSAP performed a verification survey of Building T012 at the Santa Susana Field Laboratory. The survey was in accordance with a site-specific survey plan submitted to and approved by DOE and the ORISE/ESSAP Survey Procedures and Quality Assurance Manuals (ORISE 1996a, 1995a and b). This report summarizes the procedures and results of the survey.

REFERENCE GRID

Measurement and sampling locations were referenced to the existing 1 m × 1 m reference grid established during the final status surveys. Measurement and sampling data from any ungridded surfaces, such as upper walls and ceilings, were referenced to the floor or lower wall grid coordinates or to prominent building features.

SURFACE SCANS

Surface scans for alpha, beta, and gamma activity were performed on 100 percent of floor and lower wall surfaces and 5 percent of upper surfaces using ZnS, gas proportional, and NaI scintillation detectors coupled to ratemeters or ratemeter-scalers with audible indicators. Areas of elevated direct radiation identified by scans were marked for further investigation.

SURFACE ACTIVITY MEASUREMENTS

Single point measurements to determine total alpha and total beta surface activity levels were performed on 41 randomly selected grid blocks on the floor, lower walls, and upper surfaces of Building T012 using gas proportional detectors coupled to ratemeter-scalers. A smear sample for the determination of removable activity was obtained from each direct measurement location. Measurement and sampling locations are shown in Figures 4 through 6.

EXPOSURE RATE MEASUREMENTS

ESSAP measured exposure rates at three locations at one meter above the surface using a pressurized ionization chamber (PIC). Measurement locations are shown in Figures 4 to 6. Background exposure rates measured by Rockwell in an area having similar construction as Building T012 and in which site history indicates that radiological materials have not been used, were used for comparison (Rockwell 1996).

SAMPLE ANALYSIS AND DATA INTERPRETATION

Samples and survey data were returned to ORISE's ESSAP laboratory in Oak Ridge, TN for analysis and interpretation. Smears were analyzed for gross alpha and gross beta activity using a low-background gas proportional counter. Sample analysis was performed in accordance with the ORISE/ESSAP Laboratory Procedures Manual (ORISE 1995c). Smear data and direct measurement data were converted to units of disintegrations per minute per 100 square centimeters (dpm/100 cm^2). Exposure rates were reported in units of microroentgens per hour (μR/h).

Additional information regarding major instrumentation, sampling equipment, and analytical procedures is provided in Appendices A and B.

FINDINGS AND RESULTS

DOCUMENT REVIEW

Overall, Rockwell's final radiological survey procedures were appropriate for detection of residual contamination. The survey report data provided adequate documentation of Building T012's radiological status relative to the DOE's guidelines for release for unrestricted use (DOE 1990). Comments identified by ESSAP were provided to the DOE in a September 9, 1996 correspondence (ORISE 1996b).

SURFACE SCANS

Surface scans for alpha, beta, and gamma activity on floor, lower wall, and upper surfaces identified one location of elevated direct alpha radiation on a door hinge at the entrance to the critical cell. All remaining scans were comparable to ambient background levels.

SURFACE ACTIVITY LEVELS

Results of total and removable activity are summarized in Table 1. Total activity levels ranged from less than 34 to 170 dpm/100 cm^2 and less than 230 to 480 dpm/100 cm^2 for alpha and beta, respectively.

Removable activity was less than the minimum detectable concentrations of 9 dpm/100 cm^2 for gross alpha and 15 dpm/100 cm^2 for gross beta.

EXPOSURE RATES

Exposure rates are summarized in Table 2. The Rockwell-determined average background exposure rate was 14 μR/h. ESSAP's verification exposure rates ranged from 12 to 15 μR/h.

COMPARISON OF RESULTS WITH GUIDELINES

A summary of the DOE guidelines for residual radioactive material is included as Appendix C. The primary contaminants of concern for Building T012 are uranium and mixed fission and activation products. The applicable surface contamination guidelines for uranium are as follows (DOE 1990 and 1993):

<u>Total Activity</u>

5,000 α dpm/100 cm^2, average in a 1 m^2 area

15,000 α dpm/100 cm^2, maximum in a 100 cm^2 area

<u>Removable Activity</u>

1000 α dpm/100 cm^2

The guidelines for beta-gamma emitters are:

<u>Total Activity</u>

5,000 β-γ dpm/100 cm^2, average in a 1 m^2 area

15,000 β-γ dpm /100 cm^2, maximum in a 100 cm^2 area

<u>Removable Activity</u>

1,000 β-γ dpm/100 cm^2

All surface activity levels were less than the respective total and removable surface activity guidelines.

The DOE's exposure rate guideline is 20 μR/h above background, however Rockwell has elected to use a more restrictive guideline of 5 μR/h above background. Exposure rates at 1 meter above the surface were within these guidelines.

SUMMARY

During the period of July 29 through 31, 1996 the Environmental Survey and Site Assessment Program performed verification activities for Building T012 at the Santa Susana Field Laboratory located in Ventura County, California. Verification activities included document reviews, surface scans, surface activity measurements, and exposure rate measurements.

The results of the independent verification survey demonstrate that surface activity for all areas was below applicable total and removable guidelines. In addition, exposure rates were comparable to background levels and satisfied both the DOE and the more restrictive exposure rate guideline that Rockwell has elected to use. The findings, therefore, support Rockwell's final status survey conclusion that the radiological conditions of Building T012 satisfy the DOE guidelines for release without radiological restrictions.

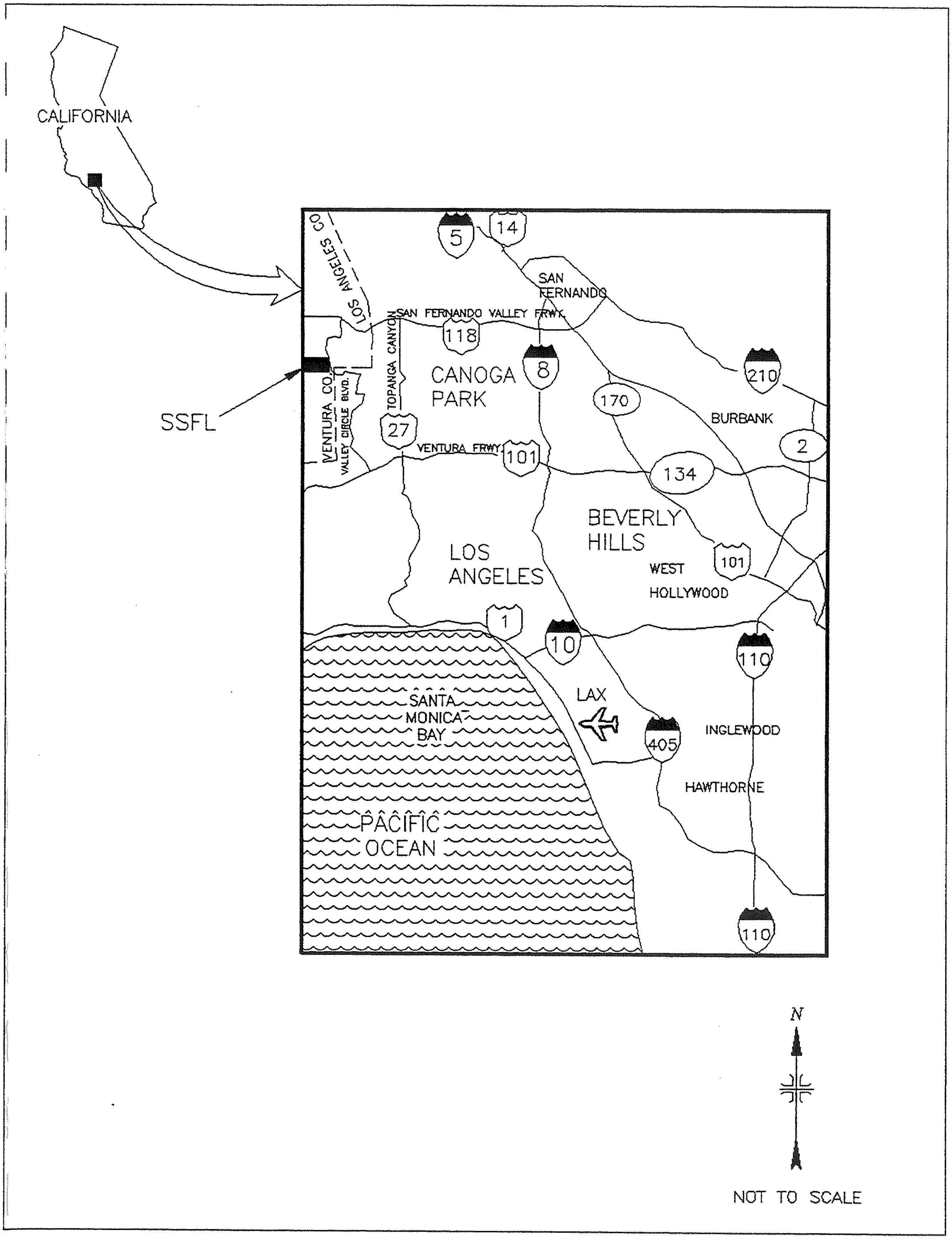
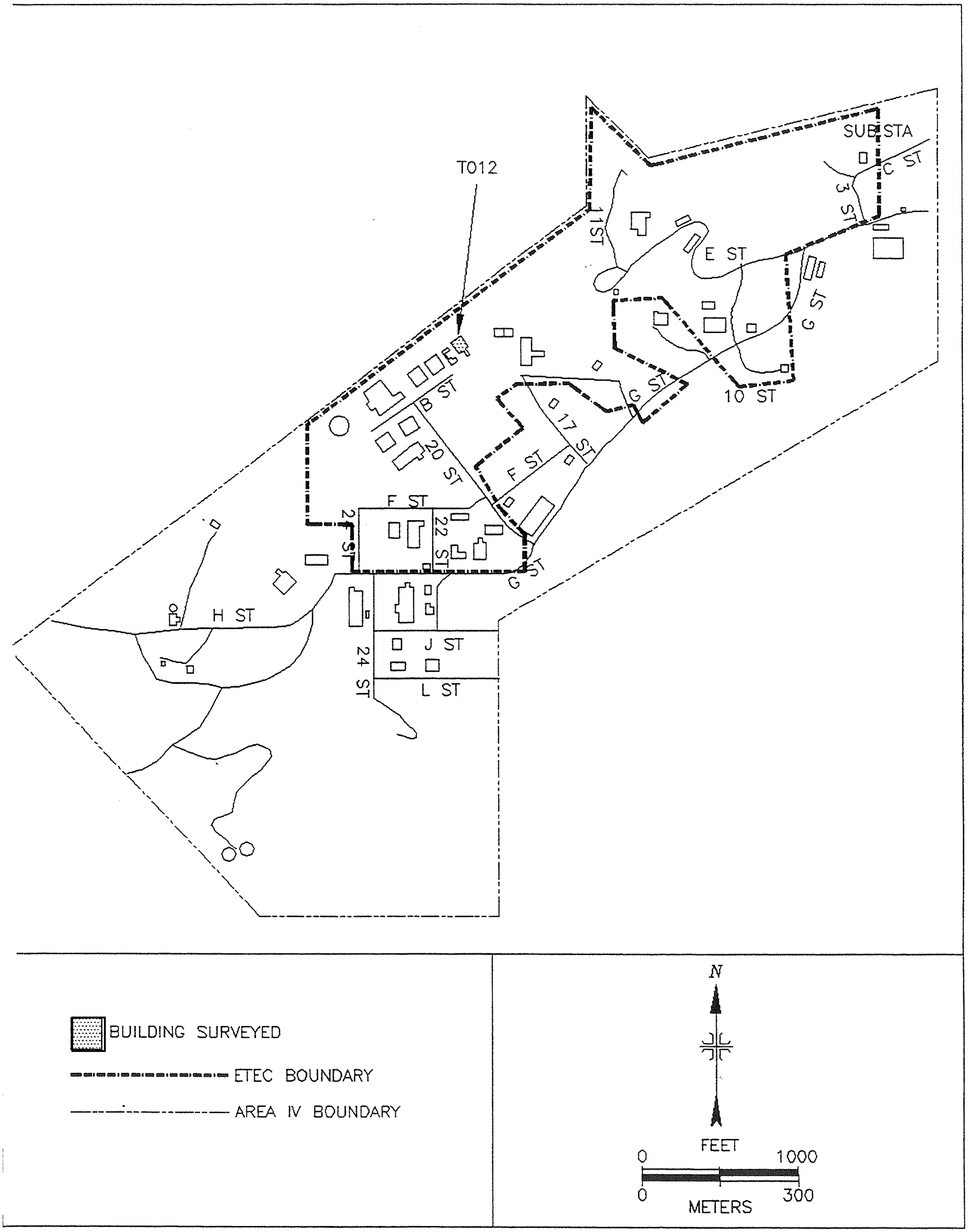


FIGURE 1: Los Angeles, California Area – Location of the Santa Susana Field Laboratory Site



IGURE 2: Santa Susana Field Laboratory Area IV, Plot Plan – Location of Building T012

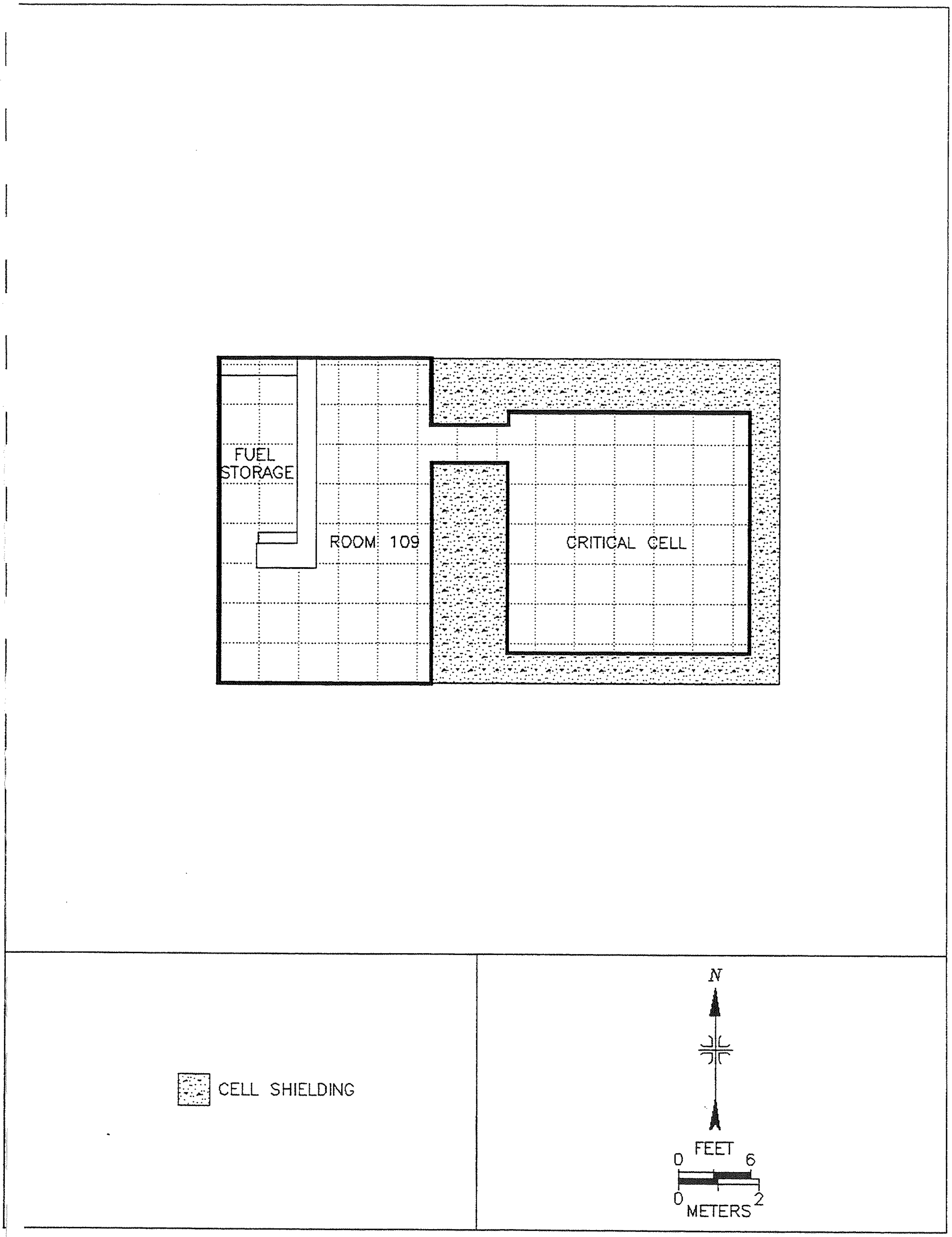


FIGURE 3: Building T012 – Floor Plan

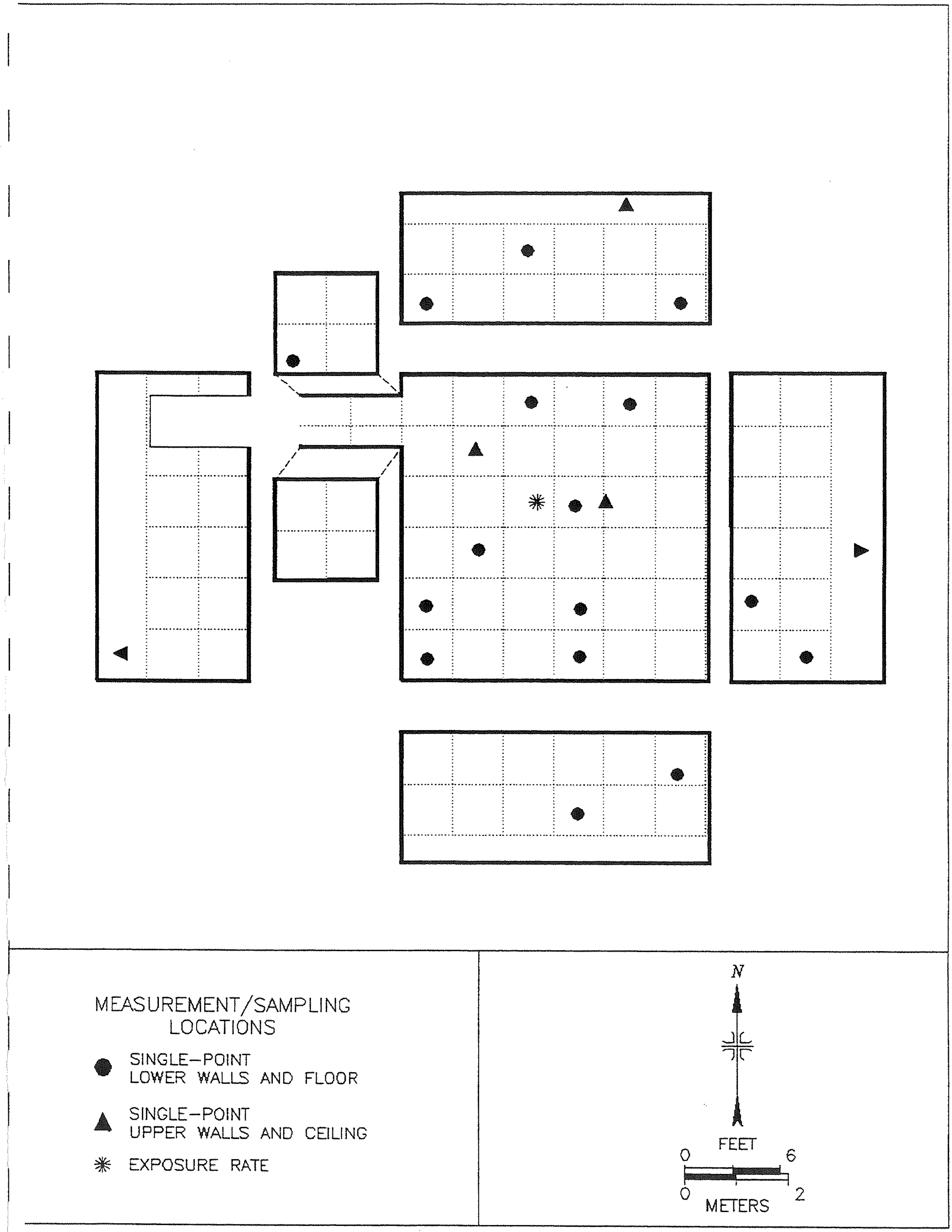


FIGURE 4: Building T012, Critical Cell — Measurement and Sampling Locations

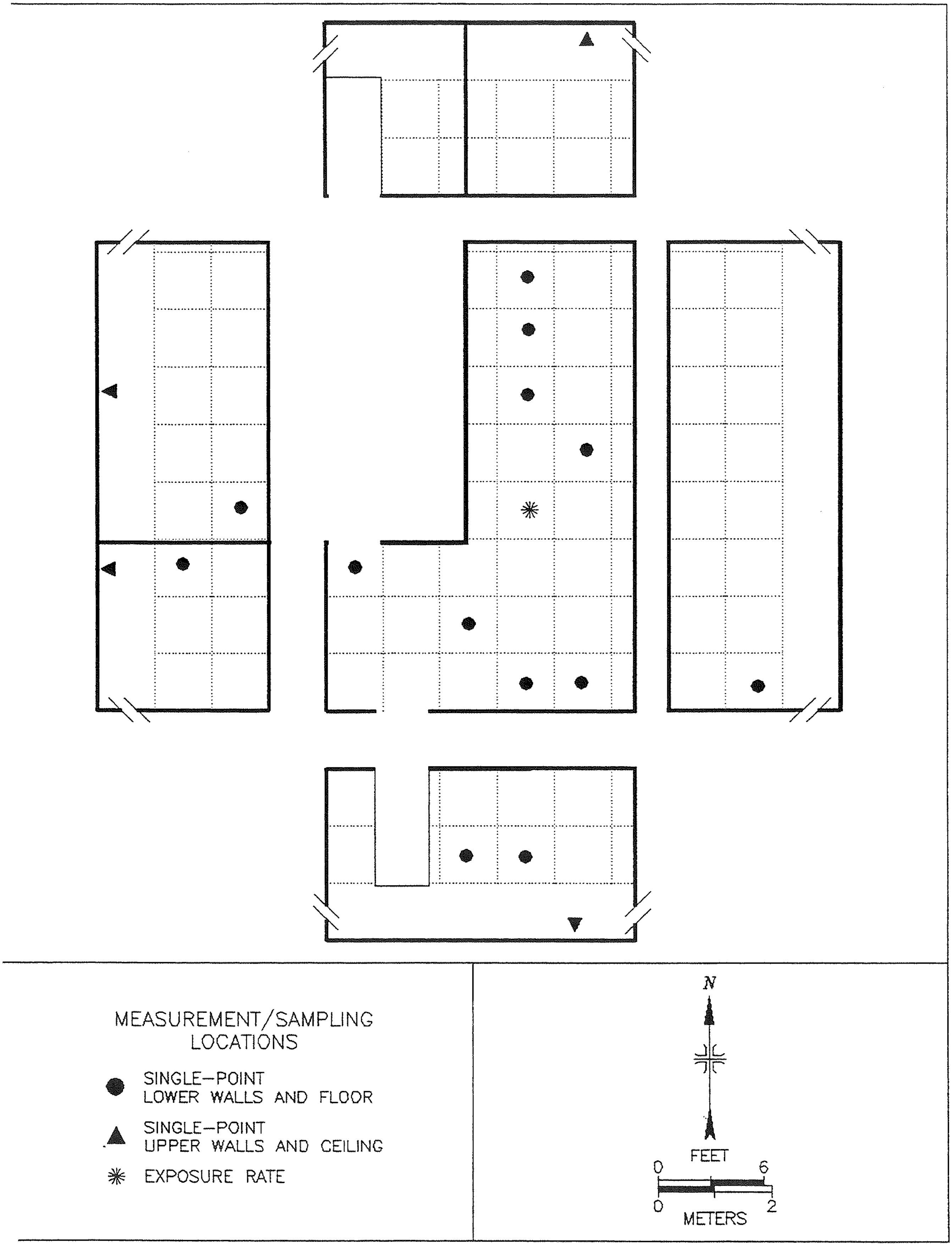


FIGURE 5: Building T012, Room 109 — Measurement and Sampling Locations

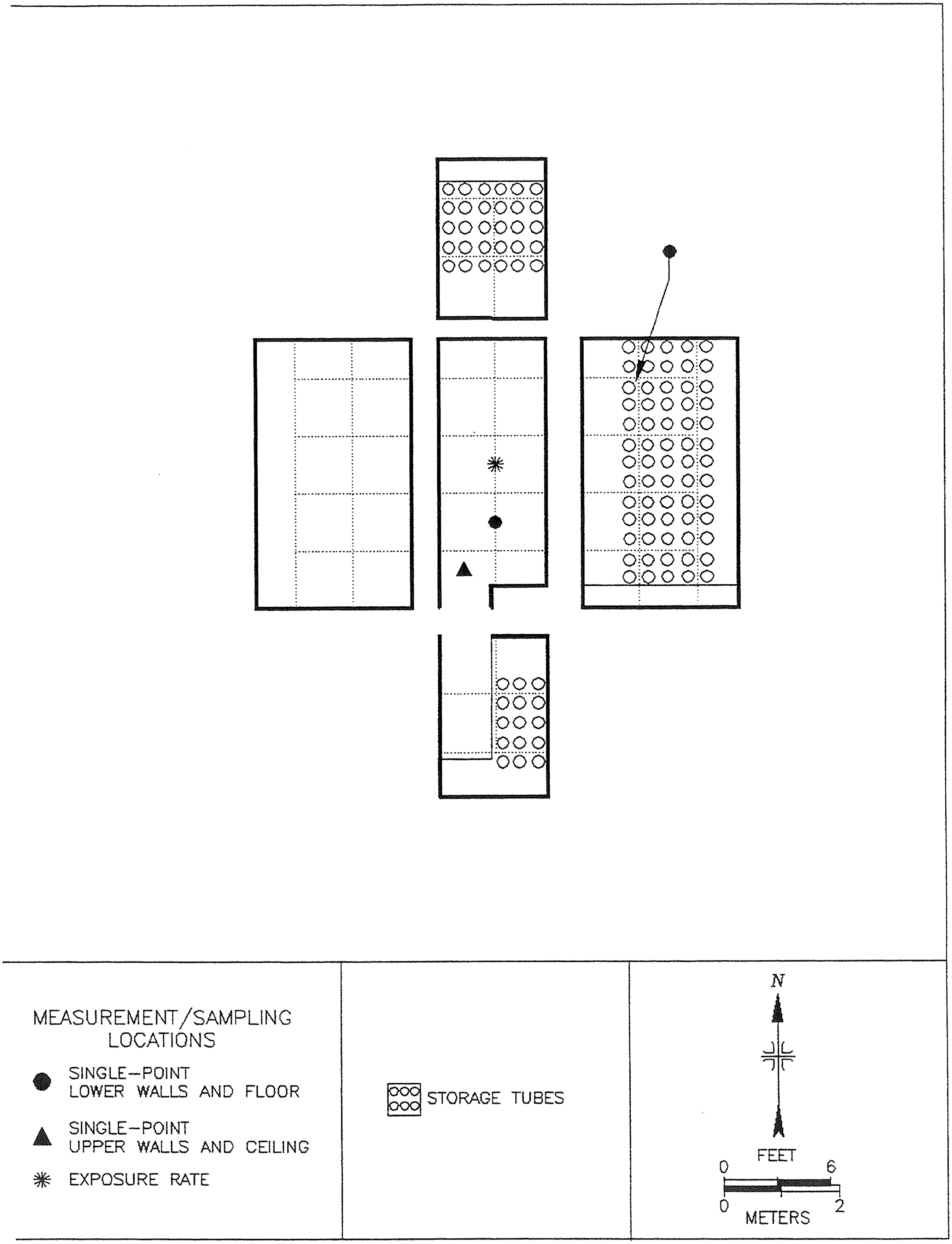


FIGURE 6: Building T012, Room 109, Fuel Storage Cell – Measurement and Sampling Locations

TABLE 1

SUMMARY OF SURFACE ACTIVITY LEVELS
BUILDING T012
SANTA SUSANA FIELD LABORATORY
ROCKWELL INTERNATIONAL
VENTURA COUNTY, CALIFORNIA

Location[a]	**Number of Measurement Locations**	**Range of Total Activity (dpm/100 cm^2)**		**Range of Removable Activity (dpm/100 cm^2)**	
		Single Measurement			
		Alpha	**Beta**	**Alpha**	**Beta**
Critical Cell					
Floor	8	<34	<230	<9	<15
Lower Walls	8	<34 to 170	<230	<9	<15
Upper Surfaces	5	<34	<230	<9	<15
Room 109					
Floor	8	<34	280 to 480	<9	<15
Lower Walls	5	<34	<230 to 330	<9	<15
Upper Surfaces	4	<34	<230	<9	<15
Fuel Storage Cell					
Floor	1	<34	380	<9	<15
Lower Wall	1	<34	<230	<9	<15
Ceiling (Attic)	1	<34	<230	<9	<15

[a]Refer to Figures 4 through 6.

TABLE 2

EXPOSURE RATES
BUILDING T012
SANTA SUSANA FIELD LABORATORY
ROCKWELL INTERNATIONAL
VENTURA COUNTY, CALIFORNIA

Location[a]	Exposure Rate at 1 m (μR/h)
Critical Cell	12
Room 109	15
Fuel Storage Cell	15

[a]Refer to Figures 4 through 6.

REFERENCES

Oak Ridge Institute for Science and Education (ORISE). Survey Procedures Manual for the Energy/Environment Systems Division, Environmental Survey and Site Assessment Program, Revision 9. Oak Ridge, TN; April 30, 1995a.

Oak Ridge Institute for Science and Education. Quality Assurance Manual for the Energy/Environment Systems Division, Environmental Survey and Site Assessment Program, Revision 7. Oak Ridge, TN; January 31, 1995b.

Oak Ridge Institute for Science and Education. Laboratory Procedures Manual for the Energy/Environment Systems Division, Environmental Survey and Site Assessment Program, Revision 9. Oak Ridge, TN; January 31, 1995c.

Oak Ridge Institute for Science and Education. Revised Verification Survey Plan for Buildings T012 and T363, Santa Susana Field Laboratory, Rockwell International, Ventura County, California. Oak Ridge, TN; July 18, 1996a.

Oak Ridge Institute for Science and Education. Comments on the Final Radiological Survey Reports for Buildings T012 and T363, Santa Susana Field Laboratory, Ventura County, California. Oak Ridge, TN; September 9, 1996b.

Rocketdyne Division, Rockwell International Corporation (Rockwell). Final Radiological Survey Report for Building T012. Canoga Park, CA; June 14, 1996.

U. S. Department of Energy (DOE). Radiation Protection of the Public and the Environment. Washington, DC: DOE Order 5400.5; February 1990 and Change 2, January 1993.

APPENDIX A

MAJOR INSTRUMENTATION

APPENDIX A

MAJOR INSTRUMENTATION

The display of a specific product is not to be construed as an endorsement of the product or its manufacturer by the authors or their employers.

