DOE/CD-ETEC-030

29c

CERTIFICATION DOCKET

FOR THE RELEASE OF BUILDING T030 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 T030 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 T030, 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 20, 1997. A copy of the notice, official correspondence, release criteria, project report, radiological surveys, and an independent verification report are compiled in this docket.

CONTENT

EXHIBIT I

DOCUMENTS SUPPORTING THE CERTIFICATION FOR THE UNRESTRICTED USE OF BUILDING T030 AT THE ENERGY TECHNOLOGY ENGINEERING CENTER

DOE F 1325.8
6-89

United States Government

Department of Energy

memorandum

DATE: September 15, 1997

REPLY TO
ATTN OF: DOE Oakland Operations Office/ER

SUBJECT: Release of Decontaminated Building 030 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 030

Building 030 is located in the north-central section of Area IV. Building T030 was constructed in 1958 as a Particle Accelerator Facility. The building has a total enclosed area of 2,311 ft^2. The facility consists of two connecting sections, both with steel framing, siding, and roofs. The rear section was configured to accommodate a low-voltage particle accelerator used as a proton on tritium neutron source. An outside concrete wall, north of the west section, provided shielding for the accelerator beam. After facility construction in 1958, a Van de Graaf accelerator was moved into the facility in 1960.

The accelerator was operated from 1960 through 1964, at which time the facility was decommissioned. Even though it was not in use, the accelerator remained in the facility after 1964. In 1966, a smear survey of the accelerator showed tritium contamination. It was believed that the tritium contamination had not spread to surrounding areas. Following removal of the accelerator in 1966, the building was surveyed and no residual contamination was found.

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 030

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 030. 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 030, 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

9/15/97
Date

DOE F 1325.8
(8-93)

United States Government Department of Energy

memorandum

DATE: September 22, 1997

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

SUBJECT: Draft Certification for Building T030 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 T030 at the Energy Technology Engineering Center (ETEC) near Chatsworth, California.

The Office of Northwestern Area Programs has implemented a decontamination and decommissioning project at ETEC as part of the Environmental Restoration Program. The objective of the project 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 September 1995, Building T030 was formally designated by the Department of Energy (DOE) for cleanup.

ETEC Building T030 was constructed in 1958 as a Particle Accelerator Facility. The rear section of the building was configured to accommodate a low-voltage particle accelerator used as a proton on tritium neutron source. A Van de Graaf accelerator was moved into the facility in 1960 (and operated through 1964) which generated neutrons using a tritium target via the $^{3}H(p,n)^{3}He$ reaction. Five-gallon cans of borated water were used for neutron shielding around the machine. The accelerator was removed in 1966. Final radiological and independent verification surveys completed in 1996 demonstrated, and the 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 Federal Register 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:

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

SUBJECT: Recommendation for Certification of Cleanup at Building T030 at the Energy Technology Engineering Center

TO: James J. Fiore, Acting Deputy Assistant Secretary for Environmental Restoration

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 T030 at the Energy Technology Engineering Center (ETEC), near Chatsworth, California.

The Oakland Operations Office has implemented a decontamination and decommissioning project at ETEC as part of the Environmental Restoration Program. The objective of the project 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 September 1995, Building T030 was formally designated by the Department of Energy (DOE) for cleanup under Environmental Restoration.

ETEC Building T030 was constructed in 1958 as a Particle Accelerator Facility. The rear section of the building was configured to accommodate a low-voltage particle accelerator used as a proton on tritium neutron source. A Van de Graaf accelerator was moved into the facility in 1960 (and operated through 1964) which generated neutrons using a tritium target via the $^{3}H(p,n)^{3}He$ reaction. Five-gallon cans of borated water were used for neutron shielding around the machine. The accelerator was removed in 1966. Final radiological and independent verification surveys completed in 1996 demonstrated, and the 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, 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: OCT 0 9 1997

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

SUBJECT: Federal Register Notice for Certification of Cleanup of Building T030 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 T030, 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 T030 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,

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-T030

Certification of the Radiological Condition of Building T030 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 T030, Particle Accelerator Facility, located at the Energy Technology Engineering Center (ETEC) near Chatsworth, California. This property 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 Boeing North American Incorporated, Rocketdyne Division, owned the land.

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 a number of 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 of 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 T030 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 T030 is located in the north-eastern section of ETEC on 10th Street, off the west side of G Street, among several adjacent buildings on paved ground. Building T030 was constructed in 1958 as a Particle Accelerator Facility. The building has a total enclosed area of 2,311 sq. ft. The facility consists of two connecting sections, both with steel framing, siding, and roofs. The rear open (west) section was constructed perpendicular to the front office (east) section. The rear section was configured to accommodate a low-voltage particle accelerator used as a proton on tritium (P-T) neutron source. An outside concrete wall, north of the west section, provided shielding for the accelerator beam. Men's and women's restrooms were built into the facility so that the facility provided a complete self-contained accelerator test installation. A fenced-in area between Buildings T030 and the adjacent building T641 was previously used as a palletized material holding area. To the north of T030, south of T641, and west of both buildings are outcroppings of Chatsworth sandstone formation. This formation is only about 50 ft. from the north and west sides of T030.