DIRECT RADIATION MEASUREMENT

Instruments

Eberline Pulse Ratemeter
Model PRM-6
(Eberline, Santa Fe, NM)

Ludlum Ratemeter-Scaler
Model 2221
(Ludlum Measurements, Inc.,
Sweetwater, TX)

Ludlum Floor Monitor
Model 239-1
(Ludlum Measurements, Inc.,
Sweetwater, TX)

Detectors

Eberline ZnS Scintillation Detector
Model AC-3-7
Effective Area, 74 cm^2
(Eberline, Santa Fe, NM)

Ludlum Gas Proportional Detector
Model 43-68
Effective Area, 126 cm^2
(Ludlum Measurements, Inc.,
Sweetwater, TX)

Ludlum Gas Proportional Detector
Model 43-37
Effective Area, 550 cm^2
(Ludlum Measurements, Inc.,
Sweetwater, TX)

Reuter-Stokes Pressurized Ionization Chamber
Model RSS-111
(Reuter-Stokes, Cleveland, OH)

Victoreen NaI Scintillation Detector
Model 489-55
3.2 cm x 3.8 cm crystal
(Victoreen, Cleveland, OH)

LABORATORY ANALYTICAL INSTRUMENTATION

Low Background Gas Proportional Counter
Model LB-5100-W
(Oxford, Oak Ridge, TN)

APPENDIX B

SURVEY AND ANALYTICAL PROCEDURES

APPENDIX B

SURVEY AND ANALYTICAL PROCEDURES

SURVEY PROCEDURES

Surface Scans

Surface scans were performed by passing the probes slowly over the surface; the distance between the probe and the surface was maintained at a minimum - nominally about 1 cm. Surfaces were scanned using either a large area gas proportional floor monitor or small area (74 cm^2 or 126 cm^2) hand-held detectors. Identification of elevated levels was based on increases in the audible signal from the recording and/or indicating instrument. Combinations of detectors and instruments used for the scans were:

Alpha	-	gas proportional detector with ratemeter-scaler
	-	ZnS scintillation detector with ratemeter-scaler
Alpha-Beta	-	gas proportional detector with ratemeter-scaler
Gamma	-	NaI scintillation detector with ratemeter

Surface Activity Measurements

Measurements of total alpha and total beta activity levels were performed using gas proportional detectors with portable ratemeter-scalers. Alpha and beta activity measurements were performed on randomly selected areas and at locations of elevated direct radiation, using gas proportional detectors with ratemeter-scalers.

Count rates (cpm), which were integrated over 1 minute in a static position, were converted to activity levels (dpm/100 cm^2) by dividing the net rate by the 4 π efficiency and correcting for the active area of the detector. The alpha activity background count rates for the gas proportional detectors averaged one cpm for all surfaces. The beta activity background count rates for the gas proportional detectors averaged 383 cpm. The alpha efficiency factor was 0.17 calibrated to Th-230.

The beta efficiency factor was 0.33 calibrated to Tl-204. The alpha minimum detectable concentration (MDC) was 34 dpm/100 cm^2, while the beta activity MDC was 230 dpm/100 cm^2. The effective window area for the gas proportional was 126 cm^2.

Removable Activity Measurements

Removable activity levels were determined using numbered filter paper disks, 47 mm in diameter. Moderate pressure was applied to the smear and approximately 100 cm^2 of the surface was wiped. Smears were placed in labeled envelopes with the location and other pertinent information recorded.

Exposure Rate Measurements

Measurements of gamma exposure rates were performed using a pressurized ionization chamber. The instrument was adjusted to one meter (3.3 ft) above the surface and allowed to stabilize. The measurement was read directly in μR/h.

Radiological Analyses

Removable Activity

Smears were counted on a low background gas proportional system for gross alpha and gross beta activity.

UNCERTAINTIES AND DETECTION LIMITS

The uncertainties associated with the analytical data presented in the tables of this report represent the 95% confidence level for that data. These uncertainties were calculated based on both the gross sample count levels and the associated background count levels. Additional uncertainties, associated with sampling and measurement procedures, have not been propagated into the data presented in this report.

Detection limits, referred to as minimum detectable concentration (MDC), were based on 2.71 plus 4.65 times the standard deviation of the background count [$2.71 + (4.65\sqrt{BKG})$]. When the activity was determined to be less than the MDC of the measurement procedure, the result was reported as less than MDC. Because of variations in background levels, measurement efficiencies, and contributions from other radionuclides in samples, the detection limits differ from sample to sample and instrument to instrument.

CALIBRATION AND QUALITY ASSURANCE

Calibration of all field and laboratory instrumentation was based on standards/sources, traceable to NIST, when such standards/sources were available. In cases where they were not available, standards of an industry recognized organization were used. Calibration of pressurized ionization chambers was performed by the manufacturer.

Analytical and field survey activities were conducted in accordance with procedures from the following documents of the Environmental Survey and Site Assessment Program:

- Survey Procedures Manual, Revision 9 (April 1995)
- Laboratory Procedures Manual, Revision 9 (January 1995)
- Quality Assurance Manual, Revision 7 (January 1995)

The procedures contained in these manuals were developed to meet the requirements of DOE Order 5700.6C and ASME NQA-1 for Quality Assurance and contain measures to assess processes during their performance.

Quality control procedures include:

- Daily instrument background and check-source measurements to confirm that equipment operation is within acceptable statistical fluctuations.
- Participation in EPA and EML laboratory Performance Evaluation Programs.
- Training and certification of all individuals performing procedures.
- Periodic internal and external audits.

APPENDIX C

RESIDUAL RADIOACTIVE MATERIAL GUIDELINES SUMMARIZED FROM DOE ORDER 5400.5

APPENDIX C

RESIDUAL RADIOACTIVE MATERIAL GUIDELINES SUMMARIZED FROM DOE ORDER 5400.5

BASIC DOSE LIMITS

The basic limit for the annual radiation dose (excluding radon) received by an individual member of the general public is 100 mrem/yr. In implementing this limit, DOE applies as low as reasonable achievable principles to set site-specific guidelines.

STRUCTURE GUIDELINES

Indoor/Outdoor Structure Surface Contamination

	Allowable Total Residual Surface Contamination (dpm/100 cm^2)[b]		
Radionuclides[a]	Average[c,d]	Maximum[d,e]	Removable[f]
Transuranics, Ra-226, Ra-228, Th-230 Th-228, Pa-231, Ac-227, I-125, I-129[g]	100	300	20
Th-Natural, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000	3,000	200
U-Natural, U-235, U-238, and associated decay products	5,000α	15,000α	1,000α
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above[h]	5,000β-γ	15,000β-γ	1,000β-γ

External Gamma Radiation

The average level of gamma radiation inside a building or habitable structure on a site that has no radiological restriction on its use shall not exceed the background level by more than 20 μR/h and will comply with the basic dose limits when an appropriate-use scenario is considered.

[a] Where surface contamination by both alpha- and beta-gamma-emitting radionuclides exists, the limits established for alpha- and beta-gamma-emitting radionuclides should apply independently.

[b] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c] Measurements of average contamination should not be averaged over an area of more than 1 m^2. For objects of less surface area, the average should be derived for each such object.

[d] The average and maximum dose rates associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h and 1.0 mrad/h, respectively, at a depth of 1 cm.

[e] The maximum contamination level applies to an area of not more than 100 cm^2.

[f] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping an area of that size with dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. It is not necessary to use wiping techniques to measure removable contamination levels, if direct scan surveys indicate that total residual surface contamination levels are within the limits for removable contamination.

[g] Guidelines for these radionuclides are not given in DOE Order 5400.5; however, these guidelines are considered applicable until guidance is provided.

[h] This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90, which has been separated from the other fission products, or mixtures where the Sr-90 has been enriched.

REFERENCES

"U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites," Revision 2, March 1987.

"DOE Order 5400.5, Radiation Protection of the Public and the Environment," January 1993.

EXHIBIT IV

BUILDING T012 FACILITY FINAL REPORT

ENERGY TECHNOLOGY ENGINEERING CENTER

OPERATED FOR THE U.S. DEPARTMENT OF ENERGY
Rocketdyne Division, Boeing North American Inc.

No. 012-AR-0001 Rev. ___
Page 1 of 16
Orig. Date May 8,1997
Rev. Date ________

FINAL REPORT

DRR 26039

TITLE: DECONTAMINATION AND DECOMMISSIONING OF BUILDING T012

- APPROVALS -

Originator	A. L. Pascolla	Fac. Mgr.	~~P. H. Horton~~
		Prog. Mgr.	M. E. Lee
		Environ.	R. Rutherford
		H&S	J. Erman
		QA	S. Reeder

REV. LTR.	REVISION	APPROVAL/DATE

OFFICIAL COPY
JUN 06 '97
NOTICE: WILL NOT BE UPDATED

CONTENTS

FIGURES

1. INTRODUCTION AND BACKGROUND

1.1 FACILITY LOCATION

The Energy Technology Engineering Center (ETEC), Santa Susana Field Lab (SSFL), is located in the Simi Hills of southeastern Ventura County, California, adjacent to the Los Angeles County line and approximately 29 miles northwest of downtown Los Angeles, directly south of the City of Simi Valley. Location of the SSFL relative to Los Angeles and vicinities is shown in Figure 1. An enlarged map of neighboring SSFL communities is shown in Figure 2. Figure 3 is a plot plan of the western portion of SSFL known as Area IV, where Building T012 is located. Building T012 is located on government-optioned land.

1.2 TOPOGRAPHY AND BUILDING CHARACTERISTICS

Building T012, located on B Street, had 120 square meters of floor space. In 1986 the passageway and metal portion containing the operations and control rooms of Building T012 (Figure 4) were demolished in order to build the Energy Technology Engineering Center (ETEC) Sodium Component Test Installation (SCTI) Power Pak section of the Cogeneration Project. The concrete vault portion of the facility remains and is used as a structural support foundation for the Cogeneration unit.

The remaining concrete vault consists of two rooms, Room 109 (fuel storage/equipment room) and Room 110 (critical cell), Figure 5. The critical assembly machine was removed when the facility was deactivated and the cell (Room 110) was used for industrial radiography for a short period of time. Room 109 is divided by a 20-in.-thick borated concrete wall in which fuel storage tubes were embedded. An air conditioning duct ran the length of the room over the fuel storage area. The critical cell (Room 110) consisted of a steel lined, 4-ft-thick concrete walled chamber that was secured by a heavy shield (vault type) door. Currently, there are no sources of water, equipment, or active lighting provided in the building. Building T012 is inside a fenced area and the only entrance is through a door which leads directly into Room 109.

1.3 FACILITY OPERATING HISTORY

Operations in Building T012 began with systems for Nuclear Auxiliary Power (SNAP) critical assemblies in 1962. These experiments used three different critical assembly machines, SCA-4A and -4B, and SCA-5. Most tests were directed at determining criticality of various configurations and conditions, such as water immersion, and were performed well below the allowed high power limit of about 100 W. No significant amounts of induced activity were produced by these operations.

Clad reactor fuel elements (U-ZrH) were stored as shipped in containers and in the fuel storage tubes located in Room 109. The SNAP critical experiments continued intermittently through 1968, when the fuel was shipped to the SSN Storage Vault (Building T064), and the facility was placed in a stand-by mode.

In 1969-1970, the SCA-4A critical assembly machine was modified for use in the NASA-sponsored Heavy Metal Reflected Fast Spectrum Reactor (HMRFSR) project, and critical experiments began in 1970. These experiments used various fabrications of highly enriched uranium rods and foil to simulate reactor fuel elements. These fuel materials were stored in the fuel storage tubes, and assembled in the critical cell (Room 110). Some extended tests, at reactor powers of up to 200 W for several hours at a time, were used for reactivity coefficient measurements. The fuel materials were returned to the original supplier in 1972, and the facility was deactivated.

In 1979, the concrete portion of the facility was modified for use by ETEC Quality Assurance in performance of X-ray machine and source radiography under Rocketdyne Use Authorization No. 18 (Reference 6). In preparation for this modification, a radiation survey found some areas that showed alpha activity approaching the allowable surface contamination limit. These areas were idendified for future work. The major modification consisted of enclosure of the fuel storage room to serve as a photographic darkroom. This modification also involved removal of four of the fuel storage tubes. This use was terminated in 1992, with all radioactive sources transferred to the Radioactive Material Handling Facility (RMHF) for storage.

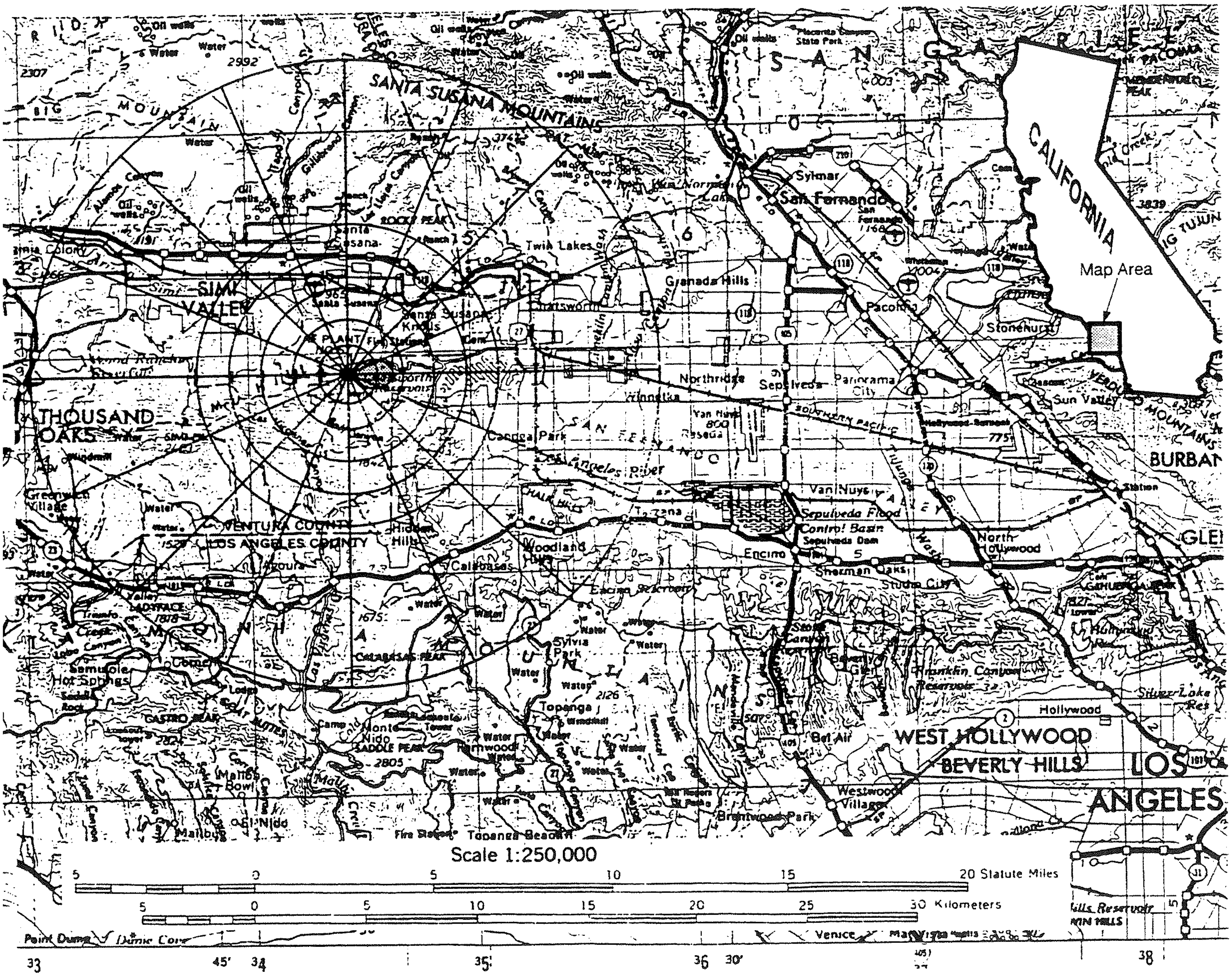


Figure 1. Location of SSFL Relative to Los Angeles and Vicinities

Figure 2. Neighboring SSFL Communities

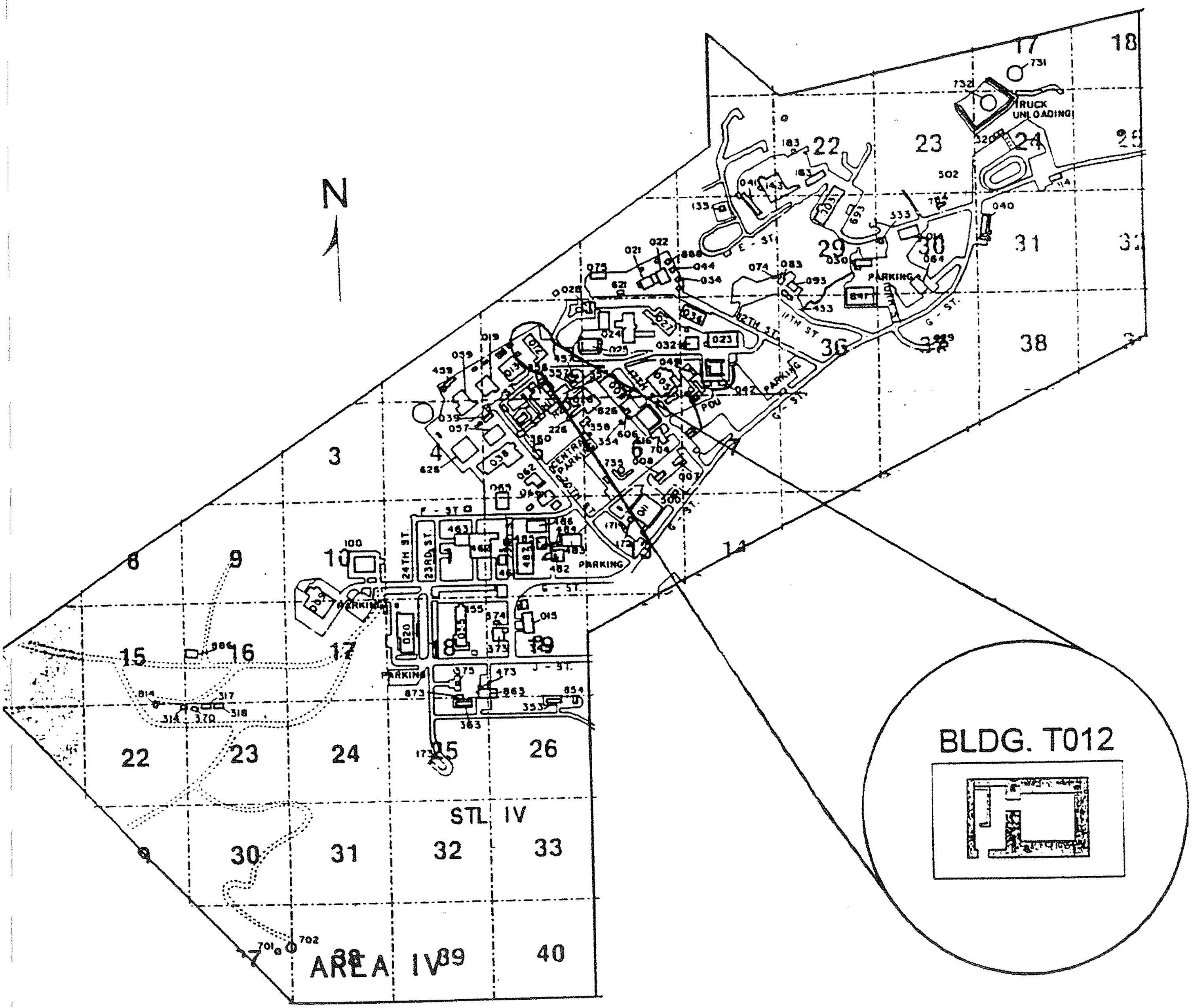


Figure 3. Santa Susana Field Laboratory (SSFL) Area IV

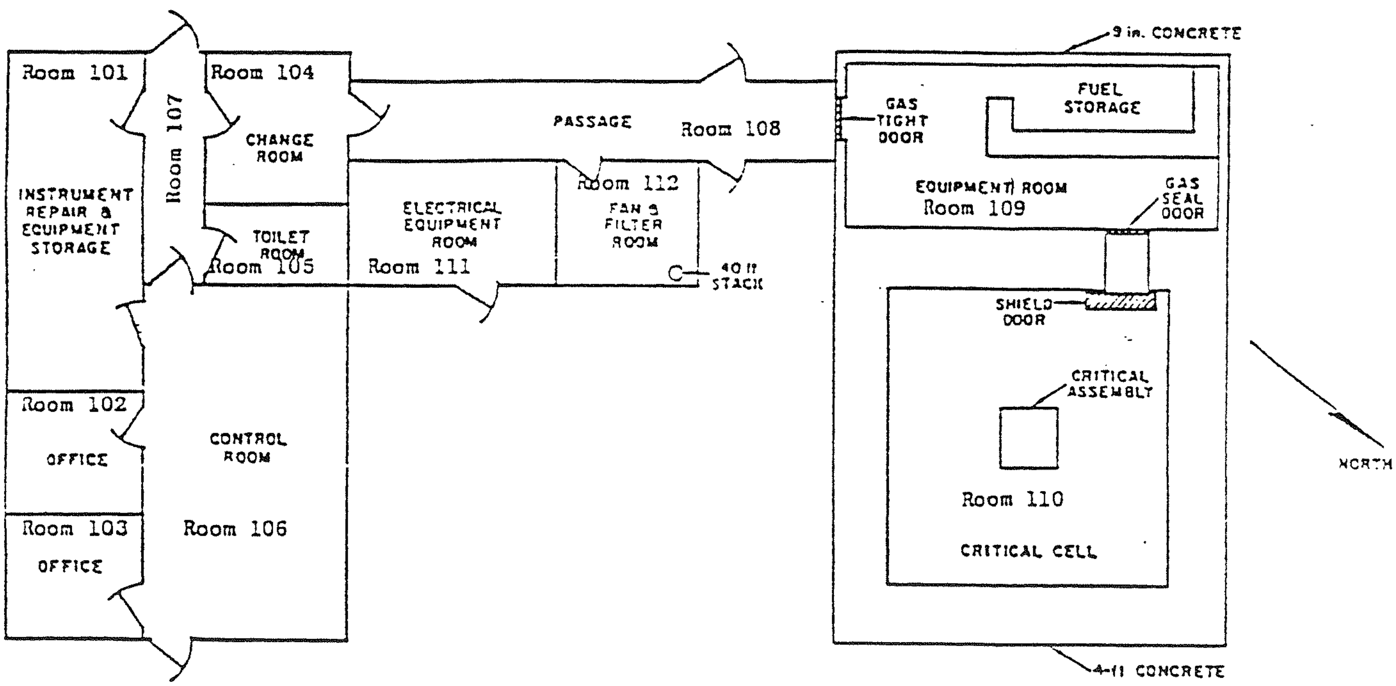


Figure 4. Original Floor Plan of Building T012

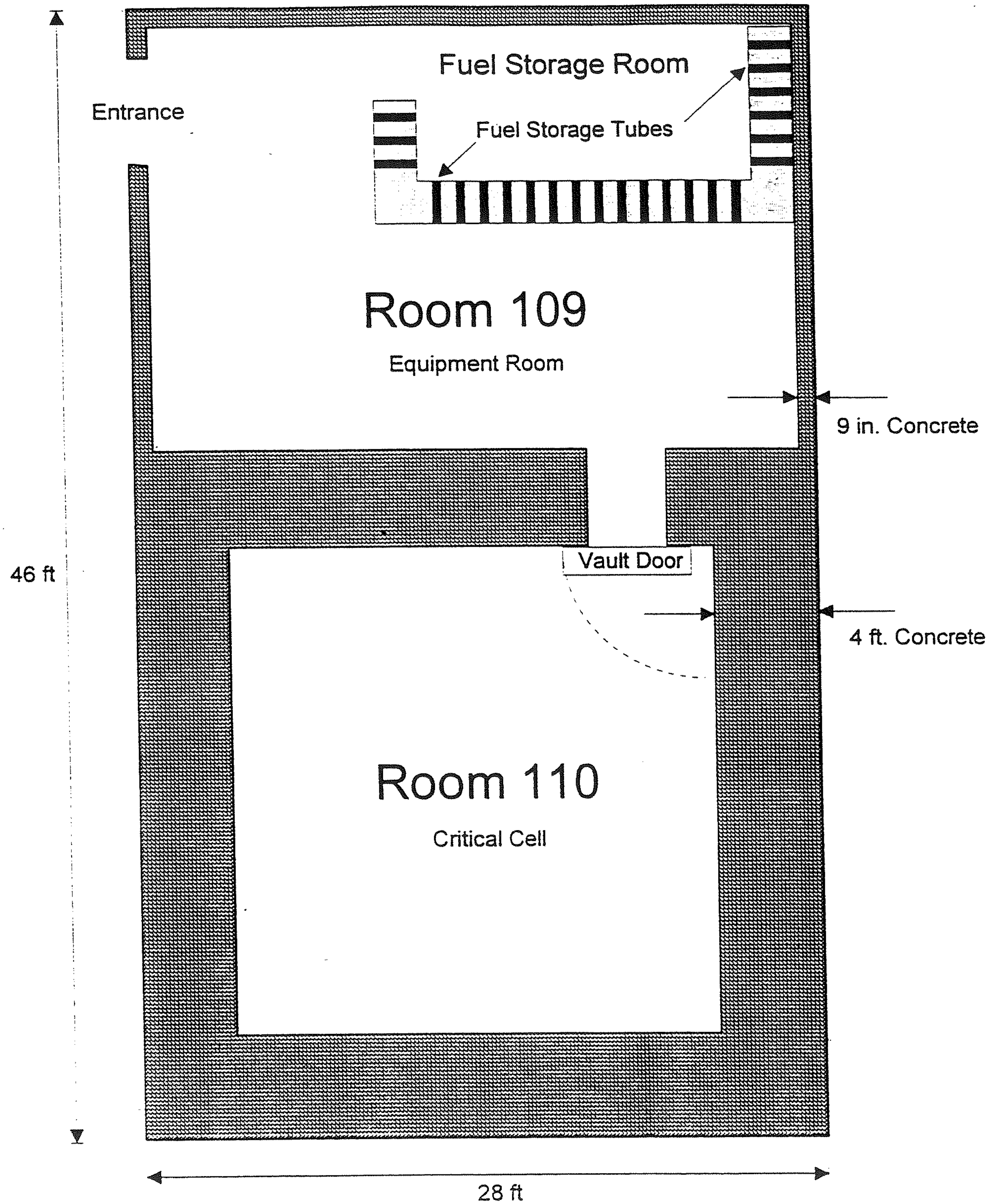


Figure 5. Existing Layout of Building T012 Critical Cell and Equipment Room

2. PRIOR DECONTAMINATION EFFORTS AND RADIOLOGICAL RESULTS

Review of previous Health and Safety Analysis Records indicates Building T012 was decontaminated and surveyed during the period of March through May 1973 (Ref. 3). Fixed contamination was painted over with an eggshell-colored paint and stenciled "Caution Fixed Alpha Radioactive Material." The holdup tank was also removed in 1973.

In 1979 a follow-up radiation survey was performed (Ref. 3). Areas with total alpha activity at or below the limit for uranium were noted and identified. The concrete portion of the facility was modified for use by ETEC Quality Assurance in performance of X-ray machine and source radiography. The major modification consisted of enclosure of the fuel storage room (Room 109) to serve as a radiographic darkroom, and the removal of four of the fuel storage tubes.

A radiological survey of the Building T012 concrete vault was conducted in 1985 preparatory to construction of the ETEC/SCTI Cogeneration plant. The results of the survey (Ref. 3) indicated the presence of alpha contamination in both Rooms 109 and 110 of the concrete vault.

The equipment area of Room 109 exhibited alpha contamination at the entrance door (840-1400 dpm alpha/100 cm^2), overhead light fixtures (2800 dpm alpha/100 cm^2), air conditioning duct (840-2800 dpm alpha/100 cm^2), radioactive exhaust duct (4200 dpm alpha/100 cm^2), and steel door frame between Rooms 109 and 110 (1960 dpm alpha/100 cm^2). Spot checks of the concrete floor surface under the floor tile revealed contamination levels of 1400-2800 dpm alpha/100 cm^2, all of these are below the allowable limit for surface contamination (5000 dpm/100 cm^2).

Survey of the fuel storage area of Room 109 revealed contamination of the concrete floor (up to 6500 dpm alpha/100 cm^2). Survey of the fuel storage tubes indicated contamination levels up to 6000 dpm alpha / 100 cm^2 at the entrance of the tubes. The tubes were surveyed internally by use of a standard alpha scintillator probe modified to provide a cylindrical sensitive surface close to the internal surface of the tubes, most tubes showed acceptably low levels of contamination, however eight contaminated fuel storage tubes were identified and removed.

The walls, ceiling, and floor of the critical cell (Room 110) were covered with paint which prevented meaningful alpha surveying. However, the walls were stencil painted "CAUTION, FIXED ALPHA RADIOACTIVE MATERIAL," but no level of contamination was indicated. Contamination was indicated on the light fixtures (2800 dpm alpha/100 cm^2) and electrical boxes (280-840 dpm alpha/100 cm^2).

3. SUMMARY

To allow the release of Building T012 for use without radiological restrictions, radioactive rials and hazardous waste were removed from the facility.

Initial decontamination and decommissioning efforts began in 1973 with the removal of the 1-up tank." In 1986 the removal of the operations control room and the enclosed passageway ccting those structures to the Equipment Room (Room 109) and the Critical Cell (Room was completed.

Final decontamination and decommissioning of the remaining portion of Building T012 (as ssed in section 4) was performed from February through June 1995. After completion of D&D efforts a comprehensive "Final Radiological Survey" (Ref. 5) was completed to nstrate regulatory compliance for the release of Building T012 without radiological ctions.

4. PROJECT ACTIVITIES AND RESULTS

4.1 PHASE I (1986)

Initial decontamination and demolition efforts of Building T012 were completed in 1986 (Ref. 7). This operation involved the removal of the ventilation exhaust stack (above roof level), the demolition of the operations and control rooms and passageway connecting these structures to the concrete portion of the facility (Rooms 109 and 110).

The above tasks were performed to accommodate the construction of the ETEC/SCTI Power Pak section of the Cogeneration project of the ETEC/SCTI.

The concrete portion (Rooms 109 and 110) of Building T012 was retained and is used as a support structure for the Power Pak facility.

4.2 PHASE II (FEBRUARY THROUGH JUNE 1995)

The objective of Phase II was to decontaminate and decommission (D&D) the remaining concrete vault structure of Building T012 sufficiently to permit its use without radiological or chemical contamination restrictions.

The accomplishment of this objective included removal of asbestos containing floor tiles and pipe insulation; removal of eight contaminated fuel storage tubes; removal of light fixtures, conduit, and ventilation systems; paint sampling and removal; and scabbling of the floor, wall, and ceiling surfaces and completion of the "Final Radiological and Chemical Contamination Assessment Survey" (Ref. 5).

5. WASTE VOLUMES GENERATED AND DISPOSAL

5.1 PHASE I (1986)

The operations and control rooms and the passageway connecting these structures to the concrete portion of the facility were completely demolished and disposed of as nonradioactive waste.

In addition to the structures, equipment from all the rooms, air conditioning and exhaust ducts, and floor tile were also removed.

During this period the radioactive exhaust system removal was completed (Ref. 7). The exhaust stack (down to the roof level) was also removed and disposed of.

5.2 PHASE II (1995)

The categories of waste generated from the remaining concrete structure of Building T012 were:

I. Low Level Radioactive Waste (LLW): The LLW included fuel storage tube cores, light fixtures, conduit, piping, ventilation ducting, air conditioning unit, concrete rubble, and soft trash. 9390 lb (280 ft^3) were sent to Hanford Washington for disposal.

II. Hazardous Waste: Hazardous waste (approximately 250 ft^3) included floor tiles, mastic and pipe insulation containing asbestos, paint containing lead, light ballasts containing PCB, freon from the air conditioner, and a small volume of hydraulic oil from the critical cell door actuator.

III. Mixed (LLW): Mixed waste items consisted of radioactively contaminated paint containing lead and contaminated floor tiles and insulation containing asbestos. 165 gallons of mixed waste were generated and are presently being stored at the RMHF facility.

6. PERSONNEL RADIATION EXPOSURE

None of the Engineering, Health & Safety Radiation Services, or Contractor personnel assigned to the Building T012 decontamination & decommissioning project received any measurable exposure to ionizing radiation .

7. PROJECT COST SUMMARY

The decontamination and decommissioning of Building T012 cost was......... $263,636.

Waste disposal costs for Building T012 was.. $125,996.

The total D&D cost for Building T012 was.. $389,632.

8. REFERENCES

1. SSWA-AN-0004, D&D Plan for Building 012 2/22/95
2. 012-AT-0001, Radiological Assessment Plan for Building T012 2/2/93
3. 355-ZR-0012, Radiation Survey of T012, SCTI Cogeneration Project 6/26/85
4. 012-SP-0003, D&D Procedure for Building T012 3/28/95
5. 012-AR-0002, Final Radiological Survey for Building T012 6/14/96
6. Authorization No. 28, ETEC Radiography at SSFL, terminated 3-10-93
7. N001DWP000011, Building T012 Modification 5/9/86
8. 012-SP-0001, Removal of Fuel Storage Tubes, Building T012 2/17/95

EXHIBIT V

FINAL DOCUMENTATION AND RADIOLOGICAL SURVEY OF
BUILDING T012

ENERGY TECHNOLOGY ENGINEERING CENTER	No. 012-AR-0002 Rev.
OPERATED FOR THE U.S. DEPARTMENT OF ENERGY ROCKETDYNE DIVISION, ROCKWELL INTERNATIONAL	Page 1 of 74 Orig. Date 6/14/96 Rev. Date DRR 25492

TITLE: FINAL RADIOLOGICAL SURVEY REPORT FOR BUILDING T012

- APPROVALS -

Originator	B.M. Oliver B. M. Oliver	ER	Phil Rutherford P. D. Rutherford
Prog. Mgr.	M. E. Lee	QA	Sam Reeder S. Reeder

REV. LTR.	REVISION	APPROVAL/DATE

OFFICIAL COPY
JUL 12 1996
NOTICE: THIS COPY SUPERSEDES ALL PRIOR COPIES ISSUED.

Form 735-A-6 Rev 6-91

CONTENTS

FIGURES

TABLES

ABSTRACT

A comprehensive radiological survey of Building T012 and surrounding areas was performed in 1985. In accordance with that survey report's recommendation, remedial efforts were undertaken to remove residual radioactively contaminated components from the Building T012 structure. After the decontamination efforts were completed, a comprehensive final survey of the building interior was performed to demonstrate regulatory compliance for release without radiological restrictions.

Results of this survey are presented in this report. The results demonstrate that Building T012 meets the requirements of DOE, NRC, and State of California for releasing Building T012 for use without radiological restrictions.

1. INTRODUCTION

Decontamination and decommissioning (D&D) of a number of formerly used nuclear facilities and sites is underway at Rockwell International's Santa Susana Field Laboratory (SSFL). During D&D of these facilities, efforts are made to eliminate or reduce residual radioactive contamination to levels that are as low as reasonably achievable (ALARA). Upon completion of D&D, radiological surveys are performed under established protocols to demonstrate that any remaining radioactivity does not exceed applicable regulatory limits. Findings from the surveys are also used to perform additional D&D or radiological investigations, as needed. The scope of these surveys includes both known and suspected areas of contamination in the Building T012 interior.

A comprehensive radiological survey of Building T012 and surrounding areas was performed in 1985 (Reference 1). Subsequent decontamination and decommissioning of Building T012 was conducted based on an assessment report (Reference 2) and a D&D plan (Reference 3). The D&D work was conducted following procedures given in Reference 4. Removal of asbestos-containing tiles was conducted under a separate procedure (Reference 5). Following D&D, a final release survey was conducted following procedures given in Reference 6.

This report is organized as follows: Section 2 gives a summary of the results of the survey and the conclusions and recommendations; Section 3 gives background information concerning past radiological status, D&D efforts, and current radiological status; Section 4 presents the survey results and the technical approach used in the data collection, analysis, and limit criteria; Section 5 gives the relevant references; and Appendices A through C provide the supporting documentation and calculations for historical records and report completeness.

2. SUMMARY AND CONCLUSIONS

Survey measurements were made for alpha and beta surface contamination on the interior walls, floors, and ceilings in Building T012, and for ambient gamma exposure rate at 1 meter above the interior floors. Additional alpha and beta measurements were also conducted on the inside surfaces of the fuel storage tubes located in Room 109. All measurements were then tested statistically for compliance with acceptable contamination limits for activation products and mixed fission products and for ambient exposure rate. The results of these tests showed that the facility is suitable for release without radiological restrictions.

For statistical interpretation, the interior gamma exposure rate measurements were subdivided into two sets, one for Room 109 and one for Room 110. This subdivision was necessary because of significant local gamma shielding inside the critical cell room (Room 110). Interpretation of the Room 109 gamma exposure rate measurements is based on an average interior gamma exposure rate background value of 14.3 μR/h for three surrogate non-radiological facilities located at the SSFL site. Interpretation of the Room 110 gamma data is based on the use of the median of the dataset (8.83 μR/h) as an unbiased estimate of the "local" background. This method has been applied previously in cases where the local gamma exposure rate background is not readily obtainable due to a lack of suitable surrogate areas for comparison. The resulting probability distributions for both sets of measurements shows no local contamination. If the corresponding building-specific values are used as a reference, the tests for the gamma exposure rate are satisfactory at all locations and meet the requirements for <5 μR/h above background.

3. BACKGROUND

3.1 Location

Building T012 is located within Rockwell International's SSFL in the Simi Hills of southeastern Ventura County, California, adjacent to the Los Angeles County line and approximately 29 miles northwest of downtown Los Angeles, directly south of the City of Simi Valley. Location of the SSFL relative to Los Angeles and vicinities is shown in Figure 1. An enlarged map of neighboring SSFL communities is shown in Figure 2. Figure 3 is a plot plan of the western portion of SSFL known as Area IV, where Building T012 is located. A drawing (plan view) of Building T012 and its adjoining areas is shown in Figure 4. Building T012 is located on government-optioned land.

3.2 Topography and Building Characteristics

Building T012 is situated on B Street among several adjacent buildings on paved ground. As originally constructed, Building T012 was a complex consisting of a critical cell and equipment room, and a separate operations and control building, connected by an enclosed walkway. In 1986, the operations and control building, and the enclosed walkway, were demolished to provide space for the construction of the Sodium Component Test Installation (SCTI) cogeneration plant. Prior to demolition, a complete radiological survey of the Building T012 complex was conducted (Reference 1). The present report deals with the remaining section of T012, consisting of the critical cell (Room 110) and adjacent equipment room (Room 109).

A layout of the existing T012 facility is shown in Figure 4. The critical cell was a sealed room with 4-foot-thick concrete walls, lined with a 1/4-inch steel liner, used to test Systems for Nuclear Auxiliary Power (SNAP) critical assemblies. The floor of the cell is a mat-type concrete foundation. Sealed during operation, this room was designed to withstand the pressure release and to contain radioactive materials in the event of a burst condition from the assemblies.

The equipment room adjacent to the critical cell has 9-inch-thick concrete walls and ceiling and a spread concrete foundation. A fuel storage area was located in the west section of the room consisting of a concrete shield wall containing 1% boron by weight. Embedded in the wall were 110 cadmium-plated tubes, 3-1/2-in ID by 20 in. long. The tubes were located on 1-ft centers, 5 tubes high and 22 tubes wide.

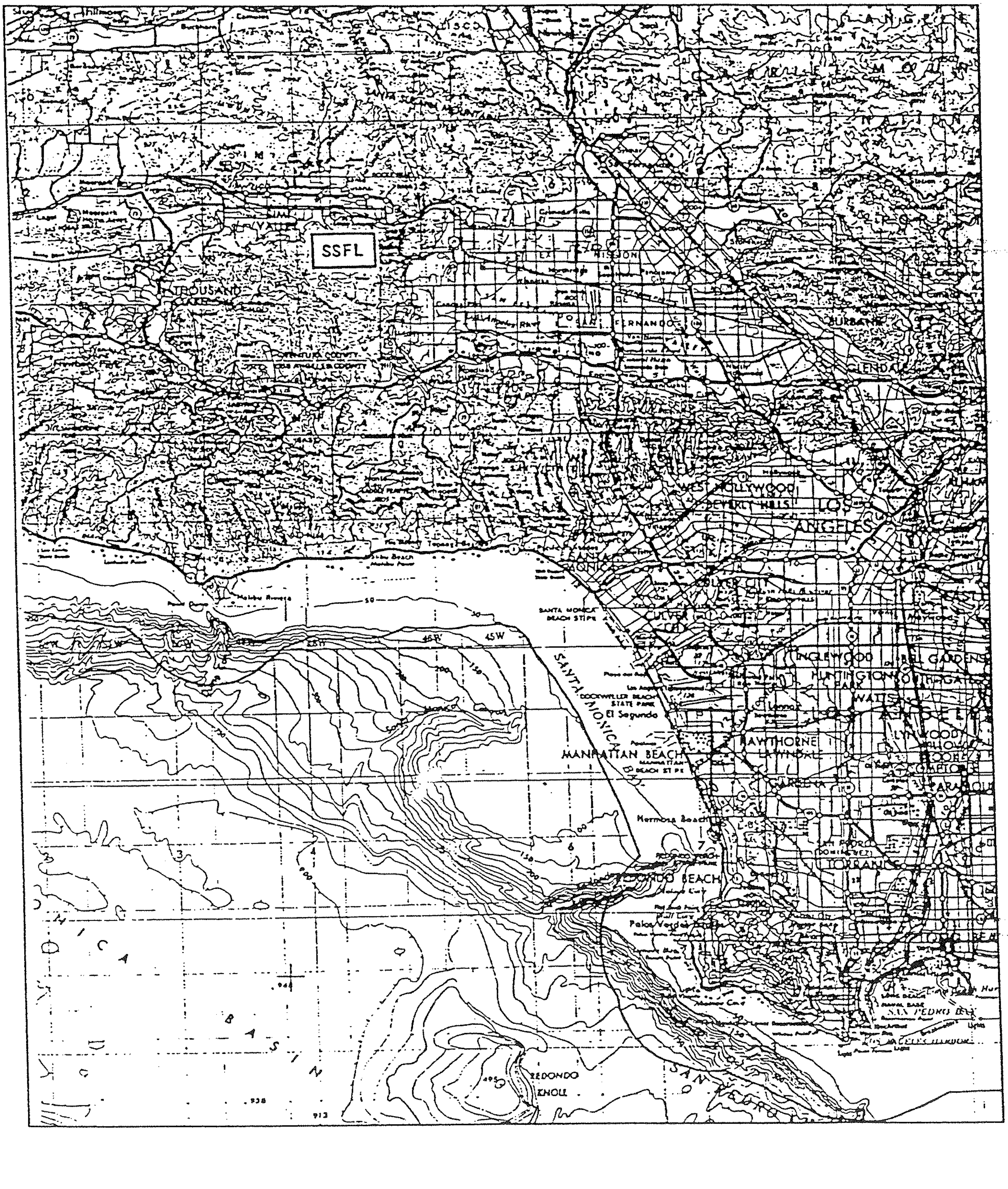


Figure 1. Location of SSFL Relative to Los Angeles and Vicinities

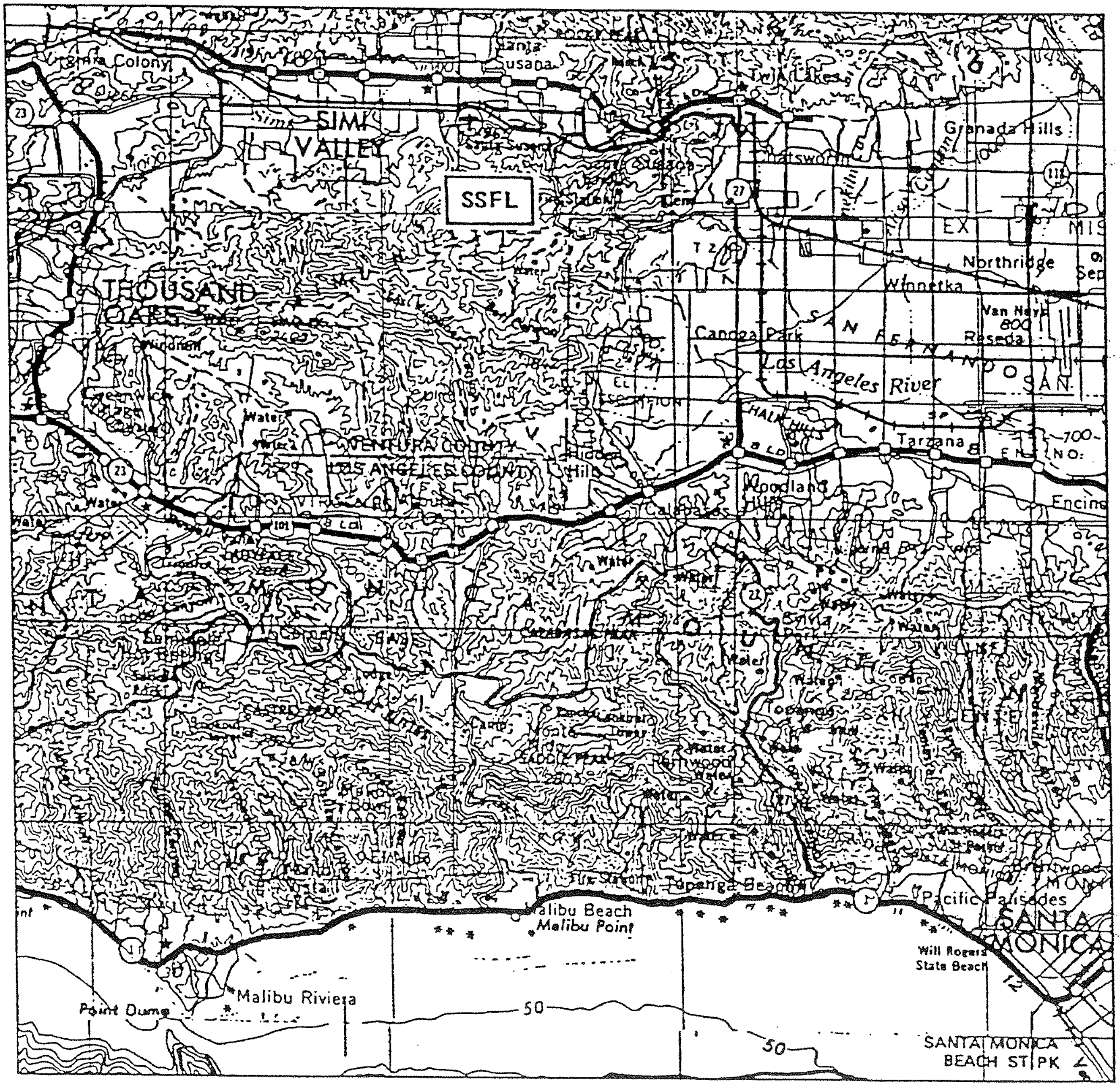


Figure 2. Neighboring SSFL Communities

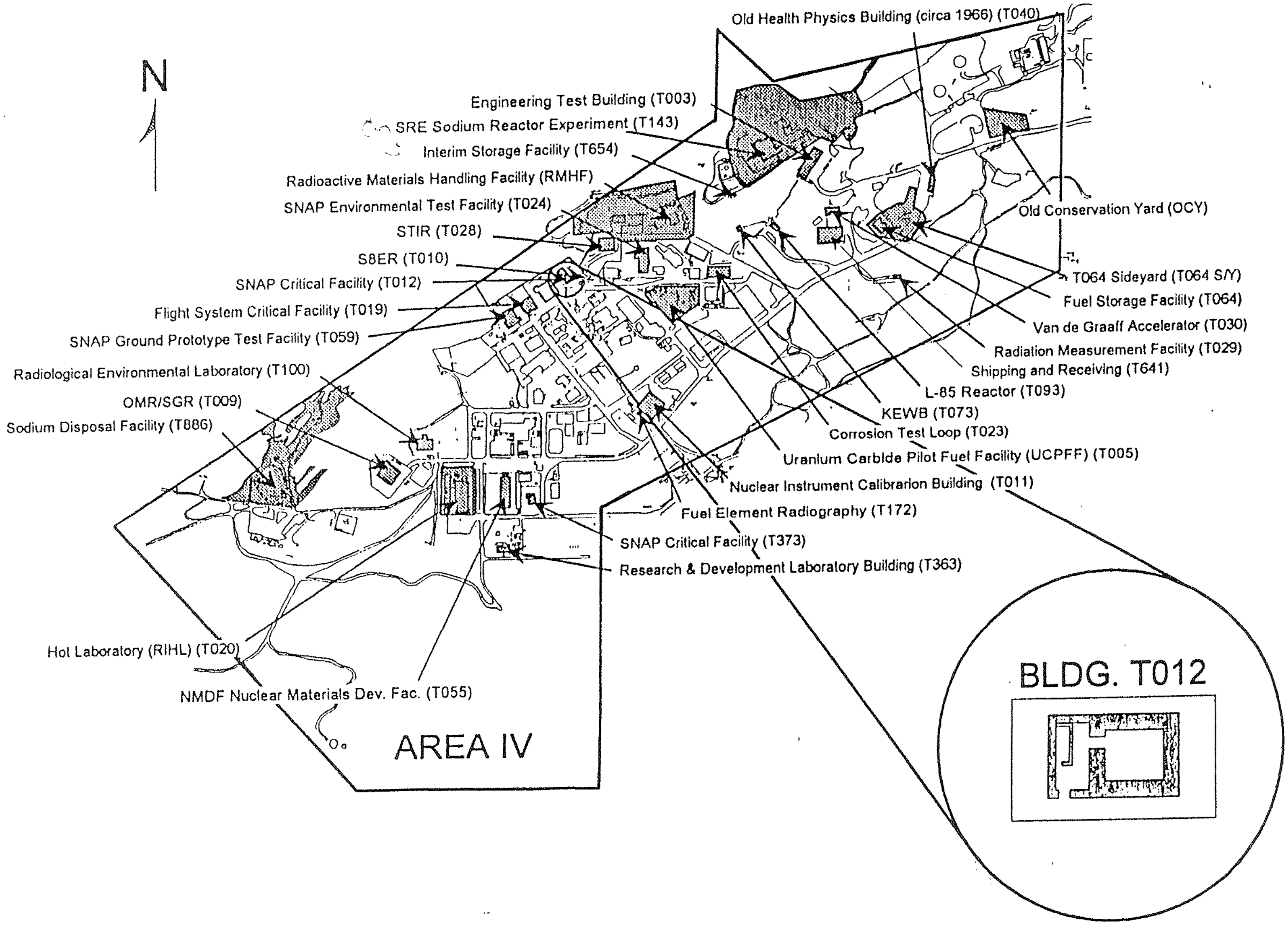


Figure 3. Santa Susana Field Laboratory (SSFL) Area IV

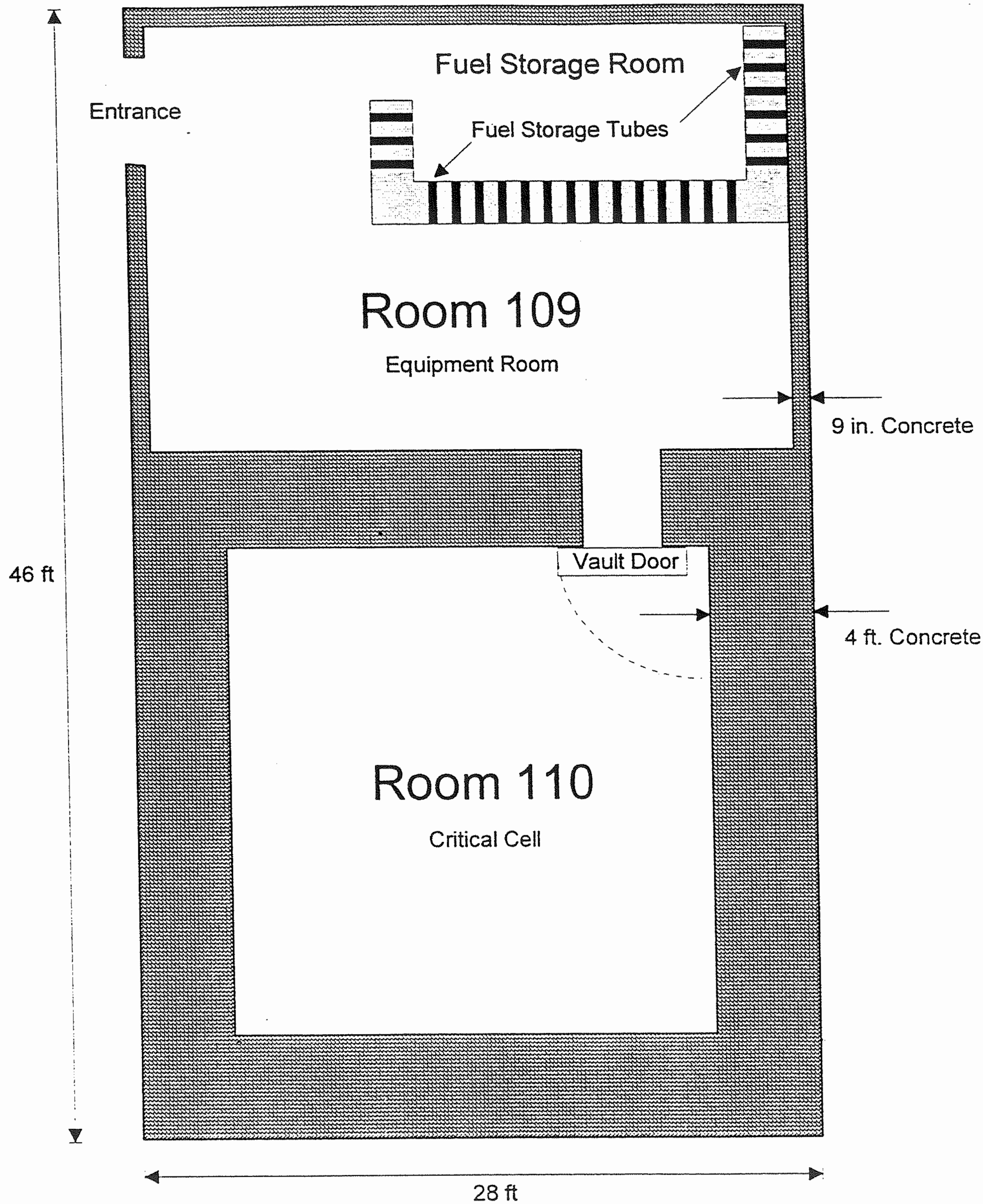


Figure 4. Layout of Building T012 Critical Cell and Equipment Room

3.3 Operating History

Operations began with SNAP critical assemblies in Building T012 in 1962. These experiments used three different critical assembly machines, SCA-4A and -4B, and SCA-5. Most tests were directed at determining criticality of various configurations and conditions, such as water immersion, and were performed well below the allowed high power limit of about 100 watts. No significant amounts of induced activity were produced by these operations.

Clad reactor fuel elements (U-ZrH) were stored as shipped, in "birdcage" packages, and in the fuel storage tubes located in Room 109. The SNAP critical experiments continued intermittently through 1968, when the fuel was shipped to the SSM Storage Vault (T064) and the facility was placed in stand-by mode.

In 1969-1970, the SCA-4A critical assembly machine was modified for use in the Heavy Metal Reflected Fast Spectrum Reactor (HMRFSR) project, and critical experiments began in 1970. These experiments used various fabrications of highly enriched uranium rods and foil to simulate reactor fuel elements. These fuel materials were stored in the fuel storage tubes, and assembled in the critical test cell (Room 110). Some extended runs, at reactor powers of up to 200 watts for several hours at a time, were used for reactivity coefficient measurements. The fuel materials were returned to the original supplier in 1972, and the facility was deactivated.

In 1979, the concrete portion of the facility was modified for use by ETEC Quality Assurance in performance of X-ray machine and source radiography under Rocketdyne Use Authorization No. 18 (Reference 7). Areas with total alpha activity at and below the limit for uranium were noted and identified. The major modification consisted of enclosure of the fuel storage room to serve as a photographic darkroom, and removal of four of the storage tubes for a film pass-through slot. This use was terminated in 1992, with all radioactive sources transferred to Radioactive Material Handling Facility (RMHF)[1] for storage. From 1992 until D&D operations in 1995, the facility was in inactive status, and remained locked and unoccupied.

3.4 Decommissioning and Demolition Efforts

3.4.1 Phase I

Initial decontamination and demolition efforts in Building T012 were completed in 1986. This operation involved the removal of the operations and control room, and the enclosed passageway connecting those structures to the Equipment Room (Room 109) and the Control Cell (Room 110). These area were removed to accommodate the construction of the ETEC/SCTI Power Pack section of the SCTI Cogeneration Project. The concrete fuel storage wall in Room 109 was retained and was used as a support structure for the Power Pack facility.

---

[1] Formerly the Radioactive Materials Disposal Facility (RMDF).

3.4.2 Phase II

The second phase of decommissioning involved the removal of asbestos-containing floor tiles and pipe insulation; removal of electrical light fixtures, conduit and ventilation systems; paint removal and sampling; and scabbling of floors, walls, and ceilings surfaces (Reference 3). Prior to removal, the floor tiles were sampled for radioactive contamination (Reference 5). Survey and removal of several contaminated fuel storage tubes occurred after the above activities were completed.

4. SURVEY RESULTS

4.1 Overview

Upon D&D of radioactive constituents, releasing a facility or area for unrestricted use requires a formal radiation survey to demonstrate that the applicable regulatory limits for such a release are met. The survey is performed under an established plan, and a statistical interpretation of the resulting data is made to determine if the regulatory release criteria have been met. This document provides the necessary framework to demonstrate that Building T012 meets DOE, NRC, and State of California criteria for release of the facility for unrestricted use. All original survey and user authorization documentation is maintained in the Building T012 final survey file in Building T100.

4.2 Scope of the Survey

For the final radiological survey of Building T012, the interior rooms were separated into two sample lots as shown in Figure 5. The sample lots were treated separately for the purposes of statistical data analyses. The distinguishable property for selecting the sample lots was the known contamination of several of the fuel storage tubes relative to the other areas. The two sample lots are shown in Table 1, with the corresponding type of surveys performed on each. Because of significant local gamma shielding in the former critical cell room (Room 110), the Lot 1 ambient gamma measurements were further subdivided between the two rooms for statistical analysis (see Section 4.5.1).

Table 1. Sample Lots Surveyed

Sample Lot No.	Room or Area	Type of Survey Performed[a]				
		Total		Removable		
		Alpha	Beta	Alpha	Beta	Ambient Gamma[b]
1	Rooms 109 and 110, except for fuel storage tubes	x	x	x	x	x
2	Fuel storage tubes in Room 109	x	x	x	x	-

[a]The type of survey performed for each sample lot was dependent on the type of surface being measured (e.g., concrete floor, walls, asphalt, gravel roof, tile floors, etc.) and the type of isotope.

[b]Ambient gamma readings were performed on the floors at a distance of 1 meter from the surface.

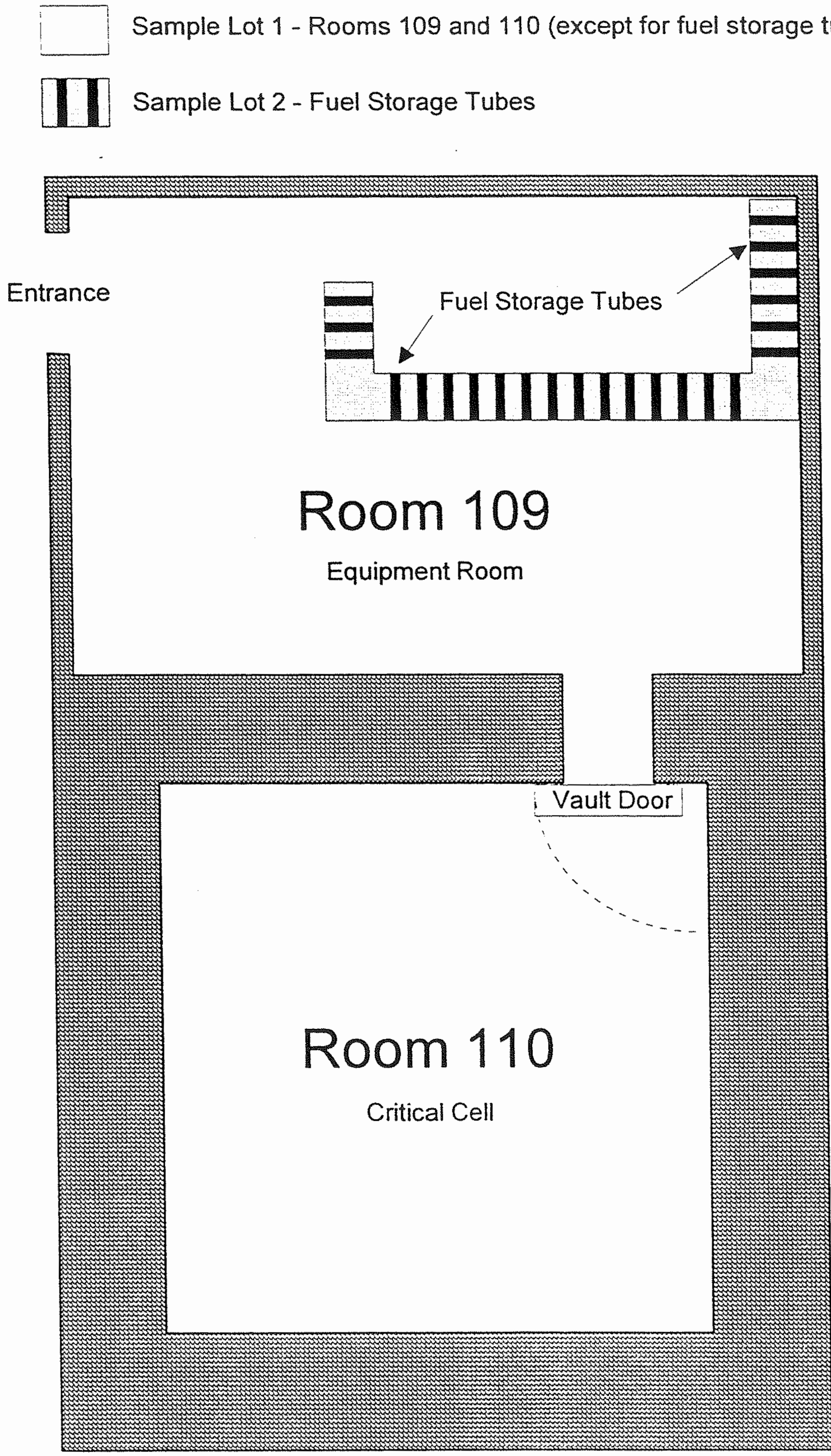


Figure 5. Building T012 Sample Lot Identification

4.3 Survey Methods

4.3.1 Sampling Methods

The method and type of survey measurement depended on the type of surfaces involved. For Sample Lot 1, a 1-m by 1-m grid was superimposed on the floors, walls, and ceilings of the entire sample lot area. For surfaces having areas less than 1-m x 1-m, a minimum area of 1-m x 1-m was surveyed by combining other adjacent remnant areas. For Sample Lot 2, each of the tubes remaining after the D&D operations was individually numbered and surveyed. All storage tubes were surveyed within Sample Lot 2.

4.3.1.1 Sample Lot 1

A 100% direct qualitative frisk of each 1-m by 1-m grid was performed using an alpha scintillation probe and a G-M pancake probe, followed by a 100% quantitative survey. This method satisfies the State of California guidelines in DECON-1 (Reference 8) that a minimum of 10% of an area shall be surveyed. Walls, floors, and ceilings were surveyed for total and removable alpha and beta activity, and for maximum alpha and beta activity, if a "hot spot" was detected when the total alpha and beta measurements were made. Additionally, the floors were surveyed for ambient gamma readings in μR/h at 1 meter. Twenty percent of all structural surfaces (pipes, conduit, light fixtures, etc.) were surveyed for total and removable alpha and beta activity.

4.3.1.2 Sample Lot 2

The 106 remaining fuel storage tubes located in Room 109 were surveyed as part of the D&D activities in 1995 (References 4 and 5), and again as part of the final survey in 1996. During D&D, a 100% quantitative survey for total alpha activity and a 100% qualitative survey for total beta activity was conducted within each tube. Any tube found to have contamination above the limits, specified in Section 4.4 below, was removed and the hole grouted in place. A total of eight contaminated tubes were removed as part of the D&D operations. A diagram showing the tubes that were removed is shown in Figure 6.

The D&D surveys were conducted using a special 3π alpha probe and a standard G-M pancake probe. As part of the final survey in 1996, a quantitative survey for removable alpha/beta was also conducted on the remaining 98 tubes.