After facility construction in 1958, a Van de Graaf accelerator was moved into the facility in 1960. The accelerator could provide a proton beam of up to tens of microamperes in current, with continuously adjustable energies from a few hundred KeV up to a maximum of about 1 MeV. The particle beam was well focused, with a diameter of a few millimeters. Neutrons were generated using a tritium target via the $^{3}H(p,n)^{3}He$ reaction. Five-gallon cans of borated water were used for neutron shielding around the machine.

The accelerator was operated from 1960 through 1964, at which time the facility was decommissioned. Even though it was not in use, the accelerator remained in the facility after 1964. In 1966, a smear survey of the accelerator showed tritium contamination. It was believed that the tritium contamination had not spread to surrounding areas. Following removal of the accelerator in 1966, the building was surveyed and no residual contamination was found. The building was released for other uses, and had subsequently been used as an office building for purchasing and on-site traffic administrative work until 1995.

In 1988, a general radiological survey was conducted to clarify and identify areas at ETEC requiring further radiological inspection or remediation; Building T030 was included in this survey. The scope of the Building T030 survey included ambient gamma exposure rate measurements, "indication" beta surveys of the accelerator room and the outside paved area used for storing palletized containers, and exterior soil samples for tritium content. The result of that survey showed no detectable contamination in the facility. Tritium analyses on ten soil samples and the beta survey showed no detectable activity. Background-corrected gamma measurements were all less than the acceptance limit of 5 μR/hr.

In September 1995, the Oak Ridge Institute for Science and Education (ORISE) conducted a confirmatory survey of several facilities at ETEC, including Building T030. With the exception of a single finding for removable tritium contamination of 6,600 dpm/100 cm^2 (below the acceptance limit of 10,000 dpm/100 cm^2) found on the north wall of the accelerator room, no unusual findings were noted. However, ORISE did question the completeness of the 1988 survey. Specifically, ORISE recommended complete measurements of total or removable surface activity and additional sampling for tritium activity in the accelerator area. Consistent with ORISE's advice, a comprehensive final survey of Building T030 was conducted by ETEC in 1996.

In 1996 approximately 2,311 sq. ft. of asbestos floor tile was removed and disposed of. The cost associated with the removal of the asbestos floor tile was approximately $9,200. The radiological survey cost associated with Building T030 could not be isolated from total radiological facility surveys but is estimated to have cost approximately $20,000.

No appreciable personnel radiation exposure was anticipated or encountered during decontamination and decommissioning and surveying of Building T030.

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 T030

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 T030 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 T030 at the Energy Technology Engineering 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 October 10, 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 23 1997

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

SUBJECT: Release of Decontaminated Building T030 without Radiological Restrictions at the Energy Technology Engineering Center

TO: Director, Environmental Restoration Division, 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 T030 at the Energy Technology Engineering Center (ETEC). 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.

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.

Sally A. Robison

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

Tentative Agenda

—Call to order and opening remarks by Clifford Miercort, Chairman of the National Coal Council.
—Approve agenda.
—Remarks by Department of Energy representative.
—Report of the Coal Policy Committee.
—Administrative reports.
—Coal's Future—Technological Challenges and Opportunities, Kurt Yeager, President & CEO Electric Power Research Institute.
—Global Climate Change Forum.
—Discussion of any other business properly brought before the Council.
—Public comment—10-minute rule.
—Adjournment.

Public Participation: The meeting is open to the public. The Chairman of the Council is empowered to conduct the meeting in a fashion that will facilitate the orderly conduct of business. Any member of the public who wishes to file a written statement with the Council will be permitted to do so, either before or after the meeting. Members of the public who wish to make oral statements pertaining to agenda items should contact Margie D. Biggerstaff at the address or telephone number listed above. Requests must be received at least five days prior to the meeting and reasonable provisions will be made to include the presentation on the agenda.

Transcript: Available for public review and copying at the Public Reading Room, Room 1E–190, Forrestal Building, 1000 Independence Avenue, S.W., Washington, DC, between 9:00 AM and 4:00 PM, Monday through Friday, except Federal holidays.

Issued at Washington, D.C., on October 15, 1997.

Rachel M. Samuel,

Deputy Committee Advisory, Management Advisory Officer.

[FR Doc. 97–27719 Filed 10–17–97; 8:45 am]

BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

[Docket No. ETEC–T030]

Certification of the Radiological Condition of Building T030 at the Energy Technology Engineering Center Near Chatsworth, CA

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 T030, Particle Accelerator Facility, located at the Energy Technology Engineering Center (ETEC) near Chatsworth, California. This property 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 Boeing North American Incorporated, Rocketdyne Division, owned the land.

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.

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Building T030 is located in the northeastern section of ETEC on 10th Street, off the west side of G Street, among several adjacent buildings on paved ground. Building T030 was constructed in 1958 as a Particle Accelerator Facility. The building has a total enclosed area of 2,311 sq. ft. The facility consists of two connecting sections, both with steel framing, siding, and roofs. The rear open (west) section was constructed perpendicular to the front office (east) section. The rear section was configured to accommodate a low-voltage particle accelerator used as a proton on tritium (P-T) neutron source. An outside concrete wall, north of the west section, provided shielding for the accelerator beam. Men's and women's restrooms were built into the facility so that the facility provided a complete self-contained accelerator test installation. A fenced-in area between Buildings T030 and the adjacent building T641 was previously used as a palletized material holding area. To the north of T030, south of T641, and west of both buildings are outcroppings of Chatsworth sandstone formation. This formation is only about 50 ft. from the north and west sides of T030.

After facility construction in 1958, a Van de Graaf accelerator was moved into the facility in 1960. The accelerator could provide a proton beam of up to tens of microamperes in current, with continuously adjustable energies from a few hundred KeV up to a maximum of about 1 MeV. The particle beam was well focused, with a diameter of a few millimeters. Neutrons were generated using a tritium target via the $^{3}H(p,n)^{3}He$ reaction. Five-gallon cans of borated water were used for neutron shielding around the machine.

The accelerator was operated from 1960 through 1964, at which time the facility was decommissioned. Even though it was not in use, the accelerator remained in the facility after 1964. In 1966, a smear survey of the accelerator showed tritium contamination. It was believed that the tritium contamination had not spread to surrounding areas. Following removal of the accelerator in 1966, the building was surveyed and no residual contamination was found. The building was released for other uses, and had subsequently been used as an office building for purchasing and on-site traffic administrative work until 1995.

In 1988, a general radiological survey was conducted to clarify and identify areas at ETEC requiring further radiological inspection or remediation; Building T030 was included in this survey. The scope of the Building T030 survey included ambient gamma exposure rate measurements, "indication" beta surveys of the accelerator room and the outside paved area used for storing palletized containers, and exterior soil samples for tritium content. The result of that survey showed no detectable contamination in the facility. Tritium analyses on ten soil samples and the beta survey showed no detectable activity. Background-corrected gamma measurements were all less than the acceptance limit of 5 μR/hr.

In September 1995, the Oak Ridge Institute for Science and Education (ORISE) conducted a confirmatory survey of several facilities at ETEC, including Building T030. With the exception of a single finding for removable tritium contamination of 6,600 dpm/100 cm^2 (below the acceptance limit of 10,000 dpm/100 cm2) found on the north wall of the accelerator room, no unusual findings were noted. However, ORISE did question the completeness of the 1988 survey. Specifically, ORISE recommended complete measurements of total or removable surface activity and additional sampling for tritium activity in the accelerator area. Consistent with ORISE's advice, a comprehensive final survey of Building T030 was conducted by ETEC in 1996.

In 1996 approximately 2,311 sq. ft. of asbestos floor tile was removed and disposed of. The cost associated with the removal of the asbestos floor tile was approximately $9,200. The radiological survey cost associated with Building T030 could not be isolated from total radiological facility surveys but is estimated to have cost approximately $20,000.

No appreciable personnel radiation exposure was anticipated or encountered during decontamination and decommissioning and surveying of Building T030.

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, DC 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 T030

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 T030 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 T030 at the Energy Technology Engineering 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 October 10, 1997.

James J. Fiore,

Acting Deputy Assistant Secretary for Environmental Restoration.

[FR Doc. 97–27720 Filed 10–17–97; 8:45 am]

BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

Energy Information Administration

Agency Information Collection Activities: Proposed Collection; Comment Request

AGENCY: Energy Information Administration, DOE.

ACTION: Agency information collection activities: Proposed collection; comment request.

SUMMARY: The Energy Information Administration (EIA) is soliciting comments concerning the proposed extension to the Form EIA–1605, "Voluntary Reporting of Greenhouse Gases," (long version) and the Form EIA–1605EZ, "Voluntary Reporting of Greenhouse Gases," (short version).

DATES: Written comments must be submitted on or before December 19, 1997. If you anticipate that you will be submitting comments, but find it difficult to do so within the period of time allowed by this notice, you should advise the contact listed below of your intention to do so as soon as possible.

ADDRESSES: Send comments to Stephen E. Calopedis, Energy Information Administration, Office of Integrated Analysis and Forecasting, EI–81, Forrestal Building, U.S. Department of Energy, Washington, DC 20585, (202) 586–1156, e-mail: stephen.calopedis@eia.doe.gov, and FAX: (202) 586–3045.