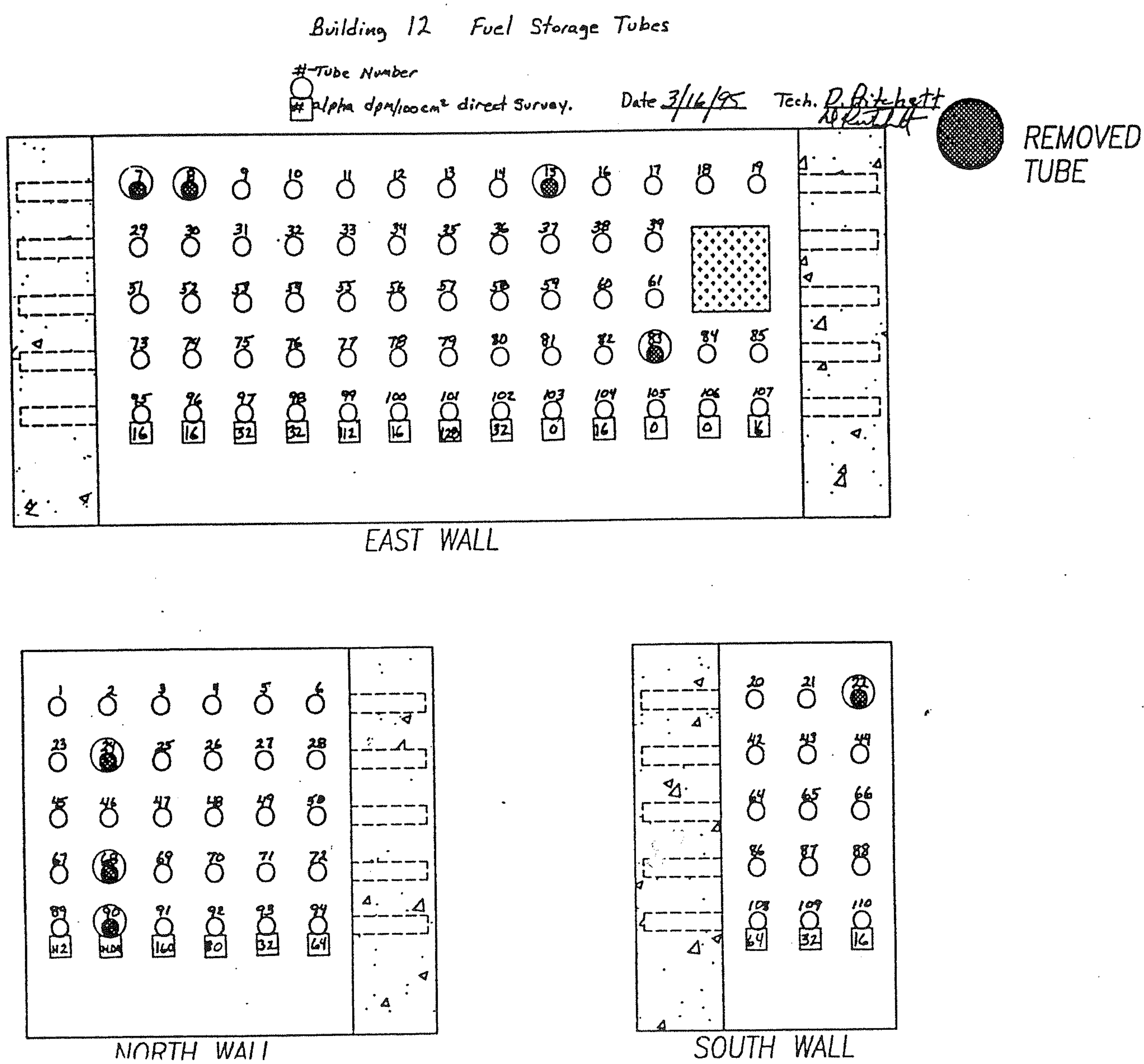


Figure 6. Map of Storage Tube Locations

4.3.2 Instrument Calibrations and Checks

Measurements of total and maximum alpha surface activity were made using alpha scintillation detectors, sensitive only to alpha particles with energies exceeding about 1.5 MeV. The detectors were calibrated with a Th-230 alpha source standard traceable to the National Institute of Standards and Technology (NIST). Measurements of the total and maximum beta surface activities were made with a thin-window pancake Geiger-Mueller (G-M) tube. The G-M detectors were calibrated with a Tc-99 beta source standard, traceable to NIST.

The internal surfaces of the fuel storage tubes were surveyed using a custom 3π alpha-scintillator pipe probe, modified from a Ludlum Large-Area alpha-scintillator, Model 43-1. The probe was constructed by machining down the outer portion of the conical light-pipe of the Model 43-1 probe, to make a cylindrical light pipe, approximately 2.75 inches in diameter. The end-face and sides of the light pipe were covered with the same ZnS(Ag) powder scintillation screen and surface aluminized mylar covering as used in the standard Ludlum alpha probes. Protective rings were placed at the front and rear of the light pipe, and the assembly was mounted on a Model 43-1 photomultiplier tube and case. The sensitive region was surrounded by a wire cage.

Calibration of the 3π probe was performed using a standard Th-230 alpha source at four locations around the circumference, and at one location on the end-face. The observed average efficiency factor was 8.0, similar to that observed for the standard rectangular Ludlum probes (7.2 to 8.1). The actual circumferential sensitive area was determined to be 86 cm^2, but this was downrated in practice to a nominal value of 50 cm^2 for conservatism.

All portable survey instruments were serviced and calibrated with NIST traceable standards on a quarterly basis. In addition, daily checks and calibrations were performed (when used) on all instrumentation to determine acceptable performance and establish a background value for the instrument on that day. Reference 9 provides further methods and procedures for environmental surveys. Measurements of removable surface activity (alpha and beta) were made by wiping approximately 100 cm^2 of surface area using standard smear disks. The activity on the disks were measured using a gas-flow proportional counter. The counters were calibrated using Th-230 and Tc-99 standard sources, traceable to NIST. A 1-min integrated count time was used. Calibration records for the survey instruments used are maintained in the Building T100 files.

The ambient exposure rates at 1 m from surfaces were measured using 1-in. NaI scintillation detectors. These instruments were calibrated against a Reuter-Stokes high-pressure ionization chamber, and daily checks were made using a Ra-226 source, traceable to NIST, placed 1-m from the detector. A 1-min integrated count time was used.

4.4 Technical Approach

4.4.1 Criteria and Their Implementation

Acceptable contamination limits and gamma exposure rates for releasing a facility for unrestricted use are prescribed in DOE, NRC, and State of California guidelines (References 8, 10, and 11). The lowest (most conservative) limits were chosen from these guidelines and incorporated into the final survey criteria for Building T012. Two specific criteria were chosen from the guidelines:

a) The surface contamination limits for alpha and beta were excerpted from DOE Order 5400.5 [Reference 10 and State of California guidelines (Reference 8)];

b) The ambient gamma exposure rate limits at 1 m were excerpted from NRC Dismantling Order for the L-85 reactor decommissioning (Reference 11) for conservatism and consistency with past decommissioning efforts. Although DOE Order 5400.5 recommends a value of 20 μR/h above background, the value of 5 μR/h from the NRC Dismantling Order was used for consistency, conservatism, and in keeping with ALARA principles.

Table 2 provides a summary of the contamination limit criteria. Table 3 summarizes the various "Statistically Significant Activity" (SSA) detection limits for the survey instruments used, and demonstrates that the detection limits and methods are well below the established limit criteria (from regulatory requirements) shown in Table 2.

As used in the tables, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation. Where surface contamination by both alpha- and beta-gamma-emitting radionuclides existed, the limits established for alpha- and beta-gamma-emitting radionuclides were applied independently. Beta-gamma mitters include mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched. No separated or enriched Sr-90 is present in T012.

Measurements of average contamination were averaged over an area of more than 1 m^2. For objects of less surface area, the average was derived for each such object. The maximum contamination level applies to an area of not more than 100 cm^2.

The amount of removable radioactivity per 100 cm^2 of surface area was determined by wiping an area of that size with dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wiping with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less than 100 cm^2 was determined, the activity per unit area was based on the actual area and the entire surface was wiped.

Table 2. Building T012 Contamination Limit Criteria

Radionuclides	Average	Maximum	Removable
U-natural, U-235, U-238, and associated decay products	<5,000 α	<15,000 α	<1,000 α
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission)	<5,000 β-γ	<15,000 β-γ	<1,000 β-γ
Surface contamination for gamma exposure rate	≤ 5 μR/h above background at 1 m		

Table 3. Observed Detection Limits versus Established Limit Criteria

	Alpha (dpm/100 cm^2)		Beta (dpm/100 cm^2)		Ambient Gamma Exposure Rate (μR/h)
	Total	**Removable**	**Total**	**Removable**	
Limit criteria	5,000	1,000	5,000	1,000	<5.0 above background
Average observed detection limit (SSA)[1]	12	5.5	280	41	0.34
Observed detection limit range	3.5 - 37	3.7 - 5.9	240 - 311	27 - 44	0.23 - 0.40
Ratio of detection limit to criteria[2]	0.24%	0.55%	5.6%	4.1%	6.8%

[1]SSA = 1.645 x √(2 x background counts) x area factor x efficiency factor/time, in units of dpm/100 cm^2.

[2]Ratio of average observed detection limit to established limit criteria.

4.4.2 Data Analyses and Statistical Criteria

A statistical procedure was used to validate the applicability of the raw survey data for selected sample lots or areas. The statistical method known as "sampling inspection by variables" (Reference 12) was used. This method has been widely applied in industry and the military and is essential where the lot size is impractically large. In the case of determining residual contamination in Building T012, the small size of the sample lots lead to approximately 100% sampling. Therefore, the "sampling inspection by variables" method is actually better than the "90/90/100" test as explained elsewhere in this report.

In sampling inspection by variables, the number of data points on which measurements are obtained is first chosen to be large so that the parameters of the distribution are likely to have a normal distribution (i.e., Gaussian). The mean of the distribution, $\bar{x}$, and its standard deviation, s, are then related to a "test statistic," TS, as follows:

$$TS = \bar{x} + ks$$

where $\bar{x}$ = average (arithmetic mean of measured values)
s = observed sample standard deviation
k = tolerance factor calculated from the number of samples to achieve the desired sensitivity for the test

TS and $\bar{x}$ are then compared with an acceptance limit, U (such as those shown in Table 2), to determine acceptance or other plans of action, including rejection of the area as contaminated and requiring further remediation.

The sample mean and standard deviation are easily calculable quantities; the value of *k*, the tolerance factor, bears further discussion. Of the various criteria for selecting plans for acceptance sampling by variables, the most appropriate is the method of Lot Tolerance Percent Defective (LTPD), also referred to as the Rejectable Quality Level (RQL). The LTPD is defined as the poorest quality that should be accepted in an individual lot. Associated with the LTPD is a parameter referred to as consumer's risk (β), the risk of accepting a lot of quality equal to or poorer than the LTPD (or 10%). USNRC Regulatory Guide 6.6 ("Acceptance Sampling Procedures for Exempted and Generally Licensed Items Containing By-Product Material") states that the value for the consumer's risk should be 0.10. Conventionally, the value assigned to the LTPD has been 10%.

The State of California has stated that the consumer's risk of acceptance (β) at 10% defective (LTPD) must be 0.1. For those choices of β and LTPD, $K_\beta = K_2 = 1.282$ (Reference 13). Values of *k* for each sample size are calculated in accordance with the following equations:

$$k = \frac{K_2 + \sqrt{K_2^2 - ab}}{a};\quad a = 1 - \frac{K_\beta}{2(n-1)};\quad b = K_2^2 - \frac{K_\beta^2}{n}$$

where k = tolerance factor,
K_β = the normal deviate exceeded with probability of β, 0.10 (from tables, K_β = 1.282),
K_2 = the normal deviate exceeded with probability equal to the LTPD, 10% (from tables, K_2 = 1.282)[2], and

---

[2] The values chosen for these coefficients for the survey correspond to assuring, with 90% confidence, that 90% of the area has residual contamination below 100% of the applicable limit (a 90/90/100 test). The choice of values for the two coefficients is consistent with industrial sampling practices and State of California guidelines (Reference 8).

n = number of samples.

The statistical criteria for acceptance of the Building T012 interior final survey are presented below.

a) Acceptance: If the test statistic ($\bar{x} + ks$) is less than or equal to the limit (U), accept the region as clean. If any single measured value exceeds 80% of the limit, decontaminate that location to as near background as is possible, but do not change the value in the analysis. Figure 7 gives an example of the sample lot acceptance by the test.

b) Collect additional measurements: If the test statistic ($\bar{x} + ks$) is greater that the limit (U), but $\bar{x}$ itself is less than U, independently resample and combine all measured values to determine if $\bar{x} + ks \leq$ U for the combined set; if so, accept the region as clean. If not, the region is contaminated and must be remediated. Figure 8 gives an example of additional measurements that must be taken in the sample lot to accept or reject it.

c) Rejection: If the test statistic ($\bar{x} + ks$) is greater than the limit (U) and $\bar{x} \geq$ U, the region is contaminated and must be remediated. Figure 9 gives an example of sample lot rejection by the test.

Thus, based on sampling inspection, we are willing to accept the hypothesis that the probability of accepting a lot as not being contaminated which is in fact 10% or more contaminated, is 0.10. Or in other words, the Building T012 final survey corresponds to assuring with 90% confidence that 90% of the area has residual contamination below 100% (a 90/90/100 test) of the applicable limits described in Table 2.

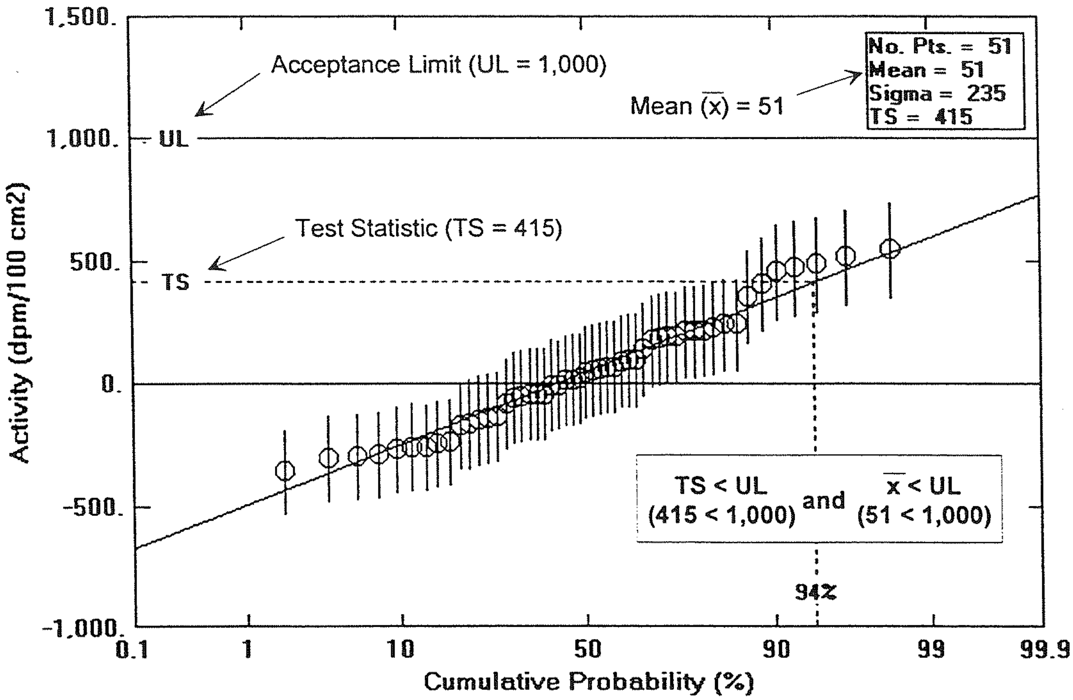


Figure 7. Example of Sample Lot Acceptance, where TS (=$\bar{x}$ + ks) ≤ UL and $\bar{x}$ ≤ UL

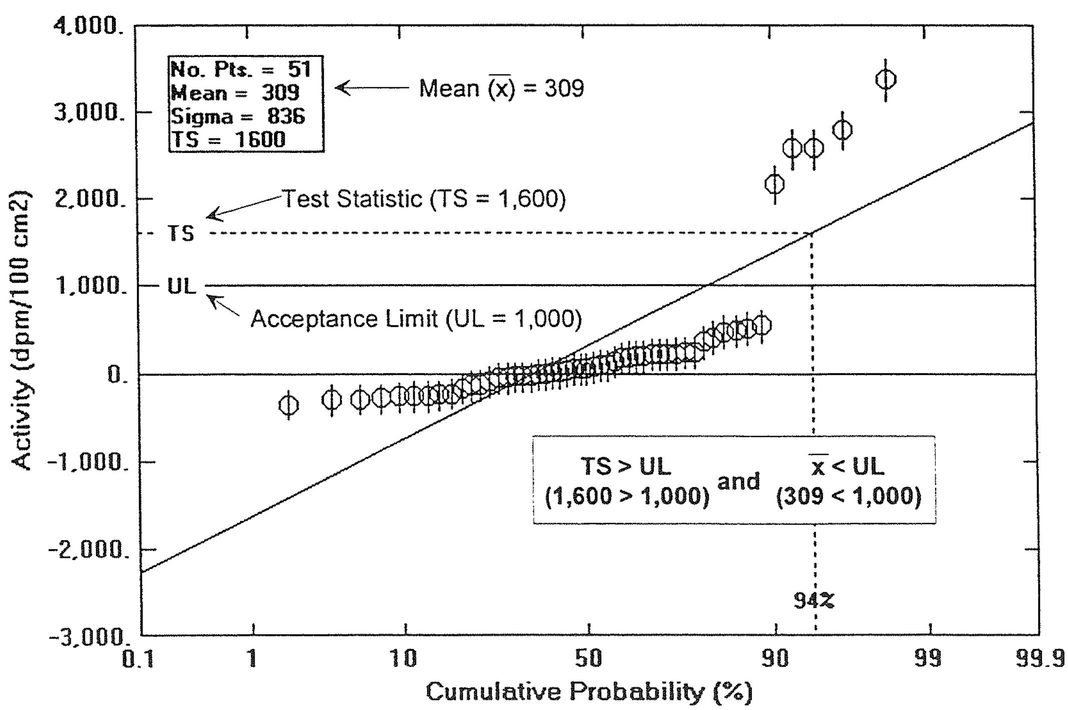


Figure 8. Example of Sample Lot Requiring Additional Measurements, where TS (=$\bar{x}$ + ks) > UL and $\bar{x}$ < UL.

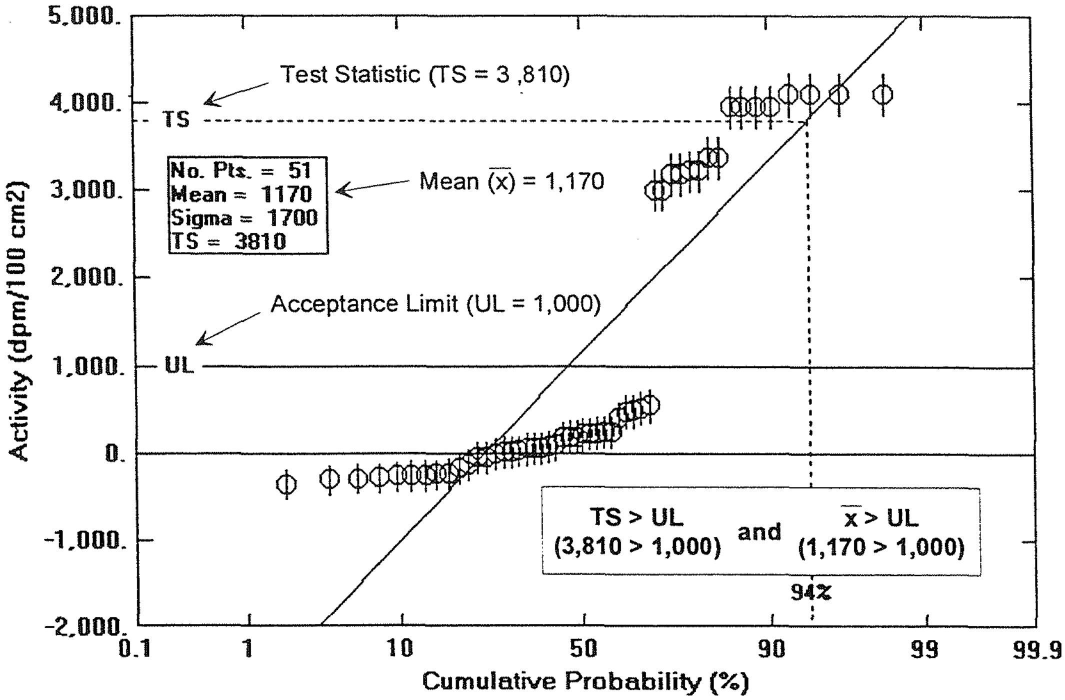


Figure 9. Example of Sample Lot Rejection, where TS ($=\bar{x} + ks$) > UL and $\bar{x}$ > UL

4.5 Sample Lot Analyses and Results

4.5.1 Sample Lot 1

4.5.1.1 Description

Sample Lot 1 consists of all surface areas in Rooms 109 (equipment room) and 110 (critical cell) with the exception of the inside surfaces of the fuel storage tubes located in Room 109, which are designated Sample Lot 2. Survey data for Lot 1 were taken in February and March of 1996.

4.5.1.2 Analyses of Sample Lot 1 Data

Raw data measurements for Sample Lot 1 were taken, adjusted for daily instrument background (except for ambient gamma exposure rates) and plotted on cumulative probability graphs as discussed previously. For statistical comparisons (using the "sampling inspection by variables" method), alpha/beta survey data from all areas within Sample Lot 1 were combined together and then analyzed for the specific type of radiation measurement made.

The cumulative plots for alpha/beta survey data are shown in Figure 10 through Figure 13. These plots are shown on two scales; a normal scale to show all the data relative to the acceptance limit, and an expanded scale showing only the data and test statistic values. The purpose of the expanded scale presentation is to allow for more detailed examination of the data to determine if deviations from a normal distribution are evident, or if the data show evidence of more than one distribution.

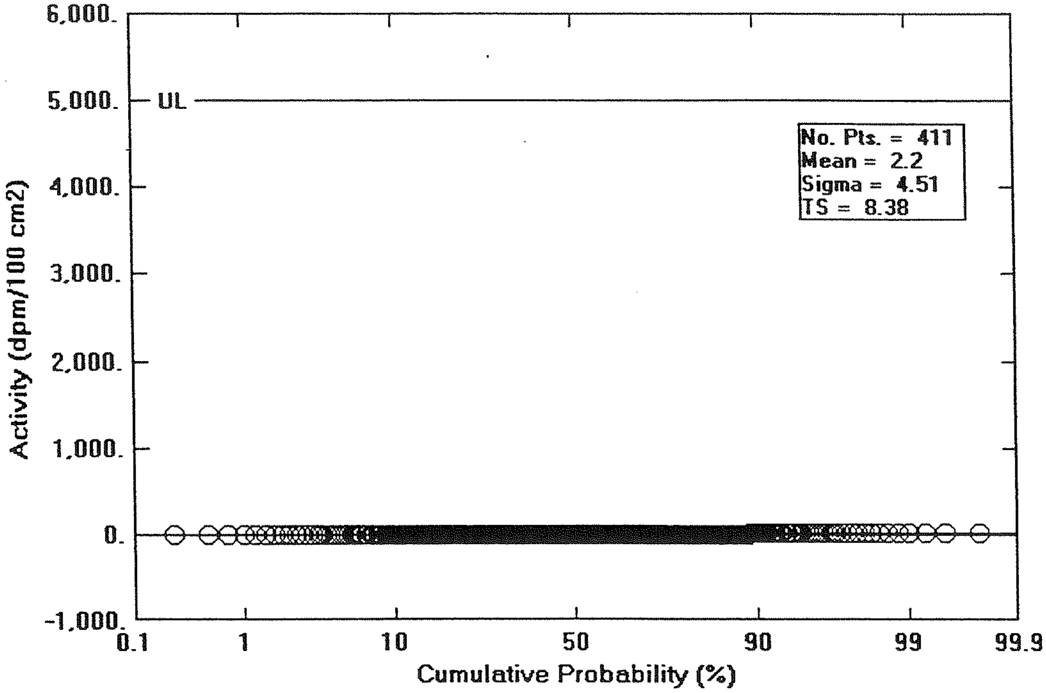
Because of physical differences in the construction of Rooms 109 and 110, the gamma survey data in Lot 1 from these two areas were separated for the purpose of statistical analysis. The two sets of gamma survey data are shown in Figure 14 and Figure 15. The gamma data are shown in two forms; 1) the raw data, and 2) the background subtracted data for comparison with the acceptance limit. For Room 109, a background value of 14.3 µR/h was used based on measurements conducted in three similarly constructed non-radiological areas located at the SSFL. The gamma exposure rate data for these three areas are shown in Table 4.

For Room 110, which clearly showed significant shielding of local gamma exposure, the median exposure rate measured in Room 110 of 8.83 µR/h was used as an unbiased estimate of the local ambient background. This method has been applied previously to final release surveys at the SSFL (e.g., see Reference 14). The combined data for Rooms 109 and 110 are shown in Figure 16, which clearly shows the two distinct data sets and the Room 110 "shielding" effect of approximately 7 µR/h.

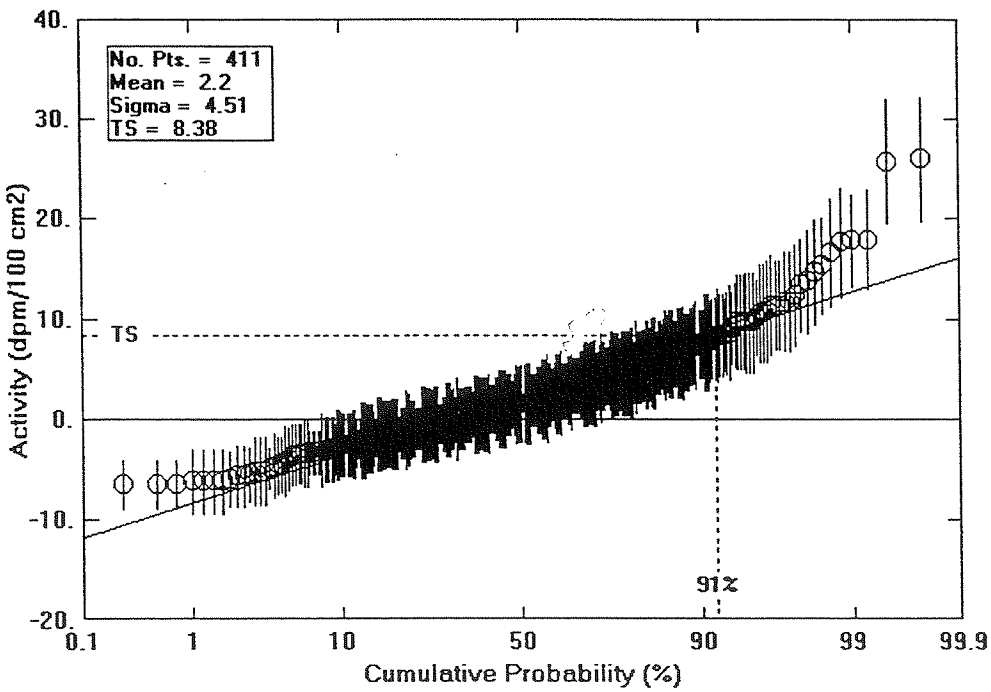
Sample lot 1 statistical results are tabulated in Table 5 for comparing the test statistics ($TS = \bar{x} + ks$) with the applicable contamination criteria or acceptance limits (U) from Table 2. The corresponding figure numbers for the graphs of each calculated cumulative probability plot are also indicated in parentheses. Individual raw measurement data and instrument backgrounds are provided in Appendix A. Individual calculated sample results used as graph data for Sample Lot 1 are provided in Appendix B. Grid location diagrams for the various survey areas in T012 are given in Appendix C.