FOR FURTHER INFORMATION CONTACT: Requests for additional information or copies of the form and instructions should be directed to Stephen E. Calopedis at the address listed above.

SUPPLEMENTARY INFORMATION:

I. Background
II. Current Actions
III. Request for Comments

I. Background

In order to fulfill its responsibilities under the Federal Energy Administration Act of 1974 (Pub. L. 93–275) and the Department of Energy Organization Act (Pub. L. 95–91), the Energy Information Administration (EIA) is obliged to carry out a central, comprehensive, and unified energy data and information program. As part of this program, EIA collects, evaluates, assembles, analyzes, and disseminates data and information related to energy resource reserves, production, demand, and technology, and related economic and statistical information relevant to the adequacy of energy resources to meet demands in the near and longer term future for the Nation's economic and social needs.

The EIA, as part of its continuing effort to reduce paperwork and respondent burden (required by the Paperwork Reduction Act of 1995 (Pub. L. 104–13)), conducts a presurvey consultation program to provide the general public and other Federal agencies with an opportunity to comment on proposed and/or continuing reporting forms. This program helps to prepare data requests in the desired format, minimize reporting burden, develop clearly understandable reporting forms, and assess the impact of collection requirements on respondents. Also, EIA will later seek approval by the Office of Management and Budget (OMB) for the collections under Section 3507(h) of the Paperwork Reduction Act of 1995 (Pub. L. 104–13, Title 44, U.S.C. Chapter 35).

The EIA developed these greenhouse gas forms pursuant to section 1605(b) of the Energy Policy Act of 1992 (Pub. L. 102–486, 42 U.S.C. 13385) to reflect the guidelines set forth in Voluntary Reporting of Greenhouse Gases under section 1605(b) of the Energy Policy Act of 1992: General Guidelines (DOE/PO–0028). These forms are designed to collect voluntarily reported data on greenhouse gas emissions, achieved reductions of these emissions, and increased carbon fixation. Further, the forms support the Climate Change Action Plan by collecting information on commitments to reduce greenhouse gas emissions and to sequester carbon in

[Federal Register: October 20, 1997 (Volume 62, Number 202)]
From the Federal Register Online via GPO Access [wais.access.gpo.gov]
[Notices]
[Page 54446-54447]
[DOCID:fr20oc97-53]

DEPARTMENT OF ENERGY

[Docket No. ETEC-T030]

Certification of the Radiological Condition of Building T030 at
the Energy Technology Engineering Center Near Chatsworth, CA

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 T030, Particle Accelerator Facility, located at the Energy Technology Engineering Center (ETEC) near Chatsworth, California. This property 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 Boeing North American Incorporated, Rocketdyne Division, owned the land.

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 a number of 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 of 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 T030 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 T030 is located in the north-eastern section of ETEC on 10th Street, off the west side of G Street, among several adjacent buildings on paved ground. Building T030 was constructed in 1958 as a Particle Accelerator Facility. The building has a total enclosed area of 2,311 sq. ft. The facility consists of two connecting sections, both with steel framing, siding, and roofs. The rear open (west) section was constructed perpendicular to the front office (east) section. The rear section was configured to accommodate a low-voltage particle accelerator used as a proton on tritium (P-T) neutron source. An outside concrete wall, north of the west section, provided shielding for the accelerator beam. Men's and women's restrooms were built into the facility so that the facility provided a complete self-contained accelerator test installation. A fenced-in area between Buildings T030 and the adjacent building T641 was previously used as a palletized material holding area. To the north of T030, south of T641, and west of both buildings are outcroppings of Chatsworth sandstone formation. This formation is only about 50 ft. from the north and west sides of T030.

After facility construction in 1958, a Van de Graaf accelerator was moved into the facility in 1960. The accelerator could provide a proton beam of up to tens of microamperes in current, with continuously adjustable energies from a few hundred KeV up to a maximum of about 1 MeV. The particle beam was well focused, with a diameter of a few millimeters. Neutrons were generated using a tritium target via the ³H(p,n)³He reaction.
Five-gallon cans of borated water were used for neutron shielding around the machine.

The accelerator was operated from 1960 through 1964, at which time the facility was decommissioned. Even though it was not in use, the accelerator remained in the facility after 1964. In 1966, a smear survey of the accelerator showed tritium contamination. It was believed that the tritium contamination had not spread to surrounding areas. *Following removal of the accelerator in 1966, the building was surveyed* and no residual contamination was found. The building was released for other uses, and had subsequently been used as an office building for purchasing and on-site traffic administrative work until 1995.