Table 4. Gamma Exposure Rates Measured in Surrogate SSFL Facilities

		Exposure Rate (µR/h)		
Location	**Data Points**	**Average**	**Range**	**Standard Deviation**
Bravo Control Room	4	13.8	0.9	0.4
Delta Bunker	5	14.5	0.8	0.3
Cocoa Bunker	5	14.5	0.5	0.2
	Average:	**14.3**		
	± 1σ	**0.4**		

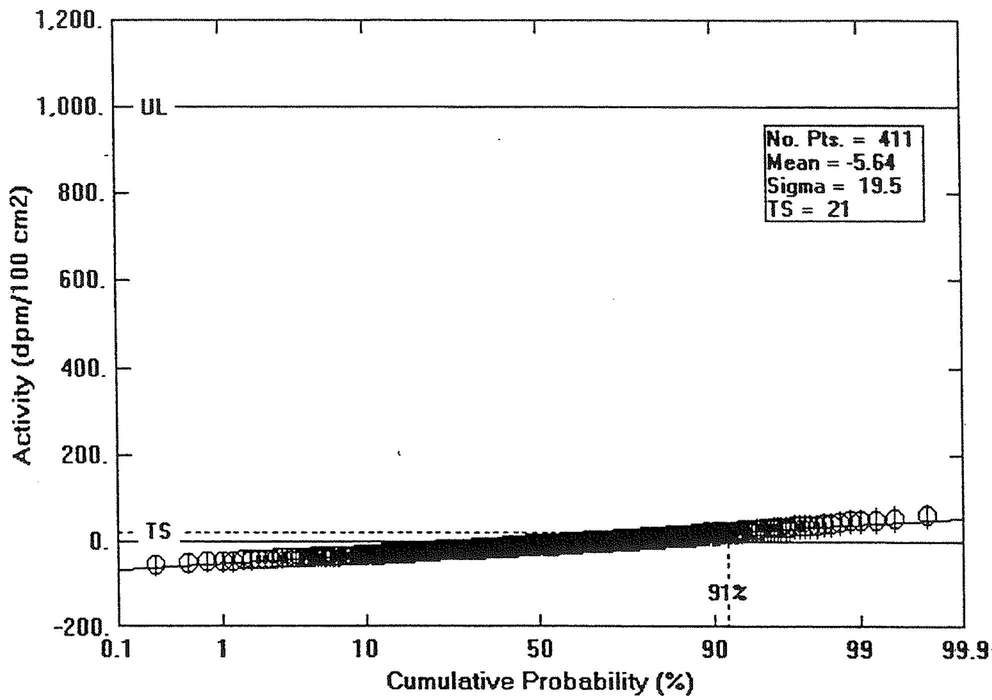


a) Normal Scale

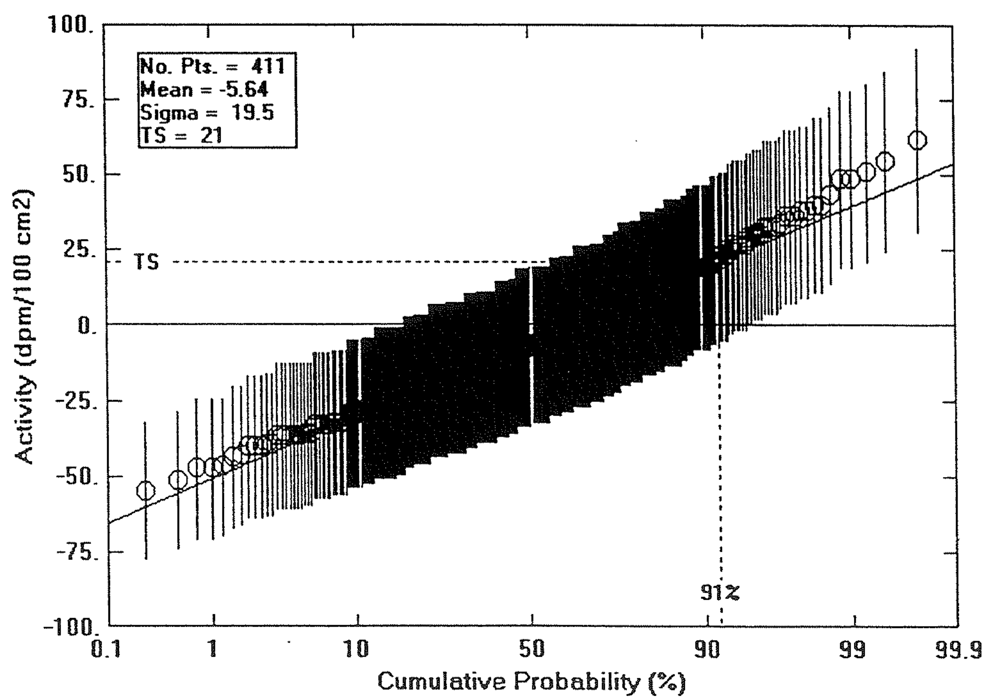


b) Expanded Scale

Figure 10. T012 - Lot 1 Total Alpha Activity

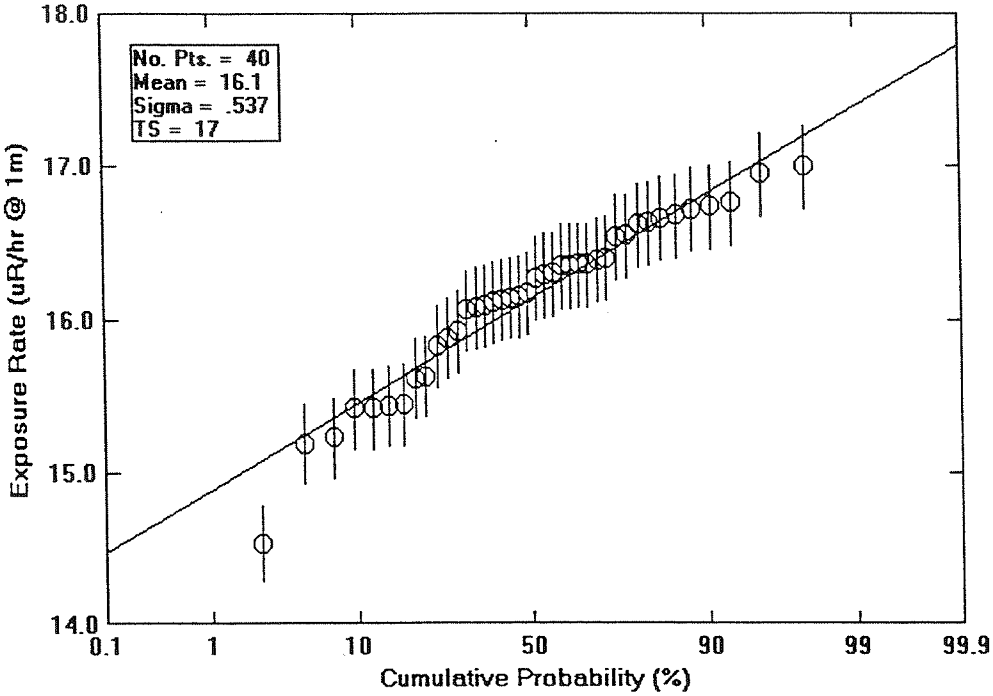


a) Normal Scale

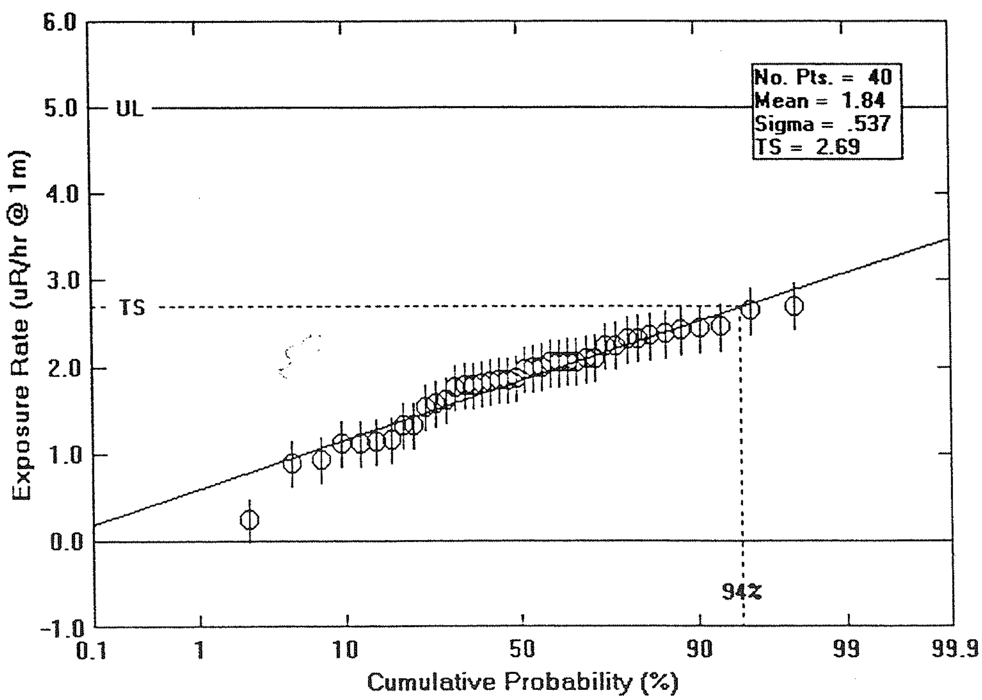


b) Expanded Scale

Figure 13. T012 - Lot 1 Removable Beta Activity

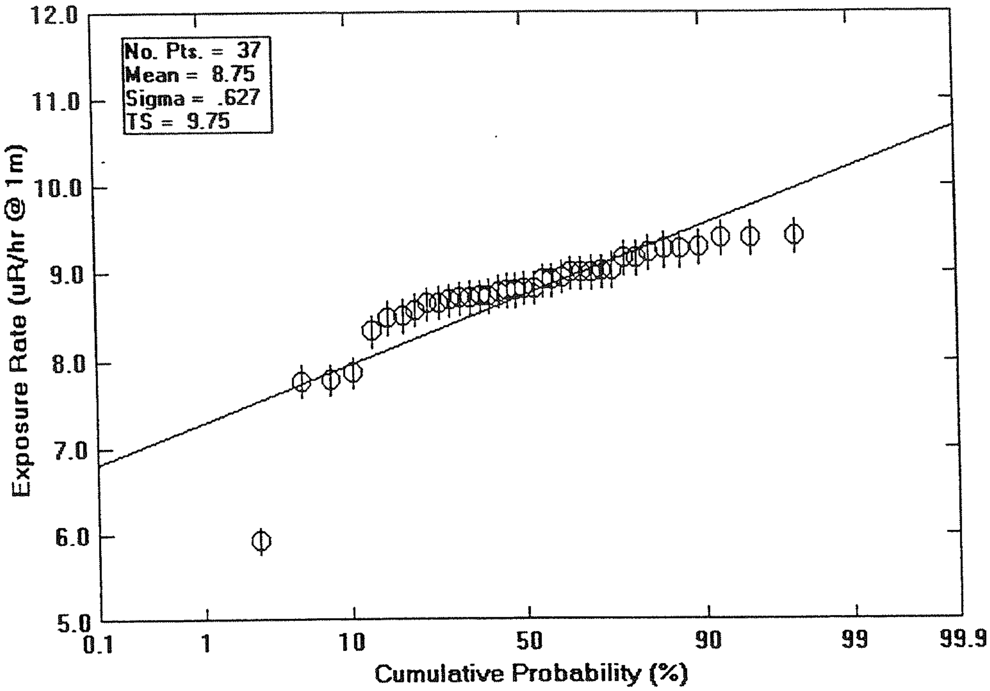


a) Gross Exposure Rate

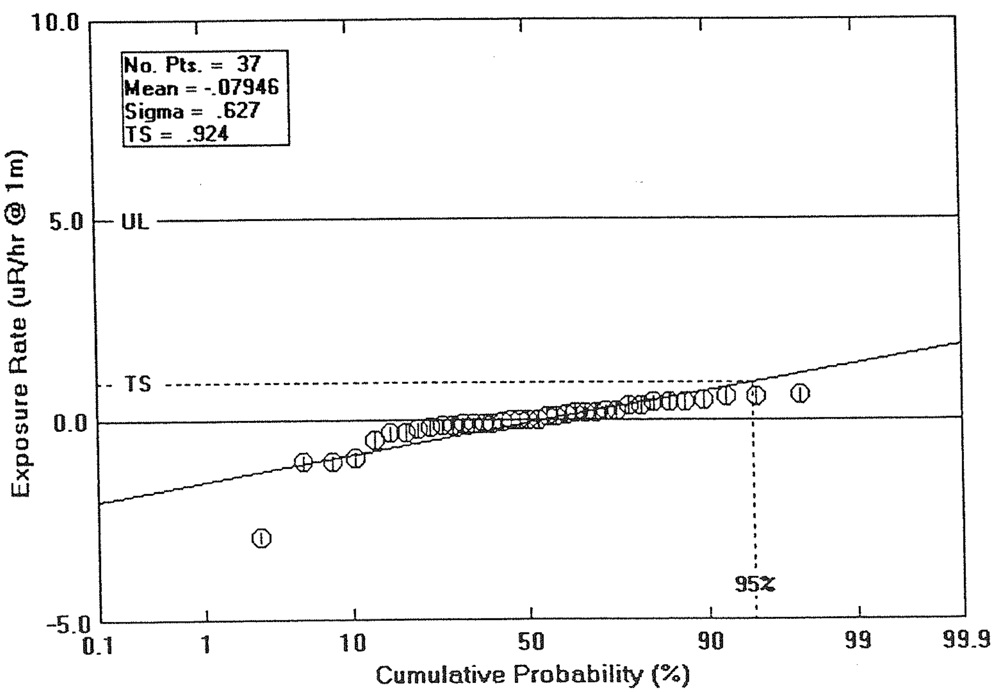


b) Net Exposure Rate

Figure 14. T012 - Lot 1 Gamma Exposure Rate (Room 109)

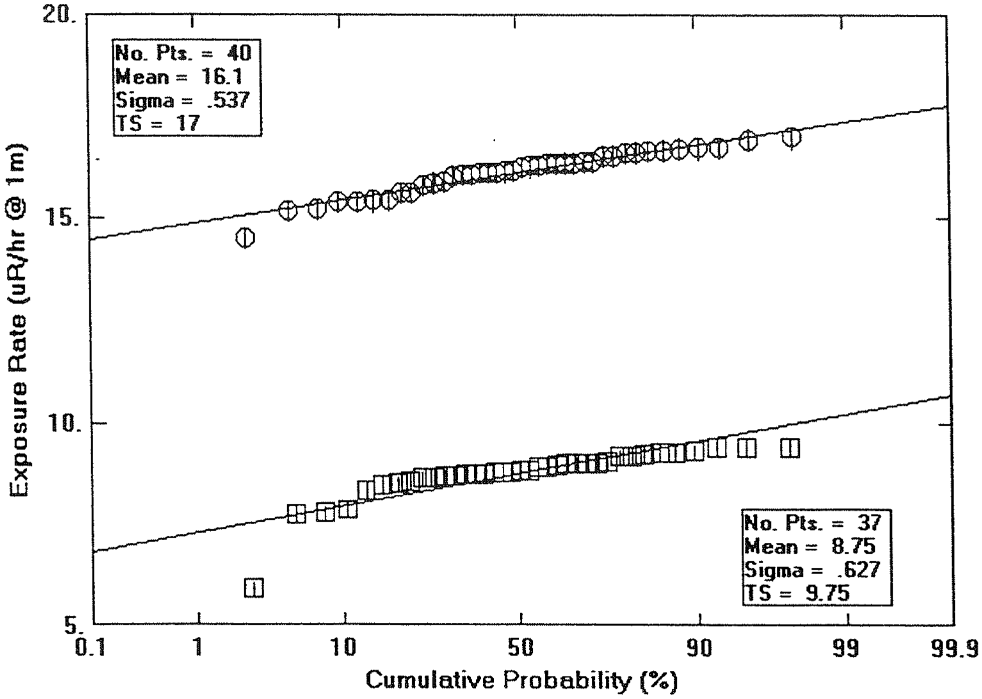


a) Gross Exposure Rate



b) Net Exposure Rate

Figure 15. T012 - Lot 1 Gamma Exposure Rate (Room 110)



O - Room 109, □ - Room 110

Figure 16. T012 - Lot 1 Gamma Exposure Rate (Total Lot)

Table 5. Sample Lot 1 Statistical Results

	Total (dpm/100 cm^2)		**Removable (dpm/100 cm^2)**		**Ambient Gamma Exposure Rate (μR/h)**
	Alpha	**Beta**	**Alpha**	**Beta**	
Acceptance Limit (UL)	5,000	5,000	1,000	1,000	5
Calculated Test Statistic (*TS* = *x* + *ks*)					
Entire area - floors, walls, ceiling, & structure	8.38 (Fig. 10)	402 (Fig. 12)	2.83 (Fig. 11)	21.0 (Fig. 13)	-
Floors only - Room 109	-	-	-	-	2.69 (Fig. 14b)
Floors only - Room 110	-	-	-	-	0.924 (Fig. 15b)

4.5.1.3 Interpretation of Results for Sample Lot 1

The survey data in Table 5, and Figure 10 through Figure 15, demonstrate that for each applicable acceptance limit (U) from Table 2, the corresponding test statistic (TS) value is less than the U, or TS <U. Therefore, the areas in Sample Lot 1 pass the "sampling inspection by variables" test and are "Accepted" as radiologically clean.

In other words, the Building T012 Sample Lot 1 survey corresponds to assuring with a 90% confidence that 90% of Sample Lot 1 has residual contamination below 100% (a 90/90/100 test) of the applicable NRC, DOE, and State of California limits given in Table 2.

4.5.2 Sample Lot 2

4.5.2.1 Description

Sample Lot 2 consists of the inside of the empty fuel storage tubes located in Room 109. All storage tubes were surveyed following procedures given in Reference 6. The tubes were surveyed in March 1995, immediately following the D&D of the facility. As discussed previously, tubes found to have contamination above the limits given in Table 2 were removed and the holes grouted in place. A follow-up quantitative survey for removable alpha/beta contamination was conducted on the remaining 98 tubes in April 1996 as part of the final survey of the facility.

4.5.2.2 Analyses of Sample Lot 2 Data

Raw data measurements for Sample Lot 2 were taken, adjusted for daily instrument background, and plotted on cumulative probability graphs as explained previously. For statistical comparisons (using the "sampling inspection by variables" method), all areas within Sample Lot 2 were combined together and then analyzed for the specific type of radiation measurement made.

Sample lot 2 results are tabulated in Table 6 for comparing the test statistic (TS = $\bar{x} + ks$) with applicable, established contamination criteria or acceptance limits (U) from Table 2. The corresponding figure numbers for the graphs of each calculated cumulative probability plot are also indicated in parentheses. Figure 17 and Figure 18 show a few data "outliers", indicating some remaining total and removable alpha contamination in the fuel storage tubes. These values are, however, well below the applicable acceptance limits of 5,000 and 1,000 dpm/100cm^2, respectively.

Individual raw measurement data and instrument backgrounds are provided in Appendix A. Individual calculated sample results used as graph data for Sample Lot 2 are provided in Appendix B. Grid location diagrams for the various survey areas in T012 are given in Appendix C.

Table 6. Sample Lot 2 Statistical Results

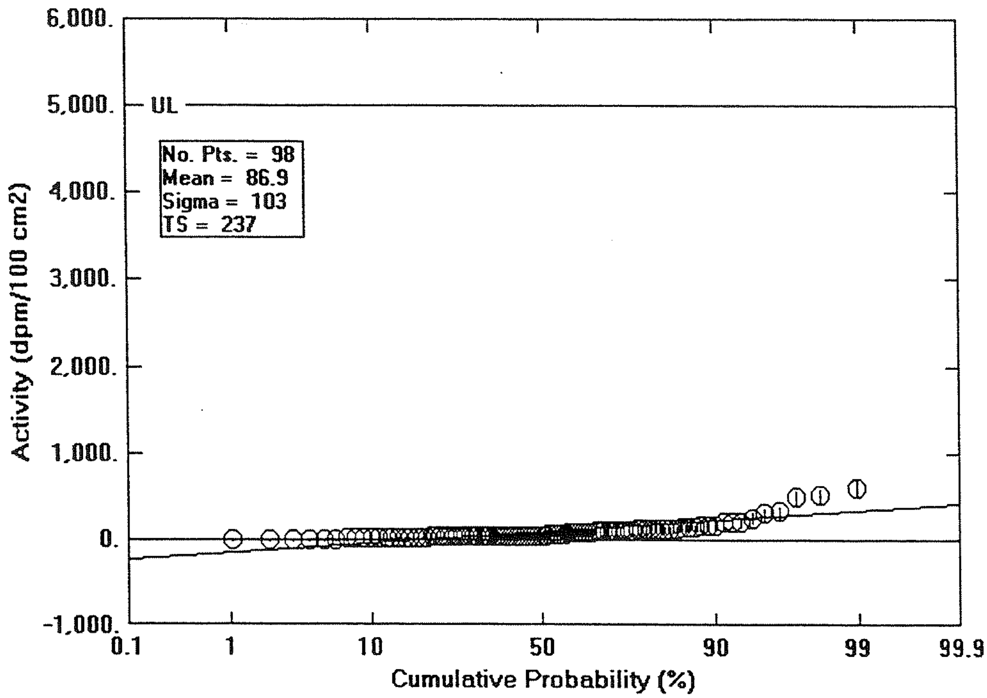
	Total (dpm/100 cm^2)		Removable (dpm/100 cm^2)	
	Alpha	**Beta**	**Alpha**	**Beta**
Acceptance Limit (UL)	5,000	5,000	1,000	1,000
Calculated Test Statistic ($TS = x + ks$)[a]				
Fuel Storage Tubes	237 (17)	<1,850[b]	21.0 (18)	24.6 (19)

[a]Numbers in parentheses refer to figure numbers.
[b]Total beta data were all "No Detectable" at a level of <50 cpm (equivalent to <1,850 dpm/100 cm^2 for the instrument used).

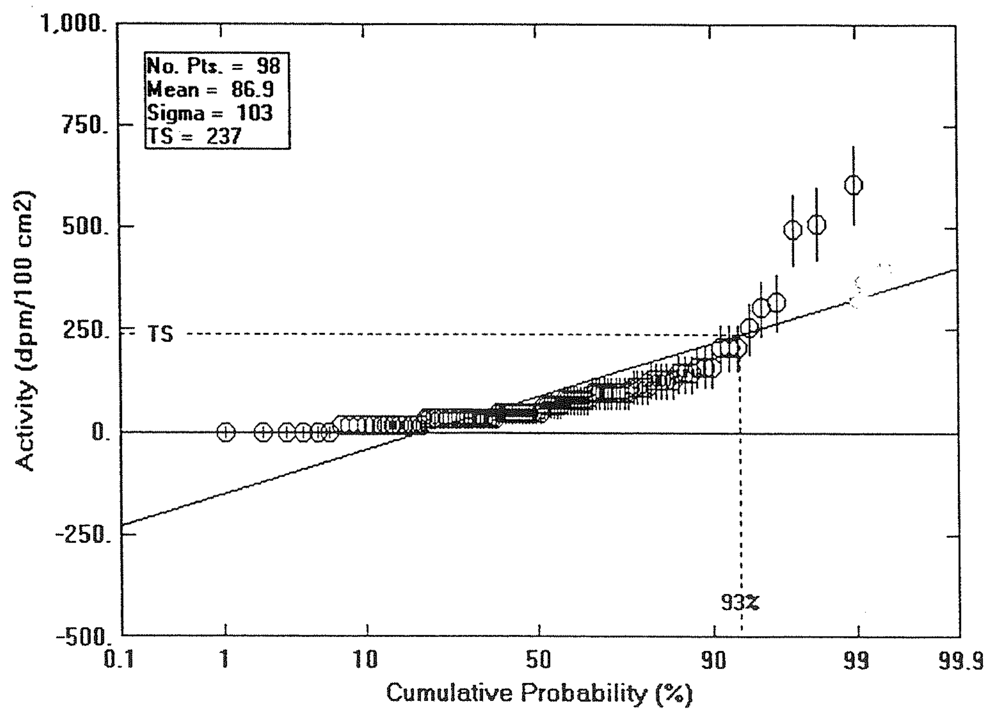
4.5.2.3 Interpretation of Results for Sample Lot 2

Table 6 and Figure 17 through Figure 19 demonstrate that for each applicable acceptance limit (U) from Table 2, the corresponding test statistic (TS) value is less than the U, or TS <U. Therefore, the survey areas in Sample Lot 2 pass the "sampling inspection by variables" test and are "Accepted" as radiologically clean.

In other words, the Building T012 Sample Lot 2 survey corresponds to assuring with a 90% confidence that 90% of Sample Lot 2 has residual contamination below 100% (a 90/90/100 test) of the applicable NRC, DOE, and State of California limits described in Table 2.

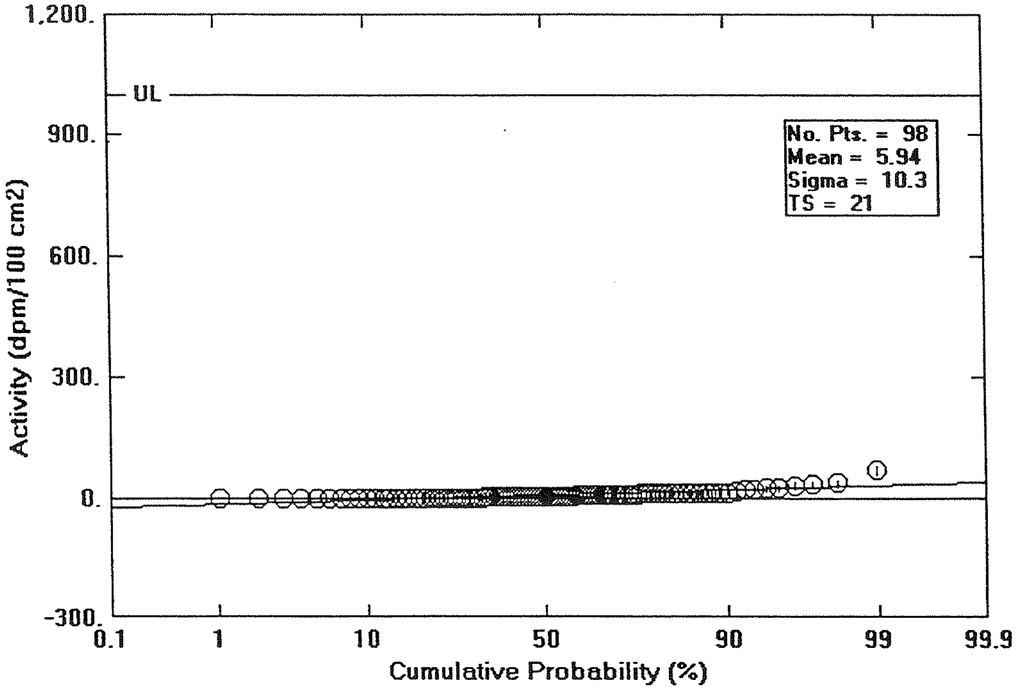


a) Normal Scale

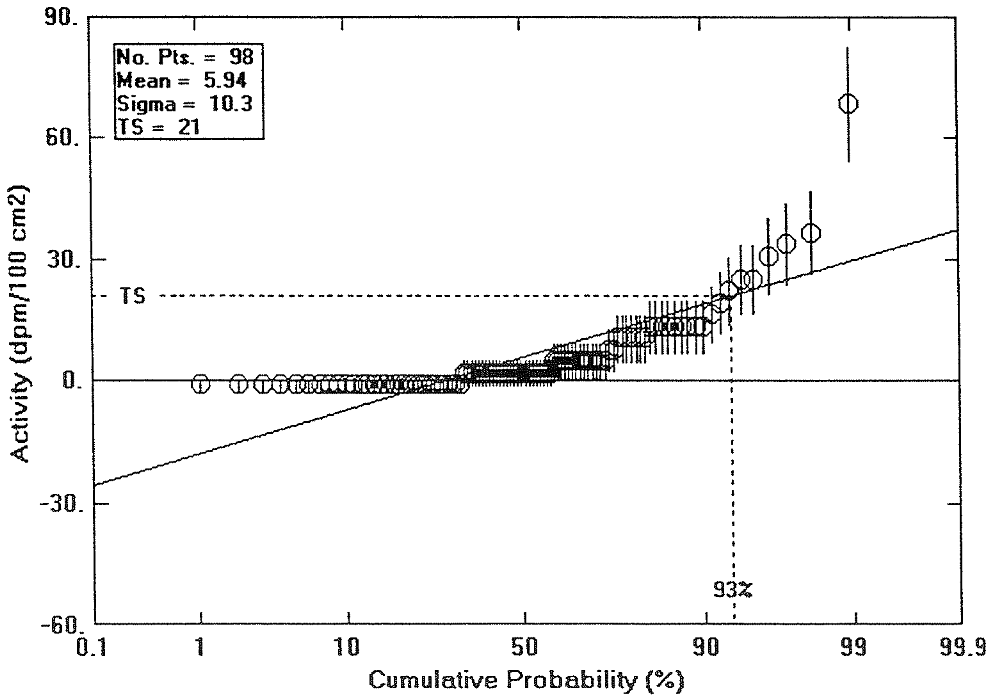


b) Expanded Scale

Figure 17. T012 - Lot 2 Total Alpha Activity

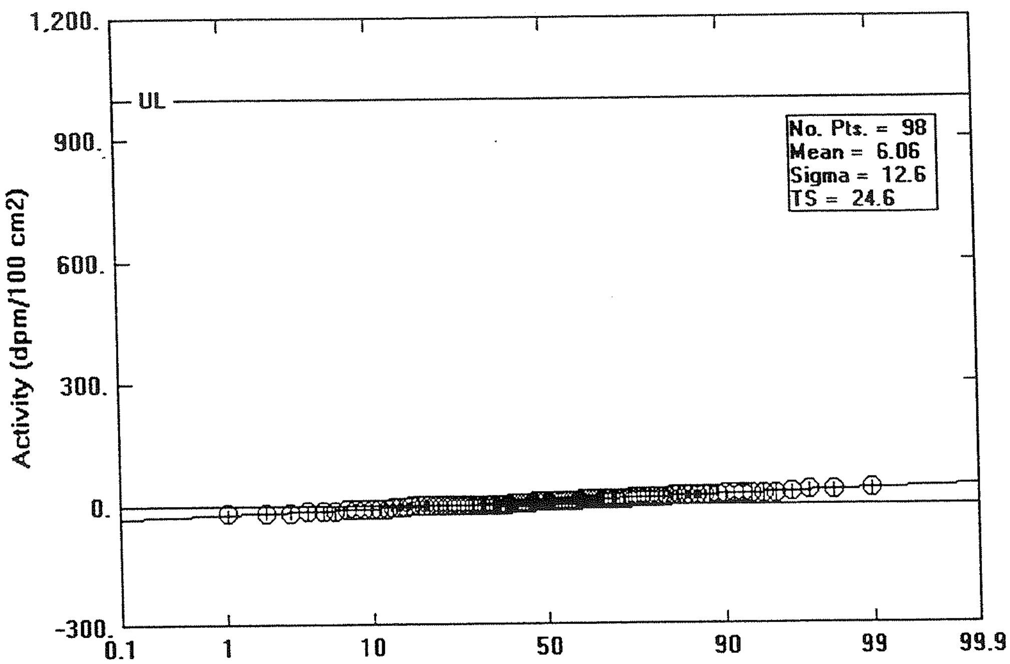


a) Normal Scale

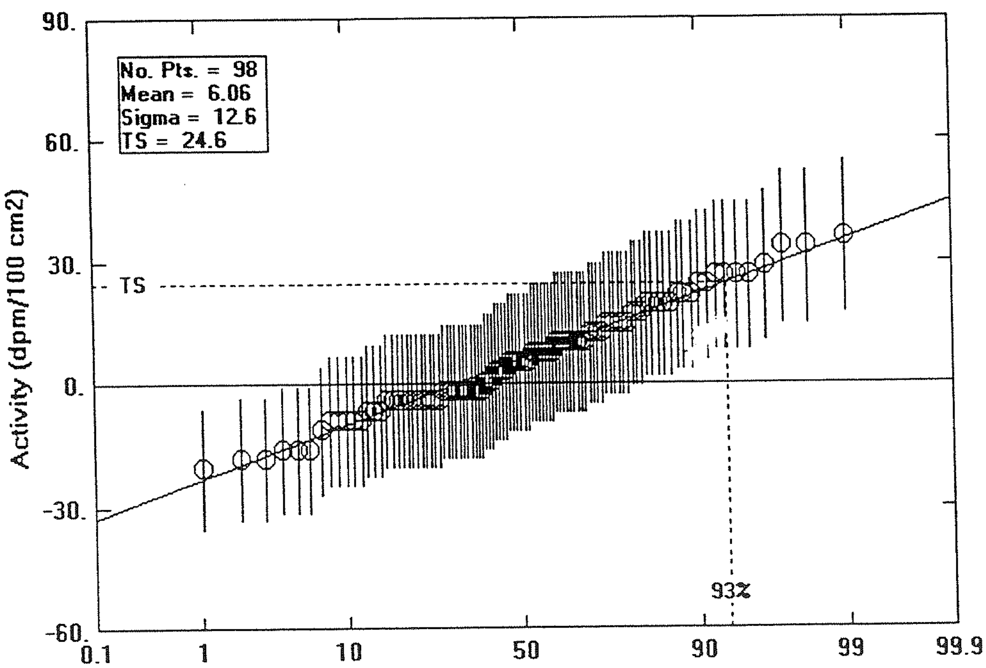


b) Expanded Scale

Figure 18. T012 Lot 2 Removable Alpha Activity



a) Normal Scale



b) Expanded Scale

Figure 19. T012 Lot 2 Removable Beta Activity

5. REFERENCES

1. Rockwell Document 355-ZR-0012, "Radiation Survey of Building T012, SCTI Cogeneration Project", June 26, 1985.
2. Rockwell Document 012-AT-0001, "Radiological Assessment Plan for Building 012", February 2, 1993.
3. Rockwell Document SSWA-AN-0004, "D&D Plan for Building 012", February 22, 1995.
4. Rockwell Document 012-SP-0003, "Decontamination and Decommissioning Procedure for Building 012", March 28, 1995.
5. Rockwell Document -12-SP-0002, "Building 012 Floor Tile Sampling Procedure", March 9, 1995.
6. Rockwell Document 012-SP-0004, "Building T012 Final Survey Procedure", June 16, 1995.
7. Rocketdyne Use Authorization No. 18, "ETEC Radiography at SSFL", terminated March 10, 1993.
8. DECON-1, State of California for Decontaminating Facilities and Equipment Prior to Release for Unrestricted Use, dated June 1977.
9. N001OP000033, Methods and Procedures for Radiological Monitoring.
10. DOE Order 5400.5, Radiation Protection of the Public and the Environment, dated February 8, 1990.
11. NRC Dismantling Order for the L-85 Reactor Decommissioning, NRC to M. E. Remley, dated March 1, 1983.
12. DOE/CH/8901, A Manual for Implementing Residual Radioactive Material Guidelines, T. L. Gilbert, et al., June 1989.
13. MIL-STD-414, Sampling Procedures and Tables for Inspection by Variables for Percent Defective, June 11, 1957.
14. Rockwell Document N704SRR990033, "Final Decontamination and Radiological Survey of Building T028", February 21, 1991.

Appendix A.

Building T012

Sample Lots 1 and 2

Final Survey Data

Lot 1 Survey Data, Room 109

SAMPLE	GRID	5 MIN		1 MIN	5 MIN		1 MIN	1 MIN	ALPHA					BETA					GAMMA	
		ALPHA			BETA			GAM	INSTRUMENT			SMEAR		INSTRUMENT			SMEAR			
NAME	NAME	TOTAL	MAX	REM	TOTAL	MAX	REM	TOTAL	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT
NORTH WALL	1	7		0	360		31		0.9	3.44	1.41	0.43	3.87	64.3	7.32	5	27	3.65		
NORTH WALL	2	12		0	384		29		0.9	3.44	1.41	0.43	3.87	64.3	7.32	5	27	3.65		
NORTH WALL	3	9		0	369		34		0.9	3.44	1.41	0.43	3.87	64.3	7.32	5	27	3.65		
NORTH WALL	4	6		1	327		35		0.9	3.44	1.41	0.43	3.87	64.3	7.32	5	27	3.65		
NORTH WALL	5	5		1	348		22		0.9	3.44	1.41	0.43	3.87	64.3	7.32	5	27	3.65		
NORTH WALL	6	8		1	367		25		0.9	3.44	1.41	0.43	3.87	64.3	7.32	5	27	3.65		
NORTH WALL	7	10		0	323		25		0.9	3.44	1.41	0.43	3.87	64.3	7.32	5	27	3.65		
NORTH WALL	8	8		1	348		25		0.9	3.44	1.41	0.43	3.87	64.3	7.32	5	27	3.65		
NORTH WALL	9	11		1	334		27		0.9	3.44	1.41	0.43	3.87	64.3	7.32	5	27	3.65		
NORTH WALL	10	8		0	343		29		0.9	3.44	1.41	0.43	3.87	64.3	7.32	5	27	3.65		
NORTH WALL	11	10		0	344		26		0.9	3.44	1.41	0.43	3.87	64.3	7.32	5	27	3.65		
NORTH WALL	12	13		0	351		30		0.9	3.44	1.41	0.43	3.87	64.3	7.32	5	27	3.65		
EAST WALL	13	2		1	324		30		0.9	3.44	1.41	0.43	3.87	64.3	7.32	5	27	3.65		
EAST WALL	14	23		0	384		32		0.9	3.44	1.41	0.43	3.87	64.3	7.32	5	27	3.65		
EAST WALL	15	12		1	381		31		0.9	3.44	1.41	0.43	3.87	64.3	7.32	5	27	3.65		
EAST WALL	16	3		0	340		27		0.9	3.44	1.41	0.43	3.87	64.3	7.32	5	27	3.65		
EAST WALL	17	7		0	342		36		0.9	3.44	1.41	0.43	3.87	64.3	7.32	5	27	3.65		
EAST WALL	18	7		0	357		27		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	19	13		0	338		23		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	20	11		0	315		25		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	21	20		0	322		20		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	22A	7		1	342		27		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	22B	7		0	357		27		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	23	13		0	320		28		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	24	14		1	305		31		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	25	11		0	355		33		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	26	12		0	354		26		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	27	8		0	319		22		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	28	16		0	318		30		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	29	12		1	323		22		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	30	12		2	342		29		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	31	5		4	376		14		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	32	13		0	332		24		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	33	6		2	343		23		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	34	11		0	315		38		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	35	5		2	261		37		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	36	4		0	313		32		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	37	8		0	357		17		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	38	4		0	339		25		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	39	9		1	342		42		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	40	6		0	347		26		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
EAST WALL	41	6		0	364		33		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
SOUTH WALL	42	8		1	347		37		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
SOUTH WALL	43	19		0	324		22		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		

Lot 1 Survey Data, Room 109

SAMPLE NAME	GRID NAME	5 MIN ALPHA TOTAL	ALPHA MAX	1 MIN ALPHA REM	5 MIN BETA TOTAL	BETA MAX	1 MIN BETA REM	1 MIN GAM TOTAL	ALPHA INSTRUMENT BACKG	ALPHA INSTRUMENT EFACT	ALPHA INSTRUMENT AFACT	ALPHA SMEAR BACKG	ALPHA SMEAR EFACT	BETA INSTRUMENT BACKG	BETA INSTRUMENT EFACT	BETA INSTRUMENT AFACT	BETA SMEAR BACKG	BETA SMEAR EFACT	GAMMA BACKG	GAMMA EFACT
SOUTH WALL	44	8		0	323		26		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
SOUTH WALL	45	7		0	370		32		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
SOUTH WALL	46	11		0	345		25		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
SOUTH WALL	47	6		0	344		29		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
SOUTH WALL	48	8		0	360		30		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
SOUTH WALL	49	12		0	345		37		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
SOUTH WALL	50	11		1	364		20		1.5	3.50	1.41	0.43	3.87	67.2	7.24	5	27	3.65		
SOUTH WALL	51	9		0	308		30		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTH WALL	52	11		0	324		32		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTH WALL	53	16		0	371		22		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTH WALL	54	20		0	373		36		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTH WALL	55	12		0	377		19		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTH WALL	56	13		1	297		23		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTH WALL	57	18		0	267		44		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTH WALL	58	6		0	261		31		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTH WALL	59	16		0	354		30		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTH WALL	60	14		0	394		25		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTH WALL	61	6		0	305		38		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTH WALL	62	10	32	0	296	387	24		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTHWEST WALL	63	13		0	350		27		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTHWEST WALL	64	9		0	338		21		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTHWEST WALL	65	8		0	332		28		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTHWEST WALL	66	4		0	337		31		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTHWEST WALL	67	9		1	386		22		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTHWEST WALL	68	5		0	362		32		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTHWEST WALL	69	9		1	353		21		0.9	3.52	1.41	0.43	3.87	65	7.13	5	27	3.65		
SOUTHWEST WALL	70	24		1	387		30		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
SOUTHWEST WALL	71	11		0	347		31		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
SOUTHWEST WALL	72	10		0	350		41		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
SOUTHWEST WALL	73	10		0	320		19		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
SOUTHWEST WALL	74	7		2	362		28		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	75	13		1	327		29		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	76	7		0	318		33		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	77	17		3	347		27		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	78	23		1	317		25		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	79	9		0	328		30		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	80	8		0	315		28		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	81	9		0	329		24		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	82	11		1	361		19		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	83	17		0	331		12		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	84	8		0	288		20		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	85	6		0	288		22		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	86	11		0	325		28		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	87	9		0	330		29		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		

Lot 1 Survey Data, Room 109

SAMPLE NAME	GRID NAME	5 MIN ALPHA TOTAL	ALPHA MAX	1 MIN ALPHA REM	5 MIN BETA TOTAL	BETA MAX	1 MIN BETA REM	1 MIN GAM TOTAL	ALPHA INSTRUMENT BACKG	ALPHA INSTRUMENT EFACT	ALPHA INSTRUMENT AFACT	ALPHA SMEAR BACKG	ALPHA SMEAR EFACT	BETA INSTRUMENT BACKG	BETA INSTRUMENT EFACT	BETA INSTRUMENT AFACT	BETA SMEAR BACKG	BETA SMEAR EFACT	GAMMA BACKG	GAMMA EFACT
NORTHWEST WALL	88	8		0	343		24		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	89	6		0	327		31		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	90	5		0	357		27		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	91	3		0	330		23		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	92	5		0	307		24		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	93	4		0	271		27		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
NORTHWEST WALL	94	13		0	328		18		1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		
FLOOR	95	9		1	365		18	3646	1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		0.0047
FLOOR	96	7		1	324		20	3519	1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		0.0047
FLOOR	97	7		1	405		34	3601	1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		0.0047
FLOOR	98	32	372	1	410	449	18	3526	1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		0.0047
FLOOR	99	7		0	343		27	3360	1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		0.0047
FLOOR	100	21		0	368		19	3126	1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		0.0047
FLOOR	101	13		0	345		24	3415	1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		0.0047
FLOOR	102	8		0	370		21	3423	1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		0.0047
FLOOR	103	13		0	364		29	3276	1.3	3.59	1.41	0.43	3.87	65.7	7.28	5	27	3.65		0.0047
FLOOR	104	18		0	332		31	3557	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	105	11		0	388		22	3503	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	106	7		1	381		20	3477	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	107	9		0	393		27	3320	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	108	15		0	351		31	3505	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	109	13		1	353		17	3516	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	110	7		0	378		23	3470	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	111	10		0	398		27	3587	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	112	12		0	400		16	3583	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	113	12		1	384		22	3519	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	114	11		0	341		24	3525	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	115	9		1	363		17	3460	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	116	8		0	376		22	3498	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	117	10		0	365		25	3559	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	118	11		0	413		31	3577	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	119	14		0	343		19	3516	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	120	15		0	355		26	3656	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	121	17		0	340		14	3465	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	122	10		0	388		22	3323	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	123	15		3	392		29	3605	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	124	17		0	397		20	3596	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
FLOOR	125	17		0	383		20	3575	1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		0.0047
CEILING	126	9		0	359		36		1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		
CEILING	127	6		0	373		23		1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		
CEILING	128	5		0	348		27		1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		
CEILING	129	6		0	361		25		1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		
CEILING	130	7		1	352		27		1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		
CEILING	131	2		0	398		28		1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		

Lot 1 Survey Data, Room 109

SAMPLE NAME	GRID NAME	5 MIN ALPHA TOTAL	ALPHA MAX	1 MIN ALPHA REM	5 MIN BETA TOTAL	BETA MAX	1 MIN BETA REM	1 MIN GAM TOTAL	ALPHA INSTRUMENT BACKG	ALPHA INSTRUMENT EFACT	ALPHA INSTRUMENT AFACT	ALPHA SMEAR BACKG	ALPHA SMEAR EFACT	BETA INSTRUMENT BACKG	BETA INSTRUMENT EFACT	BETA INSTRUMENT AFACT	BETA SMEAR BACKG	BETA SMEAR EFACT	GAMMA BACKG	GAMMA EFACT
CEILING	132	13		1	378		24		1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		
CEILING	133	7		0	392		27		1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		
CEILING	134	9		0	386		26		1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		
CEILING	135	9		0	394		17		1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		
CEILING	136	5		0	340		31		1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		
CEILING	137	3		0	390		28		1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		
CEILING	138	8		0	389		25		1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		
CEILING	139	6		0	344		28		1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		
CEILING	140	2		0	400		23		1.5	3.63	1.41	0.43	3.87	65.8	7.38	5	27	3.65		
CEILING	141	3		0	379		26		1.6	3.66	1.41	0.43	3.87	66.9	7.31	5	27	3.65		
CEILING	142	6		0	370		26		1.6	3.66	1.41	0.43	3.87	66.9	7.31	5	27	3.65		
CEILING	143	13		1	354		13		1.6	3.66	1.41	0.43	3.87	66.9	7.31	5	27	3.65		
CEILING	144	12		0	355		23		1.6	3.66	1.41	0.43	3.87	66.9	7.31	5	27	3.65		
CEILING	145	6		0	381		27		1.6	3.66	1.41	0.43	3.87	66.9	7.31	5	27	3.65		
CEILING	146	8		0	384		21		1.6	3.66	1.41	0.43	3.87	66.9	7.31	5	27	3.65		
CEILING	147	4		0	394		20		1.6	3.66	1.41	0.43	3.87	66.9	7.31	5	27	3.65		
CEILING	148	2		0	356		36		1.6	3.66	1.41	0.43	3.87	66.9	7.31	5	27	3.65		
CEILING	149	7		2	364		20		1.6	3.66	1.41	0.43	3.87	66.9	7.31	5	27	3.65		
CEILING	150	10		0	373		19		1.6	3.66	1.41	0.43	3.87	66.9	7.31	5	27	3.65		
CEILING	151	2		1	386		24		1.6	3.66	1.41	0.43	3.87	66.9	7.31	5	27	3.65		
CEILING	152	6		1	391		19		1.6	3.66	1.41	0.43	3.87	66.9	7.31	5	27	3.65		
CEILING	153	3		0	397		28		1.6	3.66	1.41	0.43	3.87	66.9	7.31	5	27	3.65		
CEILING	154	3		1	392		30		1.6	3.66	1.41	0.43	3.87	66.9	7.31	5	27	3.65		
CEILING	155	2		0	363		26		1.6	3.66	1.41	0.43	3.87	66.9	7.31	5	27	3.65		
CEILING	156	2		0	362		27		1.6	3.66	1.41	0.43	3.87	66.9	7.31	5	27	3.65		
NORTHWEST WALL	157	5		0	343		18		1.6	3.66	1.41	0.43	3.87	66.9	7.31	5	27	3.65		
FUEL STORAGE WALL	1	4		0	336		24		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		
FUEL STORAGE WALL	2	11		0	398		27		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		
FUEL STORAGE WALL	3	8		0	328		24		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		
FUEL STORAGE WALL	4	8		0	342		25		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		
FUEL STORAGE WALL	5	4		1	349		20		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		

Lot 1 Survey Data, Room 110

SAMPLE	GRID	5 MIN		1 MIN	5 MIN		1 MIN	1 MIN	ALPHA					BETA					GAMMA	
		ALPHA			BETA			GAM	INSTRUMENT			SMEAR		INSTRUMENT			SMEAR			
NAME	NAME	TOTAL	MAX	REM	TOTAL	MAX	REM	TOTAL	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT
NORTH WALL	1	7		0	196		24		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
NORTH WALL	2	3		1	172		22		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
NORTH WALL	3	9		1	212		21		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
NORTH WALL	4	4		0	201		23		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
NORTH WALL	5	2		0	190		21		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
NORTH WALL	6	3		1	190		22		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
NORTH WALL	7	5		0	186		25		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
NORTH WALL	8	5		1	180		25		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
NORTH WALL	9	5		1	214		30		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
NORTH WALL	10	5		0	221		31		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
NORTH WALL	11	6		1	202		24		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
NORTH WALL	12	5		0	211		28		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
NORTH WALL	13	13		0	166		36		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
NORTH WALL	14	7		0	173		25		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
NORTH WALL	15	5		1	185		24		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
NORTH WALL	16	6		1	187		33		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
NORTH WALL	17	0		2	182		25		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
NORTH WALL	18	4		3	216		15		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
EAST WALL	19	7		0	198		25		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
EAST WALL	20	5		0	218		21		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
EAST WALL	21	10		2	215		28		1	3.45	1.41	0.42	3.94	40.7	7.98	5	25.7	3.69		
EAST WALL	22	9		0	185		20		1	3.41	1.41	0.42	3.94	43.1	7.38	5	25.7	3.69		
EAST WALL	23	12		0	218		30		1	3.41	1.41	0.42	3.94	43.1	7.38	5	25.7	3.69		
EAST WALL	24	12		0	207		18		1	3.41	1.41	0.42	3.94	43.1	7.38	5	25.7	3.69		
EAST WALL	25	14		0	210		34		1	3.41	1.41	0.42	3.94	43.1	7.38	5	25.7	3.69		
EAST WALL	26	8		0	207		21		1	3.41	1.41	0.42	3.94	43.1	7.38	5	25.7	3.69		
EAST WALL	27	8		0	213		27		1	3.41	1.41	0.42	3.94	43.1	7.38	5	25.7	3.69		
EAST WALL	28	7		0	197		19		1	3.41	1.41	0.42	3.94	43.1	7.38	5	25.7	3.69		
EAST WALL	29	7		1	208		36		1	3.41	1.41	0.42	3.94	43.1	7.38	5	25.7	3.69		
EAST WALL	30	6		0	210		26		1	3.41	1.41	0.42	3.94	43.1	7.38	5	25.7	3.69		
EAST WALL	31	12		0	206		24		1	3.41	1.41	0.42	3.94	43.1	7.38	5	25.7	3.69		
EAST WALL	32	4		0	192		22		1	3.41	1.41	0.42	3.94	43.1	7.38	5	25.7	3.69		
EAST WALL	33	8		0	209		22		1	3.41	1.41	0.42	3.94	43.1	7.38	5	25.7	3.69		
EAST WALL	34	4		2	220		20		1	3.41	1.41	0.42	3.94	43.1	7.38	5	25.7	3.69		
EAST WALL	35	6		0	173		17		1	3.41	1.41	0.42	3.94	43.1	7.38	5	25.7	3.69		
EAST WALL	36	7		1	216		20		1	3.41	1.41	0.42	3.94	43.1	7.38	5	25.7	3.69		
SOUTH WALL	37	5		0	187		28		1	3.41	1.41	0.42	3.94	43.1	7.38	5	25.7	3.69		
SOUTH WALL	38	9		0	211		18		1	3.41	1.41	0.42	3.94	43.1	7.38	5	25.7	3.69		
SOUTH WALL	39	4		0	201		17		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
SOUTH WALL	40	3		1	189		24		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
SOUTH WALL	41	6		0	206		23		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
SOUTH WALL	42	2		1	214		31		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
SOUTH WALL	43	11		0	230		22		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
SOUTH WALL	44	6		0	206		28		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		

Lot 1 Survey Data, Room 110

SAMPLE NAME	GRID NAME	5 MIN ALPHA		1 MIN	5 MIN BETA		1 MIN	1 MIN GAM	ALPHA INSTRUMENT			ALPHA SMEAR		BETA INSTRUMENT			BETA SMEAR		GAMMA	
		TOTAL	MAX	REM	TOTAL	MAX	REM	TOTAL	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT
SOUTH WALL	45	6		0	193		21		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
SOUTH WALL	46	12		0	208		28		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
SOUTH WALL	47	5		0	195		34		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
SOUTH WALL	48	4		0	229		33		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
SOUTH WALL	49	10		0	163		26		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
SOUTH WALL	50	6		0	209		22		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
SOUTH WALL	51	6		0	199		22		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
SOUTH WALL	52	5		0	211		22		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
SOUTH WALL	53	5		0	176		24		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
SOUTH WALL	54	1		0	192		20		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
WEST WALL	55	11		0	204		24		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
WEST WALL	56	5		0	191		19		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
WEST WALL	57	4		0	216		28		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
WEST WALL	58	2		3	205		29		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
WEST WALL	59	3		1	205		16		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
WEST WALL	60	8		0	225		23		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
WEST WALL	61	4		1	196		22		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
WEST WALL	62	3		0	193		21		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
WEST WALL	63	2		0	212		20		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
WEST WALL	64	3		0	203		21		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
WEST WALL	65	6		0	184		26		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
WEST WALL	66	2		0	200		28		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
WEST WALL	67	6		0	177		32		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
WEST WALL	68	2		0	205		32		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
WEST WALL	69	4		1	189		14		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
WEST WALL	70	4		1	178		31		0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		
FLOOR	71	4		0	202		21	1277	0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		0.0047
FLOOR	72	7		1	221		26	1692	0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		0.0047
FLOOR	73	7		0	225		25	1863	0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		0.0047
FLOOR	74	8		1	204		18	1825	0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		0.0047
FLOOR	75	11		0	213		19	1893	0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		0.0047
FLOOR	76	5		2	219		28	1873	0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		0.0047
FLOOR	77	7		0	229		26	1675	0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		0.0047
FLOOR	78	10		0	204		26	1671	0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		0.0047
FLOOR	79	5		1	247		31	1846	0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		0.0047
FLOOR	80	2		0	219		21	1918	0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		0.0047
FLOOR	81	3		0	231		21	1987	0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		0.0047
FLOOR	82	3		0	211		24	1935	0.6	3.34	1.41	0.42	3.94	40.5	7.27	5	25.7	3.69		0.0047
FLOOR	83	8		0	220		24	1793	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	84	9		0	257		26	1876	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	85	10		1	235		15	1919	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	86	13		0	238		21	1939	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	87	10		0	224		18	1899	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	88	9		0	256		21	1993	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047

Lot 1 Survey Data, Room 110

SAMPLE NAME	GRID NAME	5 MIN ALPHA		1 MIN ALPHA	5 MIN BETA		1 MIN BETA	1 MIN GAM	ALPHA INSTRUMENT			ALPHA SMEAR		BETA INSTRUMENT			BETA SMEAR		GAMMA	
		TOTAL	MAX	REM	TOTAL	MAX	REM	TOTAL	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT
FLOOR	89	6		1	203		24	1877	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	90	5		0	237		26	1879	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	91	10		0	248		22	2024	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	92	4		1	227		35	2025	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	93	7		0	251		23	1972	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	94	3		0	240		24	1935	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	95	11		0	245		26	1899	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	96	1		1	225		20	1937	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	97	11		0	242		30	1945	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	98	7		0	224		20	2001	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	99	5		0	225		21	1994	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	100	6		0	215		21	1975	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	101	6		0	216		22	1893	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	102	11		1	235		19	1925	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	103	7		0	230		26	1831	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	104	7		1	241		22	1860	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	105	5		0	232		18	1890	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
FLOOR	106	6		0	223		22	1868	0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		0.0047
CEILING	107	10		0	200		25		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	108	5		0	231		24		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	109	3		0	220		24		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	110	3		0	207		26		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	111	1		0	257		16		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	112	3		0	217		17		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	113	4		1	197		13		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	114	5		0	248		21		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	115	1		2	252		26		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	116	3		0	227		25		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	117	6		0	260		27		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	118	2		0	243		26		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	119	4		0	261		22		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	120	1		0	223		32		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	121	5		0	123		22		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	122	6		1	242		25		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	123	4		1	218		22		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	124	1		1	220		20		0.9	3.37	1.41	0.42	3.94	41.6	7.16	5	25.7	3.69		
CEILING	125	7		1	233		19		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
CEILING	126	6		0	238		20		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
CEILING	127	4		0	233		24		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
CEILING	128	6		1	247		18		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
CEILING	129	13		0	248		26		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
CEILING	130	6		0	242		21		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
CEILING	131	6		0	241		16		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
CEILING	132	12		0	211		34		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		

Lot 1 Survey Data, Room 110

		5 MIN		1 MIN	5 MIN		1 MIN	1 MIN	ALPHA					BETA					GAMMA	
SAMPLE	GRID	ALPHA			BETA			GAM	INSTRUMENT			SMEAR		INSTRUMENT			SMEAR			
NAME	NAME	TOTAL	MAX	REM	TOTAL	MAX	REM	TOTAL	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT
CEILING	133	4		1	223		29		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
CEILING	134	5		0	243		25		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
CEILING	135	1		2	244		24		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
CEILING	136	9		0	242		20		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
CEILING	137	2		0	222		29		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
CEILING	138	3		1	246		39		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
CEILING	139	5		0	225		21		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
CEILING	140	0		0	224		27		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
CEILING	141	2		0	251		33		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
CEILING	142	3		0	245		27		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
AIRLOCK	143	7		0	222		39		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
AIRLOCK	144	6		0	183		28		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
AIRLOCK	145	2		2	191		24		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
AIRLOCK	146	2		0	201		31		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
AIRLOCK	147	0		0	257		22		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
AIRLOCK	148	7		0	249		25	2024	0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		0.0047
SHIELD DOOR	149	4		1	139		23		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
SHIELD DOOR	150	4		0	151		23		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
SHIELD DOOR	151	8		0	134		20		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
SHIELD DOOR	152	2		0	140		20		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
SHIELD DOOR	153	7		0	156		25		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
SHIELD DOOR	154	6		0	152		24		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
SHIELD DOOR	155	7		0	145		31		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
SHIELD DOOR	156	21	168	0	185	182	17		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		
SHIELD DOOR	158	6		0	154		22		0.5	3.42	1.41	0.42	3.94	41.1	7.22	5	25.7	3.69		

Lot 1 Survey Data, Room 109 Attic

		5 MIN		1 MIN	5 MIN		1 MIN	1 MIN	ALPHA					BETA					GAMMA	
SAMPLE	GRID	ALPHA			BETA			GAM	INSTRUMENT			SMEAR		INSTRUMENT			SMEAR			
NAME	NAME	TOTAL	MAX	REM	TOTAL	MAX	REM	TOTAL	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT
NORTH WALL	1	4		0	391		23		1.3	3.52	1.41	0.42	3.94	64.9	7.22	5	25.7	3.69		
NORTH WALL	2	8		0	340		24		1.3	3.52	1.41	0.42	3.94	64.9	7.22	5	25.7	3.69		
NORTH WALL	3	7		0	362		17		1.3	3.52	1.41	0.42	3.94	64.9	7.22	5	25.7	3.69		
EAST WALL	4	6		0	339		18		1.3	3.52	1.41	0.42	3.94	64.9	7.22	5	25.7	3.69		
EAST WALL	5	7		0	323		24		1.3	3.52	1.41	0.42	3.94	64.9	7.22	5	25.7	3.69		
EAST WALL	6	11		1	348		22		1.3	3.52	1.41	0.42	3.94	64.9	7.22	5	25.7	3.69		
EAST WALL	7	7		0	346		20		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
EAST WALL	8	9		0	345		19		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
EAST WALL	9	8		1	360		22		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
EAST WALL	10	8		0	313		24		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
EAST WALL	11	5		0	296		21		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
WEST WALL	12	9		0	354		22		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
WEST WALL	13	5		0	346		25		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
WEST WALL	14	9		0	353		18		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
WEST WALL	15	10		0	360		32		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
WEST WALL	16	8		0	368		24		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
WEST WALL	17	8		0	340		25		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
WEST WALL	18	5		2	357		29		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
WEST WALL	19	7		0	349		17		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
FLOOR	20	9		0	286		23		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
FLOOR	21	6		0	281		31		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
FLOOR	22	7		0	297		25		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
FLOOR	23	6		0	276		29		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
FLOOR	24	8		0	285		31		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
FLOOR	25	4		0	300		28		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
FLOOR	26	7		0	293		24		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
FLOOR	27	4		0	289		25		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
FLOOR	28	6		0	302		20		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
FLOOR	29	4		1	284		27		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
FLR/CEIL REMANTS	30	9		0	327		21		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
CEILING	31	8		0	389		33		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
CEILING	32	3		1	378		21		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
CEILING	33	9		1	381		24		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
CEILING	34	8		0	392		23		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
CEILING	35	5		0	387		22		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
CEILING	36	4		0	399		33		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
CEILING	37	8		0	407		31		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
CEILING	38	9		0	402		27		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
CEILING	39	4		0	389		17		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		
CEILING	40	1		0	366		29		1.4	3.55	1.41	0.42	3.94	67.6	7.18	5	25.7	3.69		

Lot 1 Survey Data, Room 109 Fuel Storage Area

		5 MIN		1 MIN	5 MIN		1 MIN	1 MIN	ALPHA					BETA					GAMMA	
SAMPLE	GRID	ALPHA			BETA			GAM	INSTRUMENT			SMEAR		INSTRUMENT			SMEAR			
NAME	NAME	TOTAL	MAX	REM	TOTAL	MAX	REM	TOTAL	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT
NORTH WALL	1	10		0	398		22		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
NORTH WALL	2	13		0	312		20		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
NORTH WALL	3	5		1	314		25		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
NORTH WALL	4	11		0	348		21		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
NORTH WALL	5	9		0	344		20		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
EAST WALL	6	7		1	315		17		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
EAST WALL	7	8		0	364		19		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
EAST WALL	8	16		0	329		16		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
EAST WALL	9	11		0	348		28		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
EAST WALL	10	11		0	354		25		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
EAST WALL	11	12		0	334		30		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
EAST WALL	12	6		0	359		17		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
EAST WALL	13	5		0	329		26		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
EAST WALL	14	8		0	323		17		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
EAST WALL	15	6		0	327		16		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
SOUTH WALL	16	16		0	384		31		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
SOUTH WALL	17	13		0	347		25		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
SOUTH WALL	18	12		0	342		24		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
WEST WALL	19	10		0	344		24		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
WEST WALL	20	13		0	328		22		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
WEST WALL	21	7		0	341		18		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
WEST WALL	22	32		0	316		28		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
WEST WALL	23	8		0	299		24		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
WEST WALL	24	9		0	360		39		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
WEST WALL	25	5		0	400		24		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
WEST WALL	26	15		0	329		20		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
WEST WALL	27	2		2	343		18		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
WEST WALL	28	3		0	337		18		1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		
FLOOR	29	10		0	410		30	3473	1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		0.0047
FLOOR	30	18		0	402		25	3404	1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		0.0047
FLOOR	31	11		1	391		26	3458	1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		0.0047
FLOOR	32	13		1	368		23	3317	1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		0.0047
FLOOR	33	18		1	366		22	3362	1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		0.0047
FLOOR	34	16		0	364		23	3317	1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		0.0047
FLOOR	35	8		0	406		29	3453	1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		0.0047
FLOOR	36	20		1	368		21	3267	1.3	3.62	1.41	0.43	3.87	66.9	7.25	5	27	3.65		0.0047
CEILING	37	1		0	283		25		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		
CEILING	38	0		1	292		29		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		
CEILING	39	3		0	301		23		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		
CEILING	40	0		1	291		23		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		
CEILING	41	0		0	275		15		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		
CEILING	42	5		0	285		22		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		
CEILING	43	3		0	288		22		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		
CEILING	44	2		0	289		26		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		

Lot 1 Survey Data, Room 109 Fuel Storage Area

		5 MIN		1 MIN	5 MIN		1 MIN	1 MIN	ALPHA					BETA					GAMMA	
SAMPLE	GRID	ALPHA			BETA			GAM	INSTRUMENT			SMEAR		INSTRUMENT			SMEAR			
NAME	NAME	TOTAL	MAX	REM	TOTAL	MAX	REM	TOTAL	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT
SOUTH LEDGE	45	6		1	351		26		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		
NORTH LEDGE	46	14		0	355		20		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		
NORTH LEDGE	47	4		0	327		21		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		
DOOR JAMB	48	7		1	328		33		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		
DOOR JAMB	49	4		0	324		35	3468	1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		0.0047
DOOR JAMB	50	11		0	284		21		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		
DOOR JAMB	51	5		1	351		30		1.3	3.52	1.41	0.43	3.87	64.9	7.22	5	27	3.65		

Appendix B.