In 1988, a general radiological survey was conducted to clarify and identify areas at ETEC requiring further radiological inspection or remediation; Building T030 was included in this survey. The scope of the Building T030 survey included ambient gamma exposure rate measurements, ``indication'' beta surveys of the accelerator room and the outside paved area used for storing palletized containers, and exterior soil samples for tritium content. The result of that survey showed no detectable contamination in the facility. Tritium analyses on ten soil samples and the beta survey showed no detectable activity. Background-corrected gamma measurements were all less than the acceptance limit of 5 <greek-m>R/hr.

In September 1995, the Oak Ridge Institute for Science and Education (ORISE) conducted a confirmatory survey of several facilities at ETEC, including Building T030.

[[Page 54447]]

With the exception of a single finding for removable tritium contamination of 6,600 dpm/100 cm² (below the acceptance limit of 10,000 dpm/ final 100 cm2) found on the north wall of the accelerator room, no unusual findings were noted. However, ORISE did question the completeness of the 1988 survey. Specifically, ORISE recommended complete measurements of total or removable surface activity and additional sampling for tritium activity in the accelerator area. Consistent with ORISE's
advice, a comprehensive survey of Building T030 was conducted by ETEC in 1996.

In 1996 approximately 2,311 sq. ft. of asbestos floor tile was removed and disposed of. The cost associated with the removal of the asbestos floor tile was approximately $9,200. The radiological survey cost associated with Building T030 could not be isolated from total radiological facility surveys but is estimated to have cost approximately $20,000.

No appreciable personnel radiation exposure was anticipated or encountered during decontamination and decommissioning and surveying of Building T030.

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, DC 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 T030

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 T030 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 T030 at the Energy Technology Engineering 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 October 10, 1997.

James J. Fiore,

Acting Deputy Assistant Secretary for Environmental Restoration.

[FR Doc. 97-27720 Filed 10-17-97; 8:45 am]
BILLING CODE 6450-01-P

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

STATE OF CALIFORNIA—HEALTH AND WELFARE AGENCY

PETE WILSON, Governor

DEPARTMENT OF HEALTH SERVICES
714/744 P STREET
P.O. BOX 942732
SACRAMENTO, CA 94234-7320

(916) 323-2759

3SEP96

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, 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

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.

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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

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 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

Radial Location	Gamma Shielding Factor	
	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 ($\bar{x} \div ks$) 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 ($\bar{x} \div ks$) is greater that the limit (U), but $\bar{x}$ itself is less than U, independently resample and combine all measured values to determine if $\bar{x} \div ks \leq = U$ 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 (m³/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/cm³)	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 (m³/yr)	8.400E+03	8.400E+03	8.400E+03	8.400E+03
Mass loading for inhalation (g/m³)	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/m³)	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/cm³)	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 T030 AT THE ENERGY TECHNOLOGY ENGINEERING CENTER AFTER DECONTAMINATION AND DECOMMISSIONING

DRAFT REPORT

VERIFICATION SURVEY OF THE INTERIM STORAGE FACILITY; BUILDINGS T030, T641, AND T013; AN AREA NORTHWEST OF BUILDINGS T019, T013, T012, AND T059; AND A STORAGE YARD WEST OF BUILDINGS T626 AND T038 SANTA SUSANA FIELD LABORATORY ROCKWELL INTERNATIONAL VENTURA COUNTY, CALIFORNIA