Building T012

Sample Lots 1 and 2

Final Survey Results

Lot 1 Survey Data, Room 109

SAMPLE NAME	GRID NAME	ALPHA (DPM/100CM2) TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	BETA (DPM/100CM2) TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	GAMMA (uR/hr) TOTAL	STD DEV
NORTH WALL	1	2.43	3.29			-1.66	2.54	281.82	191.09			14.60	27.80		
NORTH WALL	2	7.28	3.94			-1.66	2.54	457.50	194.43			7.30	27.31		
NORTH WALL	3	4.37	3.56			-1.66	2.54	347.70	192.35			25.55	28.51		
NORTH WALL	4	1.46	3.14			2.21	4.63	40.26	186.41			29.20	28.74		
NORTH WALL	5	0.49	2.99			2.21	4.63	193.98	189.40			-18.25	25.55		
NORTH WALL	6	3.40	3.43			2.21	4.63	333.06	192.07			-7.30	26.32		
NORTH WALL	7	5.34	3.69			-1.66	2.54	10.98	185.83			-7.30	26.32		
NORTH WALL	8	3.40	3.43			2.21	4.63	193.98	189.40			-7.30	26.32		
NORTH WALL	9	6.31	3.82			2.21	4.63	91.50	187.41			0.00	26.82		
NORTH WALL	10	3.40	3.43			-1.66	2.54	157.38	188.69			7.30	27.31		
NORTH WALL	11	5.34	3.69			-1.66	2.54	164.70	188.84			-3.65	26.57		
NORTH WALL	12	8.25	4.06			-1.66	2.54	215.94	189.83			10.95	27.56		
EAST WALL	13	-2.43	2.47			2.21	4.63	18.30	185.98			10.95	27.56		
EAST WALL	14	17.95	5.09			-1.66	2.54	457.50	194.43			18.25	28.04		
EAST WALL	15	7.28	3.94			2.21	4.63	435.54	194.01			14.60	27.80		
EAST WALL	16	-1.46	2.66			-1.66	2.54	135.42	188.27			0.00	26.82		
EAST WALL	17	2.43	3.29			-1.66	2.54	150.06	188.55			32.85	28.97		
EAST WALL	18	-0.49	3.76			-1.66	2.54	152.04	190.59			0.00	26.82		
EAST WALL	19	5.43	4.47			-1.66	2.54	14.48	187.96			-14.60	25.81		
EAST WALL	20	3.45	4.25			-1.66	2.54	-152.04	184.73			-7.30	26.32		
EAST WALL	21	12.34	5.18			-1.66	2.54	-101.36	185.72			-25.55	25.02		
EAST WALL	22A	-0.49	3.76			2.21	4.63	43.44	188.52			0.00	26.82		
EAST WALL	22B	-0.49	3.76			-1.66	2.54	152.04	190.59			0.00	26.82		
EAST WALL	23	5.43	4.47			-1.66	2.54	-115.84	185.43			3.65	27.07		
EAST WALL	24	6.42	4.58			2.21	4.63	-224.44	183.30			14.60	27.80		
EAST WALL	25	3.45	4.25			-1.66	2.54	137.56	190.32			21.90	28.27		
EAST WALL	26	4.44	4.36			-1.66	2.54	130.32	190.18			-3.65	26.57		
EAST WALL	27	0.49	3.89			-1.66	2.54	-123.08	185.29			-18.25	25.55		
EAST WALL	28	8.39	4.78			-1.66	2.54	-130.32	185.15			10.95	27.56		
EAST WALL	29	4.44	4.36			2.21	4.63	-94.12	185.86			-18.25	25.55		
EAST WALL	30	4.44	4.36			6.08	6.03	43.44	188.52			7.30	27.31		
EAST WALL	31	-2.47	3.49			13.82	8.15	289.60	193.19			-47.45	23.37		
EAST WALL	32	5.43	4.47			-1.66	2.54	-28.96	187.12			-10.95	26.07		
EAST WALL	33	-1.48	3.63			6.08	6.03	50.68	188.66			-14.60	25.81		
EAST WALL	34	3.45	4.25			-1.66	2.54	-152.04	184.73			40.15	29.43		
EAST WALL	35	-2.47	3.49			6.08	6.03	-543.00	176.90			36.50	29.20		
EAST WALL	36	-3.45	3.35			-1.66	2.54	-166.52	184.44			18.25	28.04		
EAST WALL	37	0.49	3.89			-1.66	2.54	152.04	190.59			-36.50	24.21		
EAST WALL	38	-3.45	3.35			-1.66	2.54	21.72	188.10			-7.30	26.32		
EAST WALL	39	1.48	4.01			2.21	4.63	43.44	188.52			54.75	30.32		
EAST WALL	40	-1.48	3.63			-1.66	2.54	79.64	189.21			-3.65	26.57		
EAST WALL	41	-1.48	3.63			-1.66	2.54	202.72	191.55			21.90	28.27		
SOUTH WALL	42	0.49	3.89			2.21	4.63	79.64	189.21			36.50	29.20		
SOUTH WALL	43	11.35	5.08			-1.66	2.54	-86.88	186.00			-18.25	25.55		

Lot 1 Survey Data, Room 109

SAMPLE NAME	GRID NAME	ALPHA (DPM/100CM2)						BETA (DPM/100CM2)						GAMMA (uR/hr)	
		TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	TOTAL	STD DEV
SOUTH WALL	44	0.49	3.89			-1.66	2.54	-94.12	185.86			-3.65	26.57		
SOUTH WALL	45	-0.49	3.76			-1.66	2.54	246.16	192.37			18.25	28.04		
SOUTH WALL	46	3.45	4.25			-1.66	2.54	65.16	188.93			-7.30	26.32		
SOUTH WALL	47	-1.48	3.63			-1.66	2.54	57.92	188.80			7.30	27.31		
SOUTH WALL	48	0.49	3.89			-1.66	2.54	173.76	191.00			10.95	27.56		
SOUTH WALL	49	4.44	4.36			-1.66	2.54	65.16	188.93			36.50	29.20		
SOUTH WALL	50	3.45	4.25			2.21	4.63	202.72	191.55			-25.55	25.02		
SOUTH WALL	51	4.47	3.65			-1.66	2.54	-121.21	179.39			10.95	27.56		
SOUTH WALL	52	6.45	3.91			-1.66	2.54	-7.13	181.64			18.25	28.04		
SOUTH WALL	53	11.42	4.49			-1.66	2.54	327.98	188.10			-18.25	25.55		
SOUTH WALL	54	15.39	4.91			-1.66	2.54	342.24	188.37			32.85	28.97		
SOUTH WALL	55	7.44	4.03			-1.66	2.54	370.76	188.91			-29.20	24.76		
SOUTH WALL	56	8.44	4.15			2.21	4.63	-199.64	177.82			-14.60	25.81		
SOUTH WALL	57	13.40	4.71			-1.66	2.54	-413.54	173.48			62.05	30.76		
SOUTH WALL	58	1.49	3.22			-1.66	2.54	-456.32	172.60			14.60	27.80		
SOUTH WALL	59	11.42	4.49			-1.66	2.54	206.77	185.79			10.95	27.56		
SOUTH WALL	60	9.43	4.27			-1.66	2.54	491.97	191.19			-7.30	26.32		
SOUTH WALL	61	1.49	3.22			-1.66	2.54	-142.60	178.96			40.15	29.43		
SOUTH WALL	62	5.46	3.78	27.30	6.00	-1.66	2.54	-206.77	177.68	442.06	190.25	-10.95	26.07		
SOUTHWEST WALL	63	8.44	4.15			-1.66	2.54	178.25	185.24			0.00	26.82		
SOUTHWEST WALL	64	4.47	3.65			-1.66	2.54	92.69	183.59			-21.90	25.29		
SOUTHWEST WALL	65	3.47	3.51			-1.66	2.54	49.91	182.76			3.65	27.07		
SOUTHWEST WALL	66	-0.50	2.89			-1.66	2.54	85.56	183.45			14.60	27.80		
SOUTHWEST WALL	67	4.47	3.65			2.21	4.63	434.93	190.12			-18.25	25.55		
SOUTHWEST WALL	68	0.50	3.06			-1.66	2.54	263.81	186.88			18.25	28.04		
SOUTHWEST WALL	69	4.47	3.65			2.21	4.63	199.64	185.65			-21.90	25.29		
SOUTHWEST WALL	70	17.72	5.59			2.21	4.63	425.88	194.73			10.95	27.56		
SOUTHWEST WALL	71	4.56	4.24			-1.66	2.54	134.68	189.21			14.60	27.80		
SOUTHWEST WALL	72	3.54	4.11			-1.66	2.54	156.52	189.63			51.10	30.10		
SOUTHWEST WALL	73	3.54	4.11			-1.66	2.54	-61.88	185.39			-29.20	24.76		
SOUTHWEST WALL	74	0.51	3.72			6.08	6.03	243.88	191.30			3.65	27.07		
NORTHWEST WALL	75	6.58	4.47			2.21	4.63	-10.92	186.39			7.30	27.31		
NORTHWEST WALL	76	0.51	3.72			-1.66	2.54	-76.44	185.10			21.90	28.27		
NORTHWEST WALL	77	10.63	4.91			9.95	7.17	134.68	189.21			0.00	26.82		
NORTHWEST WALL	78	16.70	5.50			2.21	4.63	-83.72	184.96			-7.30	26.32		
NORTHWEST WALL	79	2.53	3.99			-1.66	2.54	-3.64	186.53			10.95	27.56		
NORTHWEST WALL	80	1.52	3.86			-1.66	2.54	-98.28	184.67			3.65	27.07		
NORTHWEST WALL	81	2.53	3.99			-1.66	2.54	3.64	186.67			-10.95	26.07		
NORTHWEST WALL	82	4.56	4.24			2.21	4.63	236.60	191.16			-29.20	24.76		
NORTHWEST WALL	83	10.63	4.91			-1.66	2.54	18.20	186.96			-54.75	22.79		
NORTHWEST WALL	84	1.52	3.86			-1.66	2.54	-294.84	180.76			-25.55	25.02		
NORTHWEST WALL	85	-0.51	3.58			-1.66	2.54	-294.84	180.76			-18.25	25.55		
NORTHWEST WALL	86	4.56	4.24			-1.66	2.54	-25.48	186.10			3.65	27.07		
NORTHWEST WALL	87	2.53	3.99			-1.66	2.54	10.92	186.81			7.30	27.31		

Lot 1 Survey Data, Room 109

SAMPLE NAME	GRID NAME	ALPHA (DPM/100CM2) TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	BETA (DPM/100CM2) TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	GAMMA (uR/hr) TOTAL	STD DEV
NORTHWEST WALL	88	1.52	3.86			-1.66	2.54	105.56	188.65			-10.95	26.07		
NORTHWEST WALL	89	-0.51	3.58			-1.66	2.54	-10.92	186.39			14.60	27.80		
NORTHWEST WALL	90	-1.52	3.43			-1.66	2.54	207.48	190.61			0.00	26.82		
NORTHWEST WALL	91	-3.54	3.12			-1.66	2.54	10.92	186.81			-14.60	25.81		
NORTHWEST WALL	92	-1.52	3.43			-1.66	2.54	-156.52	183.52			-10.95	26.07		
NORTHWEST WALL	93	-2.53	3.28			-1.66	2.54	-418.60	178.25			0.00	26.82		
NORTHWEST WALL	94	6.58	4.47			-1.66	2.54	-3.64	186.53			-32.85	24.48		
FLOOR	95	2.53	3.99			2.21	4.63	265.72	191.71			-32.85	24.48	16.95	0.28
FLOOR	96	0.51	3.72			2.21	4.63	-32.76	185.96			-25.55	25.02	16.36	0.28
FLOOR	97	0.51	3.72			2.21	4.63	556.92	197.17			25.55	28.51	16.74	0.28
FLOOR	98	25.82	6.28	370.02	19.70	2.21	4.63	593.32	197.84	877.24	202.99	-32.85	24.48	16.40	0.28
FLOOR	99	0.51	3.72			-1.66	2.54	105.56	188.65			0.00	26.82	15.62	0.27
FLOOR	100	14.68	5.31			-1.66	2.54	287.56	192.13			-29.20	24.76	14.54	0.26
FLOOR	101	6.58	4.47			-1.66	2.54	120.12	188.93			-10.95	26.07	15.88	0.27
FLOOR	102	1.52	3.86			-1.66	2.54	302.12	192.40			-21.90	25.29	15.92	0.27
FLOOR	103	6.58	4.47			-1.66	2.54	258.44	191.58			7.30	27.31	15.23	0.27
FLOOR	104	10.75	5.17			-1.66	2.54	22.14	189.74			14.60	27.80	16.54	0.28
FLOOR	105	3.58	4.40			-1.66	2.54	435.42	197.61			-18.25	25.55	16.29	0.28
FLOOR	106	-0.51	3.90			2.21	4.63	383.76	196.65			-25.55	25.02	16.17	0.27
FLOOR	107	1.54	4.16			-1.66	2.54	472.32	198.30			0.00	26.82	15.44	0.27
FLOOR	108	7.68	4.86			-1.66	2.54	162.36	192.45			14.60	27.80	16.30	0.28
FLOOR	109	5.63	4.63			2.21	4.63	177.12	192.73			-36.50	24.21	16.35	0.28
FLOOR	110	-0.51	3.90			-1.66	2.54	361.62	196.23			-14.60	25.81	16.14	0.27
FLOOR	111	2.56	4.28			-1.66	2.54	509.22	198.99			0.00	26.82	16.68	0.28
FLOOR	112	4.61	4.52			-1.66	2.54	523.98	199.26			-40.15	23.93	16.66	0.28
FLOOR	113	4.61	4.52			2.21	4.63	405.90	197.06			-18.25	25.55	16.36	0.28
FLOOR	114	3.58	4.40			-1.66	2.54	88.56	191.03			-10.95	26.07	16.39	0.28
FLOOR	115	1.54	4.16			2.21	4.63	250.92	194.14			-36.50	24.21	16.09	0.27
FLOOR	116	0.51	4.03			-1.66	2.54	346.86	195.95			-18.25	25.55	16.27	0.28
FLOOR	117	2.56	4.28			-1.66	2.54	265.68	194.42			-7.30	26.32	16.55	0.28
FLOOR	118	3.58	4.40			-1.66	2.54	619.92	201.03			14.60	27.80	16.63	0.28
FLOOR	119	6.65	4.75			-1.66	2.54	103.32	191.31			-29.20	24.76	16.35	0.28
FLOOR	120	7.68	4.86			-1.66	2.54	191.88	193.01			-3.65	26.57	17.00	0.28
FLOOR	121	9.72	5.07			-1.66	2.54	81.18	190.88			-47.45	23.37	16.11	0.27
FLOOR	122	2.56	4.28			-1.66	2.54	435.42	197.61			-18.25	25.55	15.45	0.27
FLOOR	123	7.68	4.86			9.95	7.17	464.94	198.16			7.30	27.31	16.76	0.28
FLOOR	124	9.72	5.07			-1.66	2.54	501.84	198.85			-25.55	25.02	16.72	0.28
FLOOR	125	9.72	5.07			-1.66	2.54	398.52	196.92			-25.55	25.02	16.62	0.28
CEILING	126	1.54	4.16			-1.66	2.54	221.40	193.58			32.85	28.97		
CEILING	127	-1.54	3.76			-1.66	2.54	324.72	195.54			-14.60	25.81		
CEILING	128	-2.56	3.62			-1.66	2.54	140.22	192.02			0.00	26.82		
CEILING	129	-1.54	3.76			-1.66	2.54	236.16	193.86			-7.30	26.32		
CEILING	130	-0.51	3.90			2.21	4.63	169.74	192.59			0.00	26.82		
CEILING	131	-5.63	3.16			-1.66	2.54	509.22	198.99			3.65	27.07		

Lot 1 Survey Data, Room 109

SAMPLE NAME	GRID NAME	ALPHA (DPM/100CM2)						BETA (DPM/100CM2)						GAMMA (uR/hr)	
		TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	TOTAL	STD DEV
CEILING	132	5.63	4.63			2.21	4.63	361.62	196.23			-10.95	26.07		
CEILING	133	-0.51	3.90			-1.66	2.54	464.94	198.16			0.00	26.82		
CEILING	134	1.54	4.16			-1.66	2.54	420.66	197.34			-3.65	26.57		
CEILING	135	1.54	4.16			-1.66	2.54	479.70	198.44			-36.50	24.21		
CEILING	136	-2.56	3.62			-1.66	2.54	81.18	190.88			14.60	27.80		
CEILING	137	-4.61	3.32			-1.66	2.54	450.18	197.89			3.65	27.07		
CEILING	138	0.51	4.03			-1.66	2.54	442.80	197.75			-7.30	26.32		
CEILING	139	-1.54	3.76			-1.66	2.54	110.70	191.45			3.65	27.07		
CEILING	140	-5.63	3.16			-1.66	2.54	523.98	199.26			-14.60	25.81		
CEILING	141	-5.16	3.42			-1.66	2.54	325.30	195.26			-3.65	26.57		
CEILING	142	-2.06	3.86			-1.66	2.54	259.51	194.03			-3.65	26.57		
CEILING	143	5.16	4.73			2.21	4.63	142.55	191.81			-51.10	23.08		
CEILING	144	4.13	4.62			-1.66	2.54	149.86	191.95			-14.60	25.81		
CEILING	145	-2.06	3.86			-1.66	2.54	339.92	195.53			0.00	26.82		
CEILING	146	0.00	4.13			-1.66	2.54	361.85	195.94			-21.90	25.29		
CEILING	147	-4.13	3.58			-1.66	2.54	434.95	197.30			-25.55	25.02		
CEILING	148	-6.19	3.26			-1.66	2.54	157.17	192.09			32.85	28.97		
CEILING	149	-1.03	4.00			6.08	6.03	215.65	193.20			-25.55	25.02		
CEILING	150	2.06	4.38			-1.66	2.54	281.44	194.44			-29.20	24.76		
CEILING	151	-6.19	3.26			2.21	4.63	376.47	196.22			-10.95	26.07		
CEILING	152	-2.06	3.86			2.21	4.63	413.02	196.90			-29.20	24.76		
CEILING	153	-5.16	3.42			-1.66	2.54	456.88	197.71			3.65	27.07		
CEILING	154	-5.16	3.42			2.21	4.63	420.33	197.03			10.95	27.56		
CEILING	155	-6.19	3.26			-1.66	2.54	208.34	193.06			-3.65	26.57		
CEILING	156	-6.19	3.26			-1.66	2.54	201.03	192.92			0.00	26.82		
NORTHWEST WALL	157	-3.10	3.72			-1.66	2.54	62.13	190.27			-32.85	24.48		
FUEL STORAGE WALL	1	-2.48	3.22			-1.66	2.54	83.03	185.56			-10.95	26.07		
FUEL STORAGE WALL	2	4.47	4.15			-1.66	2.54	530.67	194.07			0.00	26.82		
FUEL STORAGE WALL	3	1.49	3.78			-1.66	2.54	25.27	184.43			-10.95	26.07		
FUEL STORAGE WALL	4	1.49	3.78			-1.66	2.54	126.35	186.40			-7.30	26.32		
FUEL STORAGE WALL	5	-2.48	3.22			2.21	4.63	176.89	187.37			-25.55	25.02		

Lot 1 Survey Data, Room 110

SAMPLE NAME	GRID NAME	ALPHA (DPM/100CM2)						BETA (DPM/100CM2)						GAMMA (uR/hr)	
		TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	TOTAL	STD DEV
NORTH WALL	1	1.95	3.37			-1.65	2.55	-59.85	159.50			-6.27	26.01		
NORTH WALL	2	-1.95	2.75			2.29	4.70	-251.37	154.64			-13.65	25.49		
NORTH WALL	3	3.89	3.64			2.29	4.70	67.83	162.66			-17.34	25.22		
NORTH WALL	4	-0.97	2.92			-1.65	2.55	-19.95	160.50			-9.96	25.75		
NORTH WALL	5	-2.92	2.57			-1.65	2.55	-107.73	158.30			-17.34	25.22		
NORTH WALL	6	-1.95	2.75			2.29	4.70	-107.73	158.30			-13.65	25.49		
NORTH WALL	7	0.00	3.08			-1.65	2.55	-139.65	157.49			-2.58	26.27		
NORTH WALL	8	0.00	3.08			2.29	4.70	-187.53	156.27			-2.58	26.27		
NORTH WALL	9	0.00	3.08			2.29	4.70	83.79	163.05			15.87	27.54		
NORTH WALL	10	0.00	3.08			-1.65	2.55	139.65	164.42			19.56	27.79		
NORTH WALL	11	0.97	3.23			2.29	4.70	-11.97	160.69			-6.27	26.01		
NORTH WALL	12	0.00	3.08			-1.65	2.55	59.85	162.47			8.49	27.04		
NORTH WALL	13	7.78	4.13			-1.65	2.55	-299.25	153.39			38.01	28.98		
NORTH WALL	14	1.95	3.37			-1.65	2.55	-243.39	154.84			-2.58	26.27		
NORTH WALL	15	0.00	3.08			2.29	4.70	-147.63	157.29			-6.27	26.01		
NORTH WALL	16	0.97	3.23			2.29	4.70	-131.67	157.69			26.94	28.27		
NORTH WALL	17	-4.86	2.18			6.23	6.13	-171.57	156.68			-2.58	26.27		
NORTH WALL	18	-0.97	2.92			10.17	7.29	99.75	163.44			-39.48	23.54		
EAST WALL	19	1.95	3.37			-1.65	2.55	-43.89	159.90			-2.58	26.27		
EAST WALL	20	0.00	3.08			-1.65	2.55	115.71	163.83			-17.34	25.22		
EAST WALL	21	4.81	3.72			6.23	6.13	-3.69	153.12			8.49	27.04		
EAST WALL	22	3.85	3.60			-1.65	2.55	-225.09	147.69			-21.03	24.95		
EAST WALL	23	6.73	3.96			-1.65	2.55	18.45	153.66			15.87	27.54		
EAST WALL	24	6.73	3.96			-1.65	2.55	-62.73	151.69			-28.41	24.39		
EAST WALL	25	8.65	4.19			-1.65	2.55	-40.59	152.23			30.63	28.51		
EAST WALL	26	2.88	3.47			-1.65	2.55	-62.73	151.69			-17.34	25.22		
EAST WALL	27	2.88	3.47			-1.65	2.55	-18.45	152.77			4.80	26.79		
EAST WALL	28	1.92	3.33			-1.65	2.55	-136.53	149.89			-24.72	24.67		
EAST WALL	29	1.92	3.33			2.29	4.70	-55.35	151.87			38.01	28.98		
EAST WALL	30	0.96	3.19			-1.65	2.55	-40.59	152.23			1.11	26.53		
EAST WALL	31	6.73	3.96			-1.65	2.55	-70.11	151.51			-6.27	26.01		
EAST WALL	32	-0.96	2.88			-1.65	2.55	-173.43	148.98			-13.65	25.49		
EAST WALL	33	2.88	3.47			-1.65	2.55	-47.97	152.05			-13.65	25.49		
EAST WALL	34	-0.96	2.88			6.23	6.13	33.21	154.01			-21.03	24.95		
EAST WALL	35	0.96	3.19			-1.65	2.55	-313.65	145.46			-32.10	24.11		
EAST WALL	36	1.92	3.33			2.29	4.70	3.69	153.30			-21.03	24.95		
SOUTH WALL	37	0.00	3.04			-1.65	2.55	-210.33	148.06			8.49	27.04		
SOUTH WALL	38	5.65	3.26			-1.65	2.55	61.80	147.83			-28.41	24.39		
SOUTH WALL	39	0.94	2.49			-1.65	2.55	-10.90	146.03			-32.10	24.11		
SOUTH WALL	40	0.00	2.31			2.29	4.70	-98.15	143.85			-6.27	26.01		
SOUTH WALL	41	2.83	2.83			-1.65	2.55	25.45	146.94			-9.96	25.75		
SOUTH WALL	42	-0.94	2.11			2.29	4.70	83.60	148.37			19.56	27.79		
SOUTH WALL	43	7.54	3.52			-1.65	2.55	199.93	151.19			-13.65	25.49		
SOUTH WALL	44	2.83	2.83			-1.65	2.55	25.45	146.94			8.49	27.04		

Lot 1 Survey Data, Room 110

SAMPLE NAME	GRID NAME	ALPHA (DPM/100CM2)						BETA (DPM/100CM2)						GAMMA (uR/hr)	
		TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	TOTAL	STD DEV
SOUTH WALL	45	2.83	2.83			-1.65	2.55	-69.06	144.58			-17.34	25.22		
SOUTH WALL	46	8.48	3.65			-1.65	2.55	39.99	147.30			8.49	27.04		
SOUTH WALL	47	1.88	2.66			-1.65	2.55	-54.53	144.94			30.63	28.51		
SOUTH WALL	48	0.94	2.49			-1.65	2.55	192.66	151.02			26.94	28.27		
SOUTH WALL	49	6.59	3.40			-1.65	2.55	-287.17	138.99			1.11	26.53		
SOUTH WALL	50	2.83	2.83			-1.65	2.55	47.25	147.48			-13.65	25.49		
SOUTH WALL	51	2.83	2.83			-1.65	2.55	-25.45	145.67			-13.65	25.49		
SOUTH WALL	52	1.88	2.66			-1.65	2.55	61.80	147.83			-13.65	25.49		
SOUTH WALL	53	1.88	2.66			-1.65	2.55	-192.66	141.44			-6.27	26.01		
SOUTH WALL	54	-1.88	1.88			-1.65	2.55	-76.34	144.40			-21.03	24.95		
WEST WALL	55	7.54	3.52			-1.65	2.55	10.90	146.58			-6.27	26.01		
WEST WALL	56	1.88	2.66			-1.65	2.55	-83.60	144.21			-24.72	24.67		
WEST WALL	57	0.94	2.49			-1.65	2.55	98.15	148.72			8.49	27.04		
WEST WALL	58	-0.94	2.11			10.17	7.29	18.18	146.76			12.18	27.29		
WEST WALL	59	0.00	2.31			2.29	4.70	18.18	146.76			-35.79	23.83		
WEST WALL	60	4.71	3.12			-1.65	2.55	163.58	150.32			-9.96	25.75		
WEST WALL	61	0.94	2.49			2.29	4.70	-47.25	145.13			-13.65	25.49		
WEST WALL	62	0.00	2.31			-1.65	2.55	-69.06	144.58			-17.34	25.22		
WEST WALL	63	-0.94	2.11			-1.65	2.55	69.06	148.01			-21.03	24.95		
WEST WALL	64	0.00	2.31			-1.65	2.55	3.64	146.40			-17.34	25.22		
WEST WALL	65	2.83	2.83			-1.65	2.55	-134.50	142.93			1.11	26.53		
WEST WALL	66	-0.94	2.11			-1.65	2.55	-18.18	145.85			8.49	27.04		
WEST WALL	67	2.83	2.83			-1.65	2.55	-185.39	141.63			23.25	28.03		
WEST WALL	68	-0.94	2.11			-1.65	2.55	18.18	146.76			23.25	28.03		
WEST WALL	69	0.94	2.49			2.29	4.70	-98.15	143.85			-43.17	23.25		
WEST WALL	70	0.94	2.49			2.29	4.70	-178.12	141.81			19.56	27.79		
FLOOR	71	0.94	2.49			-1.65	2.55	-3.64	146.22			-17.34	25.22	5.94	0.17
FLOOR	72	3.77	2.98			2.29	4.70	134.50	149.61			1.11	26.53	7.87	0.19
FLOOR	73	3.77	2.98			-1.65	2.55	163.58	150.32			-2.58	26.27	8.66	0.20
FLOOR	74	4.71	3.12			2.29	4.70	10.90	146.58			-28.41	24.39	8.49	0.20
FLOOR	75	7.54	3.52			-1.65	2.55	76.34	148.19			-24.72	24.67	8.80	0.20
FLOOR	76	1.88	2.66			6.23	6.13	119.96	149.26			8.49	27.04	8.71	0.20
FLOOR	77	3.77	2.98			-1.65	2.55	192.66	151.02			1.11	26.53	7.79	0.19
FLOOR	78	6.59	3.40			-1.65	2.55	10.90	146.58			1.11	26.53	7.77	0.19
FLOOR	79	1.88	2.66			2.29	4.70	323.52	154.13			19.56	27.79	8.58	0.20
FLOOR	80	-0.94	2.11			-1.65	2.55	119.96	149.26			-17.34	25.22	8.92	0.20
FLOOR	81	0.00	2.31			-1.65	2.55	207.20	151.37			-17.34	25.22	9.24	0.21
FLOOR	82	0.00	2.31			-1.65	2.55	61.80	147.83			-6.27	26.01	9.00	0.20
FLOOR	83	3.33	3.36			-1.65	2.55	85.92	148.13			-6.27	26.01	8.34	0.20
FLOOR	84	4.28	3.49			-1.65	2.55	350.84	154.40			1.11	26.53	8.72	0.20
FLOOR	85	5.23	3.62			2.29	4.70	193.32	150.70			-39.48	23.54	8.92	0.20
FLOOR	86	8.08	3.98			-1.65	2.55	214.80	151.21			-17.34	25.22	9.02	0.20
FLOOR	87	5.23	3.62			-1.65	2.55	114.56	148.82			-28.41	24.39	8.83	0.20
FLOOR	88	4.28	3.49			-1.65	2.55	343.68	154.23			-17.34	25.22	9.27	0.21

Lot 1 Survey Data, Room 110

SAMPLE NAME	GRID NAME	ALPHA (DPM/100CM2) TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	BETA (DPM/100CM2) TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	GAMMA (uR/hr) TOTAL	STD DEV
FLOOR	89	1.43	3.08			2.29	4.70	-35.80	145.16			-6.27	26.01	8.73	0.20
FLOOR	90	0.48	2.93			-1.65	2.55	207.64	151.04			1.11	26.53	8.74	0.20
FLOOR	91	5.23	3.62			-1.65	2.55	286.40	152.90			-13.65	25.49	9.41	0.21
FLOOR	92	-0.48	2.77			2.29	4.70	136.04	149.33			34.32	28.75	9.42	0.21
FLOOR	93	2.38	3.22			-1.65	2.55	307.88	153.40			-9.96	25.75	9.17	0.21
FLOOR	94	-1.43	2.60			-1.65	2.55	229.12	151.55			-6.27	26.01	9.00	0.20
FLOOR	95	6.18	3.74			-1.65	2.55	264.92	152.39			1.11	26.53	8.83	0.20
FLOOR	96	-3.33	2.23			2.29	4.70	121.72	148.99			-21.03	24.95	9.01	0.20
FLOOR	97	6.18	3.74			-1.65	2.55	243.44	151.89			15.87	27.54	9.04	0.21
FLOOR	98	2.38	3.22			-1.65	2.55	114.56	148.82			-21.03	24.95	9.30	0.21
FLOOR	99	0.48	2.93			-1.65	2.55	121.72	148.99			-17.34	25.22	9.27	0.21
FLOOR	100	1.43	3.08			-1.65	2.55	50.12	147.26			-17.34	25.22	9.18	0.21
FLOOR	101	1.43	3.08			-1.65	2.55	57.28	147.43			-13.65	25.49	8.80	0.20
FLOOR	102	6.18	3.74			2.29	4.70	193.32	150.70			-24.72	24.67	8.95	0.20
FLOOR	103	2.38	3.22			-1.65	2.55	157.52	149.85			1.11	26.53	8.51	0.20
FLOOR	104	2.38	3.22			2.29	4.70	236.28	151.72			-13.65	25.49	8.65	0.20
FLOOR	105	0.48	2.93			-1.65	2.55	171.84	150.19			-28.41	24.39	8.79	0.20
FLOOR	106	1.43	3.08			-1.65	2.55	107.40	148.65			-13.65	25.49	8.69	0.20
CEILING	107	5.23	3.62			-1.65	2.55	-57.28	144.62			-2.58	26.27		
CEILING	108	0.48	2.93			-1.65	2.55	164.68	150.02			-6.27	26.01		
CEILING	109	-1.43	2.60			-1.65	2.55	85.92	148.13			-6.27	26.01		
CEILING	110	-1.43	2.60			-1.65	2.55	-7.16	145.86			1.11	26.53		
CEILING	111	-3.33	2.23			-1.65	2.55	350.84	154.40			-35.79	23.83		
CEILING	112	-1.43	2.60			-1.65	2.55	64.44	147.61			-32.10	24.11		
CEILING	113	-0.48	2.77			2.29	4.70	-78.76	144.09			-46.86	22.96		
CEILING	114	0.48	2.93			-1.65	2.55	286.40	152.90			-17.34	25.22		
CEILING	115	-3.33	2.23			6.23	6.13	315.04	153.56			1.11	26.53		
CEILING	116	-1.43	2.60			-1.65	2.55	136.04	149.33			-2.58	26.27		
CEILING	117	1.43	3.08			-1.65	2.55	372.32	154.89			4.80	26.79		
CEILING	118	-2.38	2.42			-1.65	2.55	250.60	152.06			1.11	26.53		
CEILING	119	-0.48	2.77			-1.65	2.55	379.48	155.06			-13.65	25.49		
CEILING	120	-3.33	2.23			-1.65	2.55	107.40	148.65			23.25	28.03		
CEILING	121	0.48	2.93			-1.65	2.55	-608.60	130.26			-13.65	25.49		
CEILING	122	1.43	3.08			2.29	4.70	243.44	151.89			-2.58	26.27		
CEILING	123	-0.48	2.77			2.29	4.70	71.60	147.78			-13.65	25.49		
CEILING	124	-3.33	2.23			2.29	4.70	85.92	148.13			-21.03	24.95		
CEILING	125	4.34	2.97			2.29	4.70	198.55	151.19			-24.72	24.67		
CEILING	126	3.38	2.81			-1.65	2.55	234.65	152.05			-21.03	24.95		
CEILING	127	1.45	2.46			-1.65	2.55	198.55	151.19			-6.27	26.01		
CEILING	128	3.38	2.81			2.29	4.70	299.63	153.58			-28.41	24.39		
CEILING	129	10.13	3.80			-1.65	2.55	306.85	153.75			1.11	26.53		
CEILING	130	3.38	2.81			-1.65	2.55	263.53	152.73			-17.34	25.22		
CEILING	131	3.38	2.81			-1.65	2.55	256.31	152.56			-35.79	23.83		
CEILING	132	9.16	3.67			-1.65	2.55	39.71	147.35			30.63	28.51		