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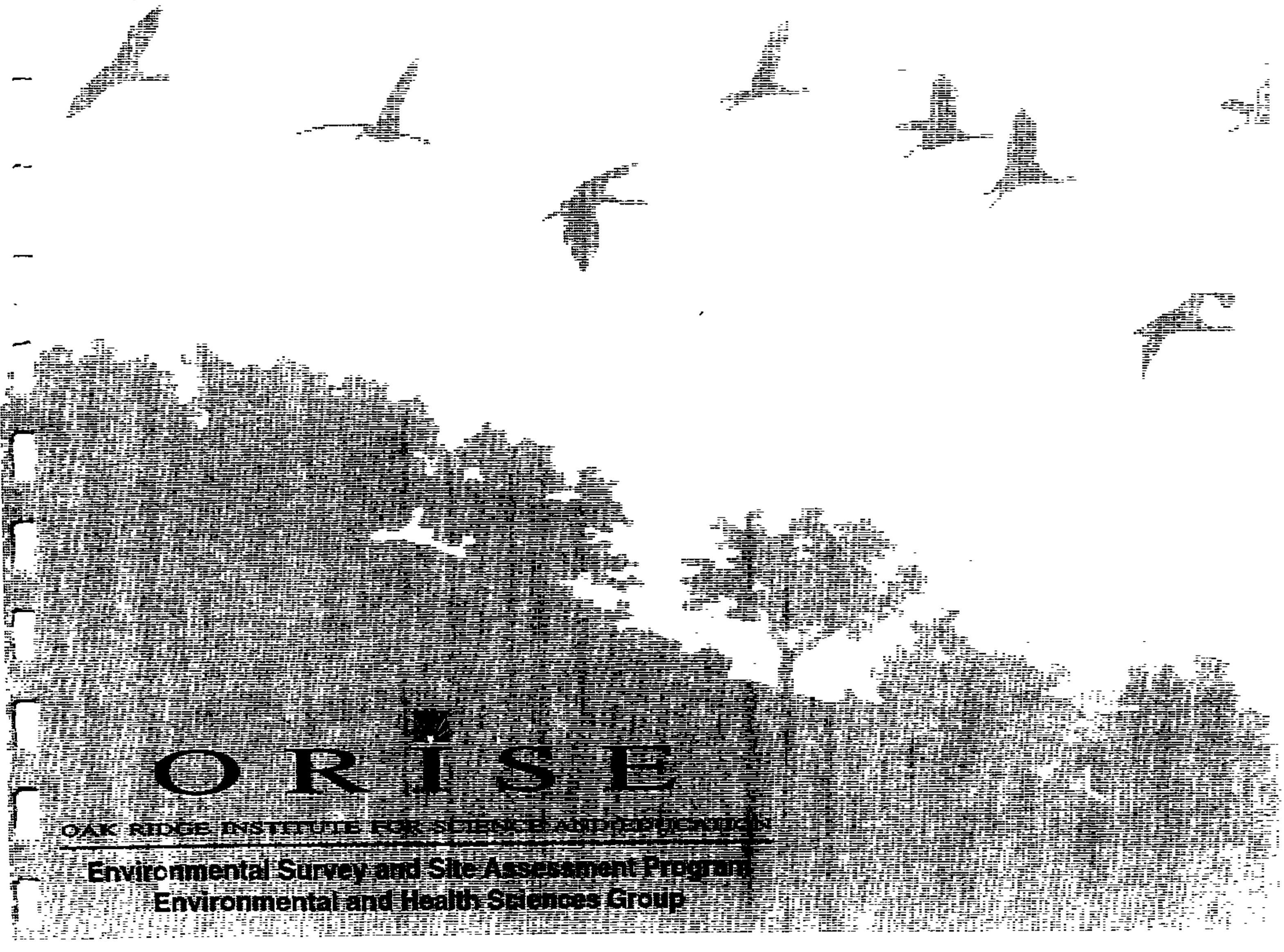
Prepared for the Office of Environmental Restoration
U.S. Department of Energy



VERIFICATION SURVEY OF THE INTERIM STORAGE FACILITY; BUILDINGS T030, T641, AND T013; AN AREA NORTHWEST OF BUILDINGS T019, T013, T012, AND T059; AND A STORAGE YARD WEST OF BUILDINGS T626 AND T038 SANTA SUSANA FIELD LABORATORY ROCKWELL INTERNATIONAL VENTURA COUNTY, CALIFORNIA

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DRAFT REPORT

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

PAGE

ABBREVIATIONS AND ACRONYM

AEC	Atomic Energy Commission
cm	centimeter
cpm	counts per minute
DOE	Department of Energy
dpm/100 cm^2	disintegrations per minute per 100 square centimeters
EM	Environmental Restoration and 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
GM	Geiger Mueller
ha	hectare
ISF	Interim Storage Facility
km	kilometer
m	meter
m^2	square meter
NaI	Sodium Iodide
NIST	National Institute of Standards and Technology
NW Area	Northwest Area
ORISE	Oak Ridge Institute for Science and Education
pCi/g	picocuries per gram
PIC	pressurized ionization chamber
SSFL	Santa Susana Field Laboratory
SNAP	Systems for Nuclear and Auxiliary Power
SRE	Sodium Reactor Experiment
μR/h	microroentgens per hour
ZnS	Zinc Sulfide

VERIFICATION SURVEY
OF THE
INTERIM STORAGE FACILITY; BUILDINGS T030, T641, AND T013; AN AREA NORTHWEST OF BUILDINGS T019, T013, T012, AND T059; AND A STORAGE YARD WEST OF BUILDINGS T626 AND T038
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INTRODUCTION AND SITE HISTORY

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 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), activation products (tritium [H-3], Co-60, Eu-152, Eu-154, Ni-63, Pm-147, 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 of contaminated facilities began in the late 1960's and continues as other DOE-sponsored projects are phased out and transitioned to DOE EM-40. As part of this program, Rockwell/Rocketdyne performed decommissioning and final status surveys of a number of facilities that supported the various nuclear related ETEC operations during the latter part of the 1950's and continuing through the 1980's.

The Interim Storage Facility (ISF), also referred to as DOE Facility 654, was constructed in 1958 to support the Sodium Reactor Experiment (SRE). The ISF was used to store dummy and spent fuel elements, shipping and storage casks, hot waste generated at the SRE, and items from the Organic Moderated Reactor Experiment and Systems for Nuclear and Auxiliary Power (SNAP). The ISF consisted of a concrete pad with a trench containing eight 51-centimeter diameter galvanized steel cells extending 7.6 meters into the rock strata. While the ISF was in use, a number of the items stored there deteriorated and released low-level contamination to adjacent asphalt surfaces and soil areas. Decommissioning of the ISF began in 1984 and involved removal of contaminated surfaces, soil, and the storage cells. The area was then backfilled and returned to a natural state (Rockwell 1985).

Building T030 was used from 1960 through 1964 to house a Van deGraaf accelerator facility for the performance of activation experiments. In 1965, the facility was converted for use as an office building although the accelerator remained on-site in an unused condition until at least 1966. Sometime after 1966 the facility was surveyed, and tritium contamination was identified on the accelerator. The accelerator was removed and the facility released for other uses. An asphalt area south of Building T030 was fenced and used for the storage of palletized items. It has not been verified, but items stored there may have included drums containing mixed fission products (Rockwell 1988a).

Building T641 was constructed in 1964 to serve as a shipping and receiving facility for SSFL. All radioactive and nuclear material shipments were only handled on the outdoor dock of the building. Documentation indicates that all shipments were fully packaged and never opened while on the dock. There have been no documented leaks at this facility (Rockwell 1988a).

Building T013 was constructed in 1961 for the assembly and checkout of non-nuclear SNAP reactor components. In 1970, the facility was redesignated as the ETEC Thermal Transient Facility and used for thermal testing and seismic test equipment. Rockwell/Rocketdyne classified this building as non-nuclear related.

The storage area northwest of T059, T019, T013, and T012 consists of a paved area between the buildings and the SNAP facility fence line. The property then drops sharply off to the SSFL property line. The paved portion of this Northwest Area (NW Area) was used for equipment staging and gas tanks. Site documentation identified this area as non-nuclear.

The final area was a storage yard west of Building T626 and T038 that was used for storing equipment and salvageable components. In 1978, drums containing sand contaminated with Co-60 were stored there. Rockwell/Rocketdyne performed final status surveys of each of these areas in the latter part of the 1980's and did not identify residual contamination (Rockwell 1988b).

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 by the DOE to perform verification surveys of these buildings and areas. This report describes the results of the verification surveys.

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 are conducted in Rockwell International-owned and DOE-owned facilities located within the 117 ha Area IV (Figure 2). The ETEC portion of Area IV consists of government-owned buildings that occupy 36 ha.

The ISF was located in the north-central portion of Area IV. The ISF was paved with a concrete berm containing the eight storage cells. The pavement, berms, and storage cells were removed during the decommissioning and the area was backfilled and graded. Total area of the ISF is not provided in the project documentation, but is estimated to be approximately 150 m^2 based on survey maps. Figures 2 and 3 show the location and plot plan of the ISF.

Building T030 is located north of G Street on 10th Street which is north of G Street in the eastern portion of Area IV (Figure 2). The building is constructed with steel framing, siding, and roofs and consists of an east office section and a west section where the particle accelerator was located. Total floor area of the building is 215 m^2; the west section occupies 125 m^2 of the total. There is an exterior concrete wall at the northern end of the west section that provided shielding for the accelerator beam. Building T641 is located immediately to the south of T030. Total building area is 713 m^2. The loading dock area where radioactive materials were received is located on the east end of the building and occupies approximately 200 m^2. The floor plans of Buildings T030 and T641 are shown on Figures 4 and 5.

Building T013 is located on B Street and is constructed of steel framing and siding (Figure 2). The north half of the building contains office and storage areas while the south half contains the seismic test equipment. Total floor area is approximately 780 m^2. Figure 6 shows the floor plan.

Buildings T626 and T038 are located west of 20th Street in Area IV (Figure 2). The storage area where the contaminated sands were stored is located to the western side of these buildings (Figure 7). The entire area is paved with asphalt. The area northwest of Buildings T059, T019, T013, and T012 (the NW Area) is paved with asphalt for approximately 30 meters north of the buildings, where the asphalt ends and the area drops-off to the property line (Figures 2, 8, and 9). This portion of the NW Area is covered with brush with interspersed boulders and sandstone outcroppings.

OBJECTIVE

The objective of the verification surveys was to validate that cleanup procedures and survey methods utilized by Rockwell/Rocketdyne were adequate. Perfomance of independent document reviews and evaluation of measurement and sampling data provides assurance that the post-remediation data is sufficient, accurate, and demonstrates that remedial actions were accomplished in accordance with appropriate standards and guidelines, and that authorized limits were met.

DOCUMENT REVIEW

ESSAP has reviewed Rockwell/Rocketdyne's supporting documentation concerning each building or outdoor areas final status survey procedures and results (Rockwell 1985, 1988a, and1988b).