Lot 1 Survey Data, Room 110

SAMPLE NAME	GRID NAME	ALPHA (DPM/100CM2) TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	BETA (DPM/100CM2) TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	GAMMA (uR/hr) TOTAL	STD DEV
CEILING	133	1.45	2.46			2.29	4.70	126.35	149.46			12.18	27.29		
CEILING	134	2.41	2.64			-1.65	2.55	270.75	152.90			-2.58	26.27		
CEILING	135	-1.45	1.80			6.23	6.13	277.97	153.07			-6.27	26.01		
CEILING	136	6.27	3.27			-1.65	2.55	263.53	152.73			-21.03	24.95		
CEILING	137	-0.48	2.05			-1.65	2.55	119.13	149.28			12.18	27.29		
CEILING	138	0.48	2.26			2.29	4.70	292.41	153.41			49.08	29.68		
CEILING	139	2.41	2.64			-1.65	2.55	140.79	149.80			-17.34	25.22		
CEILING	140	-2.41	1.52			-1.65	2.55	133.57	149.63			4.80	26.79		
CEILING	141	-0.48	2.05			-1.65	2.55	328.51	154.26			26.94	28.27		
CEILING	142	0.48	2.26			-1.65	2.55	285.19	153.24			4.80	26.79		
AIRLOCK	143	4.34	2.97			-1.65	2.55	119.13	149.28			49.08	29.68		
AIRLOCK	144	3.38	2.81			-1.65	2.55	-162.45	142.31			8.49	27.04		
AIRLOCK	145	-0.48	2.05			6.23	6.13	-104.69	143.77			-6.27	26.01		
AIRLOCK	146	-0.48	2.05			-1.65	2.55	-32.49	145.57			19.56	27.79		
AIRLOCK	147	-2.41	1.52			-1.65	2.55	371.83	155.27			-13.65	25.49		
AIRLOCK	148	4.34	2.97			-1.65	2.55	314.07	153.92			-2.58	26.27	9.41	0.21
SHIELD DOOR	149	1.45	2.46			2.29	4.70	-480.13	134.01			-9.96	25.75		
SHIELD DOOR	150	1.45	2.46			-1.65	2.55	-393.49	136.32			-9.96	25.75		
SHIELD DOOR	151	5.30	3.13			-1.65	2.55	-516.23	133.03			-21.03	24.95		
SHIELD DOOR	152	-0.48	2.05			-1.65	2.55	-472.91	134.20			-21.03	24.95		
SHIELD DOOR	153	4.34	2.97			-1.65	2.55	-357.39	137.27			-2.58	26.27		
SHIELD DOOR	154	3.38	2.81			-1.65	2.55	-386.27	136.51			-6.27	26.01		
SHIELD DOOR	155	4.34	2.97			-1.65	2.55	-436.81	135.17			19.56	27.79		
SHIELD DOOR	156	17.84	4.68	159.61	12.59	-1.65	2.55	-148.01	142.67	-169.67	142.13	-32.10	24.11		
SHIELD DOOR	158	3.38	2.81			-1.65	2.55	-371.83	136.89			-13.65	25.49		
0	0	0.00	0.00			0.00	0.00	0.00	0.00			0.00	0.00		
0	0	0.00	0.00			0.00	0.00	0.00	0.00			0.00	0.00		
0	0	0.00	0.00			0.00	0.00	0.00	0.00			0.00	0.00		
0	0	0.00	0.00			0.00	0.00	0.00	0.00			0.00	0.00		
0	0	0.00	0.00			0.00	0.00	0.00	0.00			0.00	0.00		
0	0	0.00	0.00			0.00	0.00	0.00	0.00			0.00	0.00		

Lot 1 Survey Data, Room 109 Attic

SAMPLE NAME	GRID NAME	ALPHA (DPM/100CM2) TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	BETA (DPM/100CM2) TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	GAMMA (uR/hr) TOTAL	STD DEV
NORTH WALL	1	-2.48	3.22			-1.65	2.55	480.13	193.13			-9.96	25.75		
NORTH WALL	2	1.49	3.78			-1.65	2.55	111.91	186.12			-6.27	26.01		
NORTH WALL	3	0.50	3.65			-1.65	2.55	270.75	189.17			-32.10	24.11		
EAST WALL	4	-0.50	3.51			-1.65	2.55	104.69	185.98			-28.41	24.39		
EAST WALL	5	0.50	3.65			-1.65	2.55	-10.83	183.72			-6.27	26.01		
EAST WALL	6	4.47	4.15			2.29	4.70	169.67	187.23			-13.65	25.49		
EAST WALL	7	0.00	3.75			-1.65	2.55	57.44	187.78			-21.03	24.95		
EAST WALL	8	2.00	4.00			-1.65	2.55	50.26	187.64			-24.72	24.67		
EAST WALL	9	1.00	3.88			2.29	4.70	157.96	189.69			-13.65	25.49		
EAST WALL	10	1.00	3.88			-1.65	2.55	-179.50	183.20			-6.27	26.01		
EAST WALL	11	-2.00	3.47			-1.65	2.55	-301.56	180.79			-17.34	25.22		
WEST WALL	12	2.00	4.00			-1.65	2.55	114.88	188.88			-13.65	25.49		
WEST WALL	13	-2.00	3.47			-1.65	2.55	57.44	187.78			-2.58	26.27		
WEST WALL	14	2.00	4.00			-1.65	2.55	107.70	188.74			-28.41	24.39		
WEST WALL	15	3.00	4.13			-1.65	2.55	157.96	189.69			23.25	28.03		
WEST WALL	16	1.00	3.88			-1.65	2.55	215.40	190.78			-6.27	26.01		
WEST WALL	17	1.00	3.88			-1.65	2.55	14.36	186.96			-2.58	26.27		
WEST WALL	18	-2.00	3.47			6.23	6.13	136.42	189.29			12.18	27.29		
WEST WALL	19	0.00	3.75			-1.65	2.55	78.98	188.19			-32.10	24.11		
FLOOR	20	2.00	4.00			-1.65	2.55	-373.36	179.36			-9.96	25.75		
FLOOR	21	-1.00	3.61			-1.65	2.55	-409.26	178.64			19.56	27.79		
FLOOR	22	0.00	3.75			-1.65	2.55	-294.38	180.93			-2.58	26.27		
FLOOR	23	-1.00	3.61			-1.65	2.55	-445.16	177.91			12.18	27.29		
FLOOR	24	1.00	3.88			-1.65	2.55	-380.54	179.21			19.56	27.79		
FLOOR	25	-3.00	3.32			-1.65	2.55	-272.84	181.36			8.49	27.04		
FLOOR	26	0.00	3.75			-1.65	2.55	-323.10	180.36			-6.27	26.01		
FLOOR	27	-3.00	3.32			-1.65	2.55	-351.82	179.79			-2.58	26.27		
FLOOR	28	-1.00	3.61			-1.65	2.55	-258.48	181.64			-21.03	24.95		
FLOOR	29	-3.00	3.32			2.29	4.70	-387.72	179.07			4.80	26.79		
FLR/CEIL REMANTS	30	2.00	4.00			-1.65	2.55	-78.98	185.15			-17.34	25.22		
CEILING	31	1.00	3.88			-1.65	2.55	366.18	193.59			26.94	28.27		
CEILING	32	-4.00	3.17			2.29	4.70	287.20	192.12			-17.34	25.22		
CEILING	33	2.00	4.00			2.29	4.70	308.74	192.53			-6.27	26.01		
CEILING	34	1.00	3.88			-1.65	2.55	387.72	193.99			-9.96	25.75		
CEILING	35	-2.00	3.47			-1.65	2.55	351.82	193.33			-13.65	25.49		
CEILING	36	-3.00	3.32			-1.65	2.55	437.98	194.92			26.94	28.27		
CEILING	37	1.00	3.88			-1.65	2.55	495.42	195.98			19.56	27.79		
CEILING	38	2.00	4.00			-1.65	2.55	459.52	195.32			4.80	26.79		
CEILING	39	-3.00	3.32			-1.65	2.55	366.18	193.59			-32.10	24.11		
CEILING	40	-6.01	2.83			-1.65	2.55	201.04	190.51			12.18	27.29		

Lot 1 Survey Data, Room 109 Fuel Storage Area

SAMPLE NAME	GRID NAME	ALPHA (DPM/100CM2)						BETA (DPM/100CM2)						GAMMA (uR/hr)	
		TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	TOTAL	STD DEV
NORTH WALL	1	3.57	4.15			-1.66	2.54	460.38	196.22			-18.25	25.55		
NORTH WALL	2	6.64	4.51			-1.66	2.54	-163.13	184.34			-25.55	25.02		
NORTH WALL	3	-1.53	3.46			2.21	4.63	-148.63	184.63			-7.30	26.32		
NORTH WALL	4	4.59	4.27			-1.66	2.54	97.87	189.40			-21.90	25.29		
NORTH WALL	5	2.55	4.02			-1.66	2.54	68.87	188.85			-25.55	25.02		
EAST WALL	6	0.51	3.75			2.21	4.63	-141.38	184.77			-36.50	24.21		
EAST WALL	7	1.53	3.89			-1.66	2.54	213.88	191.61			-29.20	24.76		
EAST WALL	8	9.70	4.84			-1.66	2.54	-39.88	186.75			-40.15	23.93		
EAST WALL	9	4.59	4.27			-1.66	2.54	97.87	189.40			3.65	27.07		
EAST WALL	10	4.59	4.27			-1.66	2.54	141.38	190.23			-7.30	26.32		
EAST WALL	11	5.61	4.39			-1.66	2.54	-3.63	187.45			10.95	27.56		
EAST WALL	12	-0.51	3.61			-1.66	2.54	177.63	190.92			-36.50	24.21		
EAST WALL	13	-1.53	3.46			-1.66	2.54	-39.88	186.75			-3.65	26.57		
EAST WALL	14	1.53	3.89			-1.66	2.54	-83.38	185.90			-36.50	24.21		
EAST WALL	15	-0.51	3.61			-1.66	2.54	-54.38	186.47			-40.15	23.93		
SOUTH WALL	16	9.70	4.84			-1.66	2.54	358.88	194.34			14.60	27.80		
SOUTH WALL	17	6.64	4.51			-1.66	2.54	90.63	189.27			-7.30	26.32		
SOUTH WALL	18	5.61	4.39			-1.66	2.54	54.38	188.57			-10.95	26.07		
WEST WALL	19	3.57	4.15			-1.66	2.54	68.87	188.85			-10.95	26.07		
WEST WALL	20	6.64	4.51			-1.66	2.54	-47.13	186.61			-18.25	25.55		
WEST WALL	21	0.51	3.75			-1.66	2.54	47.12	188.43			-32.85	24.48		
WEST WALL	22	26.03	6.33			-1.66	2.54	-134.13	184.91			3.65	27.07		
WEST WALL	23	1.53	3.89			-1.66	2.54	-257.38	182.48			-10.95	26.07		
WEST WALL	24	2.55	4.02			-1.66	2.54	184.88	191.06			43.80	29.65		
WEST WALL	25	-1.53	3.46			-1.66	2.54	474.88	196.49			-10.95	26.07		
WEST WALL	26	8.68	4.73			-1.66	2.54	-39.88	186.75			-25.55	25.02		
WEST WALL	27	-4.59	2.98			6.08	6.03	61.62	188.71			-32.85	24.48		
WEST WALL	28	-3.57	3.15			-1.66	2.54	18.13	187.87			-32.85	24.48		
FLOOR	29	3.57	4.15			-1.66	2.54	547.38	197.82			10.95	27.56	16.15	0.27
FLOOR	30	11.74	5.05			-1.66	2.54	489.38	196.75			-7.30	26.32	15.83	0.27
FLOOR	31	4.59	4.27			2.21	4.63	409.63	195.28			-3.65	26.57	16.08	0.27
FLOOR	32	6.64	4.51			2.21	4.63	242.88	192.16			-14.60	25.81	15.42	0.27
FLOOR	33	11.74	5.05			2.21	4.63	228.38	191.89			-18.25	25.55	15.63	0.27
FLOOR	34	9.70	4.84			-1.66	2.54	213.88	191.61			-14.60	25.81	15.42	0.27
FLOOR	35	1.53	3.89			-1.66	2.54	518.38	197.29			7.30	27.31	16.06	0.27
FLOOR	36	13.78	5.26			2.21	4.63	242.88	192.16			-21.90	25.29	15.19	0.27
CEILING	37	-5.46	2.72			-1.66	2.54	-299.63	177.96			-7.30	26.32		
CEILING	38	-6.45	2.53			2.21	4.63	-234.65	179.27			7.30	27.31		
CEILING	39	-3.47	3.06			-1.66	2.54	-169.67	180.57			-14.60	25.81		
CEILING	40	-6.45	2.53			2.21	4.63	-241.87	179.12			-14.60	25.81		
CEILING	41	-6.45	2.53			-1.66	2.54	-357.39	176.78			-43.80	23.65		
CEILING	42	-1.49	3.37			-1.66	2.54	-285.19	178.25			-18.25	25.55		
CEILING	43	-3.47	3.06			-1.66	2.54	-263.53	178.69			-18.25	25.55		
CEILING	44	-4.47	2.89			-1.66	2.54	-256.31	178.83			-3.65	26.57		

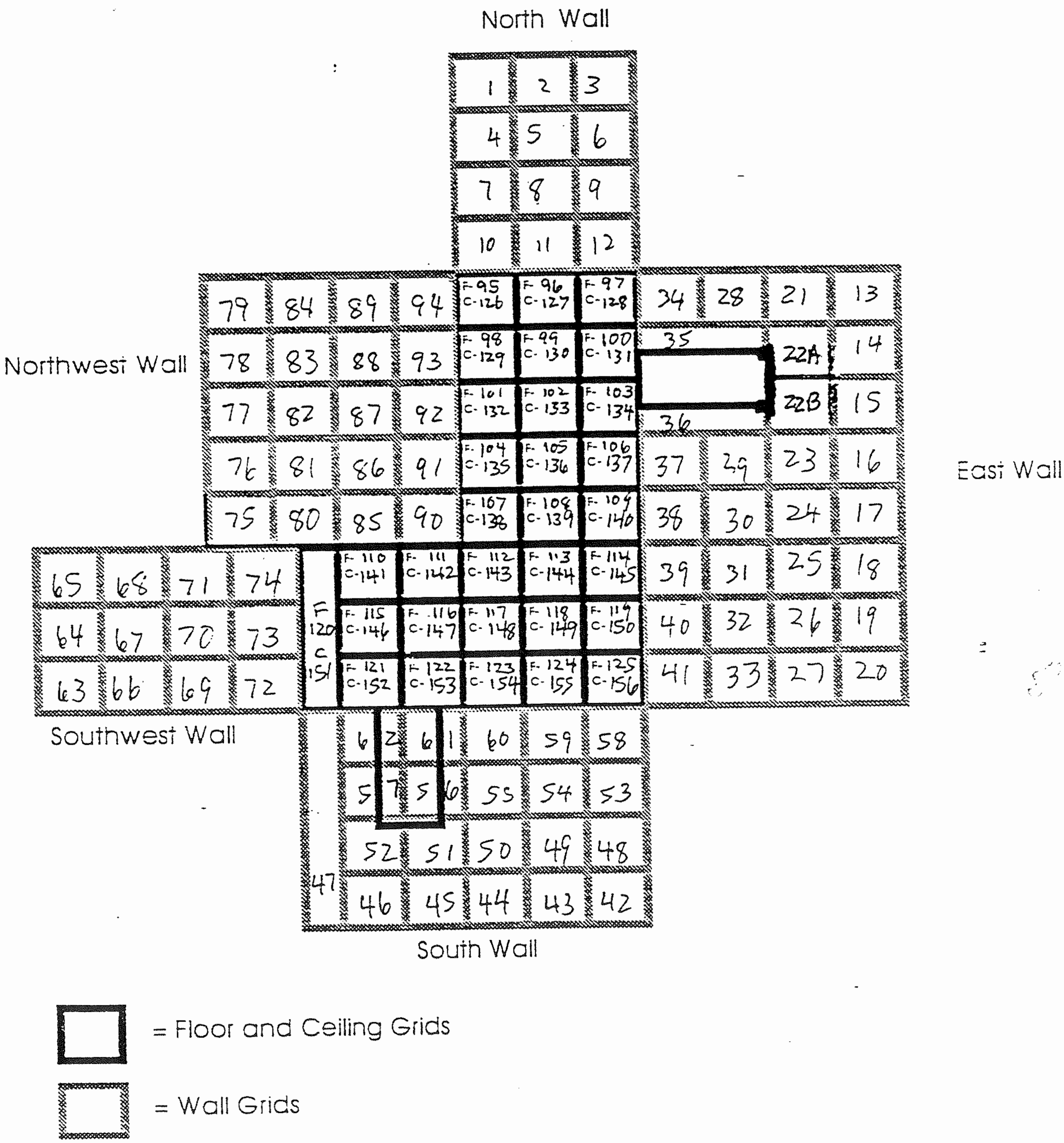
Lot 1 Survey Data, Room 109 Fuel Storage Area

SAMPLE NAME	GRID NAME	ALPHA (DPM/100CM2)						BETA (DPM/100CM2)						GAMMA (uR/hr)	
		TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	TOTAL	STD DEV	MAX	STD DEV	REM	STD DEV	TOTAL	STD DEV
SOUTH LEDGE	45	-0.50	3.51			2.21	4.63	191.33	187.65			-3.65	26.57		
NORTH LEDGE	46	7.44	4.49			-1.66	2.54	220.21	188.21			-25.55	25.02		
NORTH LEDGE	47	-2.48	3.22			-1.66	2.54	18.05	184.29			-21.90	25.29		
DOOR JAMB	48	0.50	3.65			2.21	4.63	25.27	184.43			21.90	28.27		
DOOR JAMB	49	-2.48	3.22			-1.66	2.54	-3.61	183.86			29.20	28.74	16.13	0.27
DOOR JAMB	50	4.47	4.15			-1.66	2.54	-292.41	178.10			-21.90	25.29		
DOOR JAMB	51	-1.49	3.37			2.21	4.63	191.33	187.65			10.95	27.56		

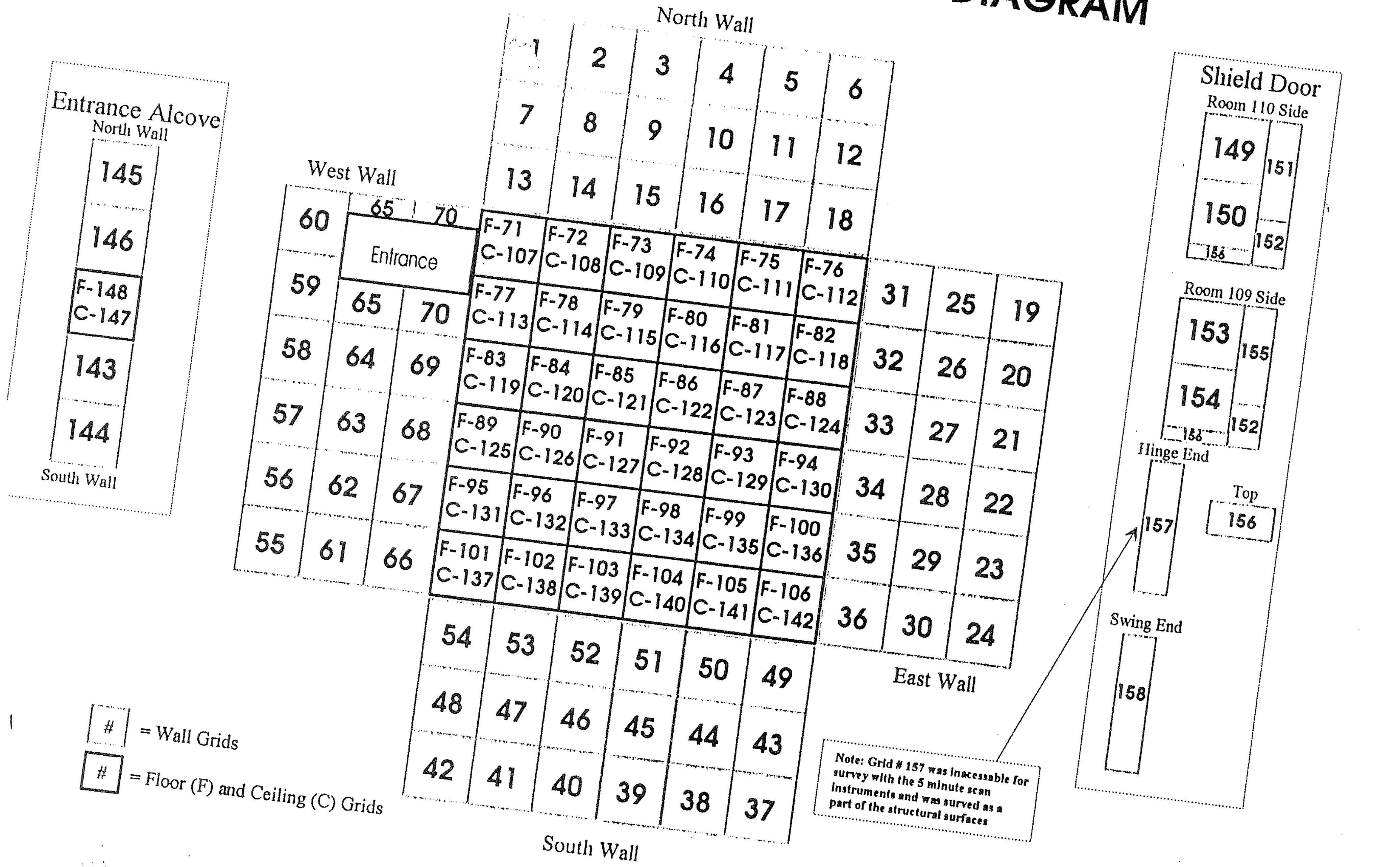
Appendix C.

Grid Locations for T012 Survey

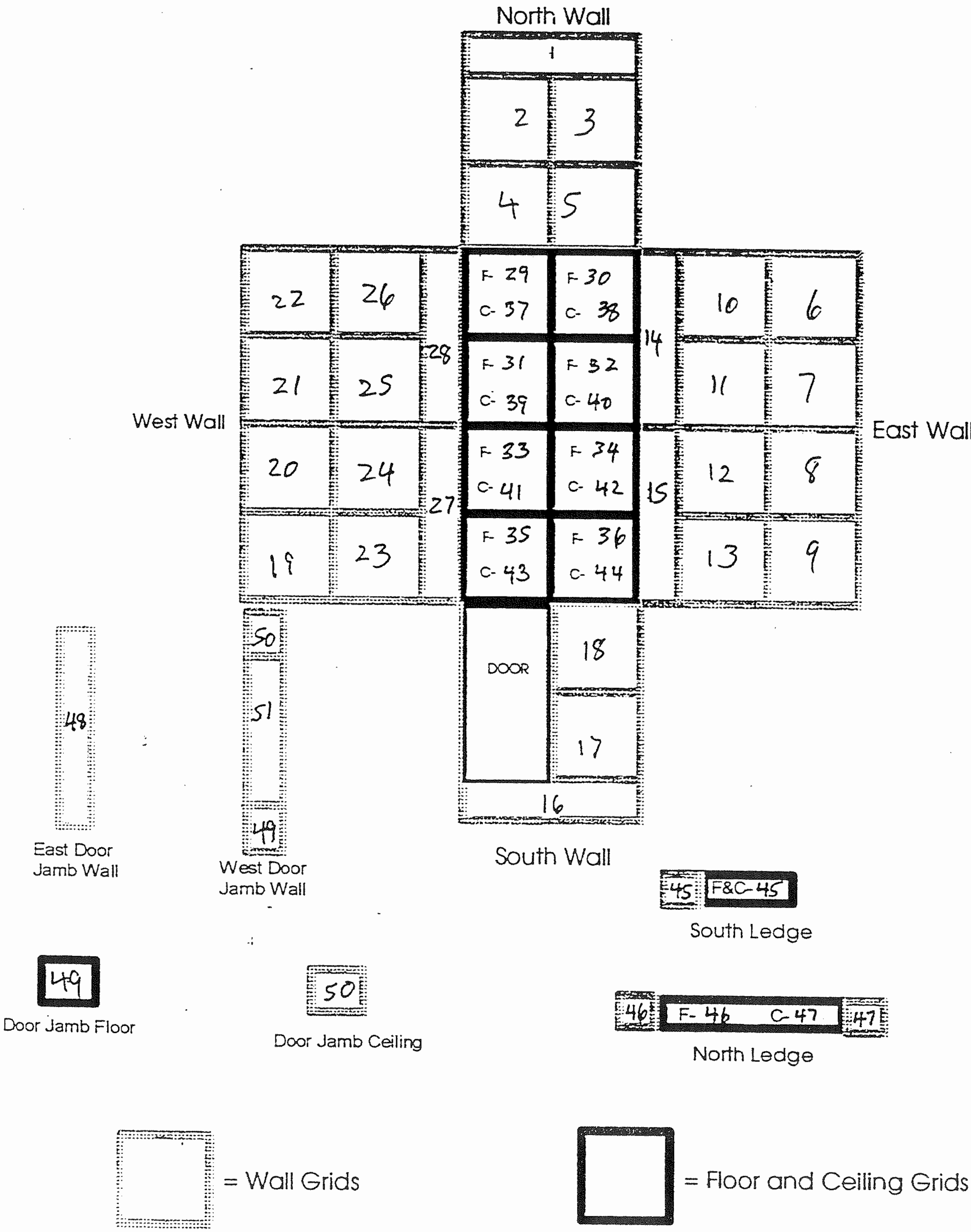
T012 ROOM 109 MAIN ROOM GRID MAP



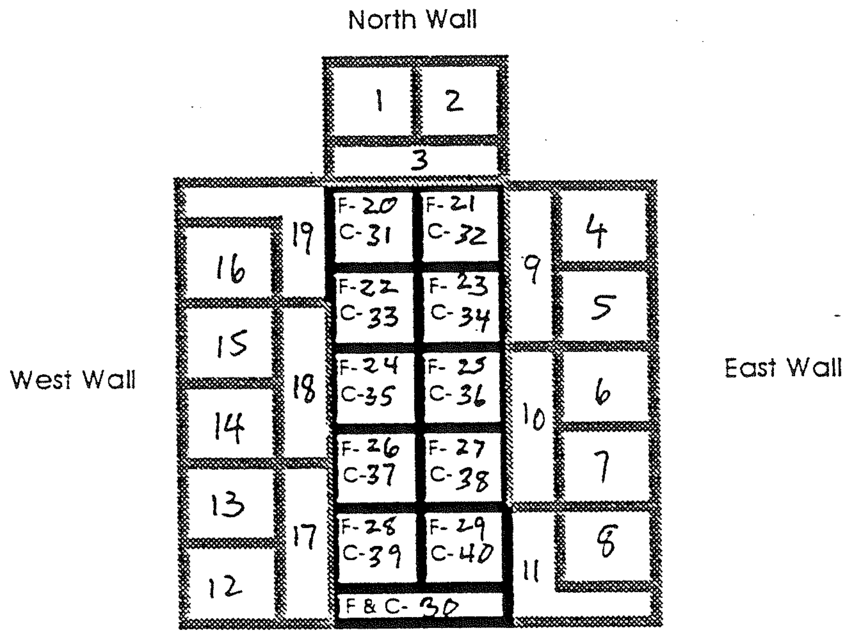
IC.2 ROOM 110 GRID LOCATION DIAGRAM

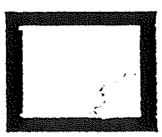


T012 ROOM 109 (FUEL STORAGE) GRID MAP

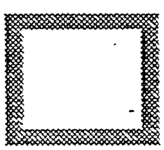


T012 ATTIC ABOVE FUEL STORAGE 109B GRID MAP





= Floor and Ceiling Grids



= Wall Grids

T012 ROOM 109 WALL TO FUEL STORAGE

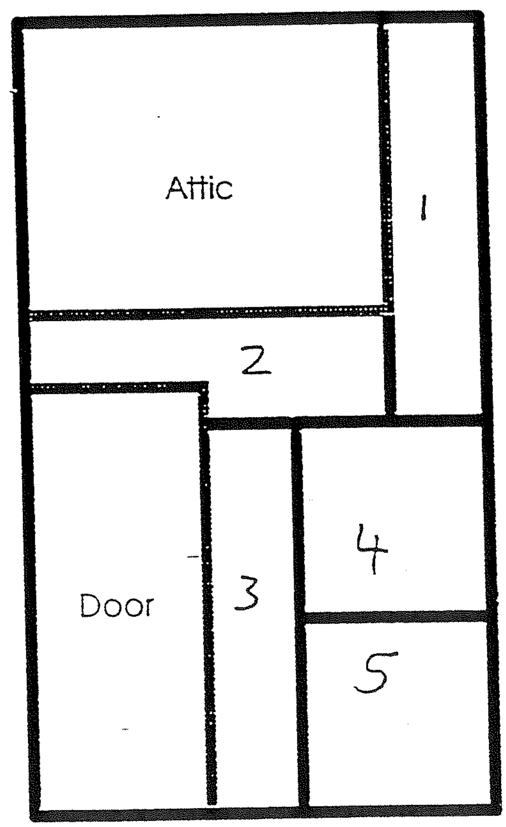


EXHIBIT VI

NATIONAL ENVIRONMENTAL POLICY ACT DOCUMENTATION FOR DECONTAMINATION AND DECOMMISSIONING OF BUILDING T012 AT THE ENERGY TECHNOLOGY ENGINEERING CENTER

ERWM
LIDDLE
4/15/92

ERWM
CULLEN
4/ 16/92

AMEMS
DAVIS
4/16/92

OCC
BRECHBILL
4/22/92

DAMA
LAMBERT
4/24/92

DM
VAETH
4/27/92

AMC
DAVIS
4-29-92

APR 29 1992

DOE San Francisco Field Office (ERWM)

Categorical Exclusion (CX) Determination for Environmental Remediation of Buildings and Work Areas by Decontamination and Removal and Disposal of Hazardous and Radioactive Waste

Susan Brechbill, Acting AMEMS

In accordance with DOE NEPA Guidelines, Section D, and SEN-15-90, I have determined that the subject project satisfies the requirements for exclusion from further NEPA review based on the following:

CX DETERMINATION

NEPA Document Number: ET-EM-92-12

Proposed Action: Environmental Remediation of Buildings and Work Areas by Decontamination and Removal and Disposal of Hazardous and Radioactive Waste

Location: Energy Technology Engineering Center (ETEC), Santa Susana Field Laboratory, Ventura County, CA

Description: Remove stored equipment, decontaminate facilities and adjacent grounds to remove low level radioactivity contamination, and restore them to conditions suitable for use without radiological restrictions. Also, excavate, as needed, adjacent grounds to remove hazardous and radioactively contaminated soil and debris. Package the hazardous and radioactively contaminated fixtures, surplus equipment and debris, and ship it to an approved radioactive waste disposal facility.

Buildings and Work Areas to be Remediated

Radioactive Materials Disposal Facility (ADS 4005-AC):
- Building 022, RA Materials Storage Vault
- Building 021, Decontamination and Packaging
- Building 034, Offices
- Building 044, Health-Physics Services
- Four peripheral storage structures & the storage yard

Building 023, Liquid Metals Chemistry Laboratory (ADS 5002-AC)

Buildings and Work Areas to be Remediated (Continued)

SSFL Work Areas Decontamination (ADS 4006-WC):
Sodium Reactor Experiment (SRE) Moderator Shipping Cask stored in:
Building 012, SNAP Critical Facility
Building 100 Area, Construction Work Trenches
Old Conservation Yard Packaged Waste Disposal

CX To Be Applied (from Section D, DOE NEPA Guidelines):

CX as identified in Federal Register Volume 55, Number 174, dated September 7, 1990, for "1. The removal actions and other actions described below, if it is determined that such an action would not threaten a violation of applicable statutory, regulatory or permit requirements, including requirements of DOE Orders; would not require siting and construction or major expansion of waste disposal, recovery, or treatment facilities (including incinerators and facilities for treating waste water, surface water, or ground water); and would not adversely affect environmentally sensitive areas.... c. Removal actions under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (including those taken as final response actions and those taken before remedial action) and actions similar in scope under the Resource Conservation and Recovery Act (RCRA) and other authorities (including the Atomic Energy Act, as amended) and those taken as partial closure actions and those taken before corrective action.... (12) Use of chemicals and other materials to retard the spread of the release or to mitigate its effects, where the use of such chemicals would reduce the spread of, or direct contact with, the contamination; {and}.... (16) Treatment (including incineration), recovery, storage or disposal of wastes at existing facilities permitted for the type of waste resulting from the removal action, where needed, to reduce the likelihood of human, animal, or food chain exposure."

The project will not affect historic, archaeological, or architecturally significant properties; will not impact environmentally sensitive areas or critical habitats; is not located in a floodplain, wetland, or prime agricultural land; and will not utilize special sources of water, sole source aquifers, well heads, or other resources vital to the region.

I have determined that the proposed action meets the requirements for the CX referenced above. Therefore, I have determined that the proposed action may be categorically excluded from further NEPA review and documentation.

/s/
James T. Davis
Acting Manager

cc: D. Williams, EM-443
A. Kluk, EM-443
C. Borgstrom, EH-25