PROCEDURES

ESSAP personnel conducted independent measurement and sampling activities at the SSFL facility during the period September 11 through 14, 1995. Survey activities were performed in accordance with a site-specific survey plan (Vitkus 1995), using procedures and instruments described in the ESSAP Survey Procedures and Quality Assurance Manuals and summarized in Appendices A and B.

For this survey, ESSAP classified buildings or outdoor areas that did not have a history of radiological use or storage as unaffected (referred to as "non-nuclear use" in Rockwell/Rocketdyne documentation). Buildings and outdoor areas with a history of radiological use, or where radioactive materials were known to or suspected of having been stored, were classified as affected areas. Survey coverage was determined based on whether an area was designated as unaffected or affected in accordance with the following procedures.

SURVEY PROCEDURES: UNAFFECTED AREAS

The following survey procedures applied to Building T013 and the NW Area.

Reference System

Measurement and sampling locations were referenced to prominent building or site features, and recorded on representative area drawings.

Surface Scans

Surface scans for alpha, beta, and gamma activity were performed in Building T013 and the paved portions of the NW Area. Only gamma scans were performed in the soil portions of the NW Area. Scan area coverage was approximately 10 to 50 percent of the floors and lower walls (up to 2 meters) of Building T013 and the paved and soil areas of the NW Area. Scans were performed using gas proportional, ZnS, GM, and/or NaI scintillation detectors coupled to ratemeters or ratemeter-scalers with audible indicators.

Surface Activity Measurements

Direct measurements for total alpha and total beta activity were performed at 31 randomly selected locations within Building T013 and at 25 locations on the paved portion of the NW Area. Direct measurements were made using gas proportional, ZnS, and/or GM detectors coupled to ratemeter-scalers. A smear sample for the determination of removable gross alpha and gross beta activity was collected from each of the Building T013 direct measurement locations. Figures 6 and 8 show measurement and sampling locations in unaffected areas.

Exposure Rate Measurements

ESSAP performed exterior background exposure rate measurements at six locations within 0.5 to 10 km of the site (Figure 10) and used Rockwell's previously determined building interior background exposure rate measurements for data comparisons. Exposure rate measurements were performed at four locations in Building T013 and a total of seven locations within the NW Area. Exposure rate measurements were performed at 1 meter above the surface using a pressurized ionization chamber (PIC). Figures 6, 7, and 8 show measurement locations.

Soil Sampling

Background soil samples were collected from the six background exposure measurement locations (Figure 10). Surface (0 to 15 cm) soil samples were collected from five locations in the NW area (Figure 9).

SURVEY PROCEDURES: AFFECTED AREAS

The following survey procedures were applicable to Building T030, the Building T641 loading dock, the ISF, and the storage yard west of Buildings T626 and T038.

Reference System

Measurement and sampling locations were referenced to prominent building or site features, and recorded on representative area drawings.

Surface Scans

Surface scans for alpha, beta, and gamma activity were performed over 50 to 100 percent of the accessible floors and lower walls (up to 2 m) within Building T030, the Building T641 loading dock, and the paved portions of the storage yard. Accessible overhead surfaces where material may have settled or accumulated were also scanned. Gamma scans only were performed in the ISF and the soil area that is located west of the storage yard. The ISF was excavated to a depth of 7.5 to 9 meters when the storage cells were removed and then backfilled to grade. As a result of back-filling, the original soil was inaccessible; therefore, scans of the ISF were concentrated in the peripheral areas where contamination may have migrated. Scans were performed using gas proportional, ZnS, GM, and/or NaI scintillation detectors coupled to ratemeters or ratemeter-scalers with audible indicators.

Surface Activity Measurements

Single-point direct measurements for total alpha and total beta activity were performed on floors, walls, equipment, and on pavement in the designated areas. A total of 19, 50, and 25 measurements were performed in Building T030, the Storage Yard west of Buildings T626 and T038, and the Building T641 loading dock, respectively. Direct measurements were performed using gas proportional, ZnS, and/or GM detectors coupled to ratemeter-scalers. A smear sample for the determination of removable gross alpha and gross beta activity was collected from each direct measurement location. In the western portion of Building T030, a second smear was collected from each direct measurement location for determination of removable tritium activity levels. Measurement and sampling locations for total and removable activity are shown in Figures 4, 5, and 7.

Exposure Rate Measurements

Exterior background exposure rate measurements were made at six locations within 0.5 to 10 km of the site (Figure 10). Exposure rate measurements were performed at 17 locations in the affected areas. Figures 3, 4, 5, and 7 indicate measurement locations. Exposure rate measurements were performed at 1 meter above the surface using a PIC.

Soil Sampling

Individual soil samples were collected from four locations in the ISF area. One composite surface (0-15 cm) soil sample was collected from the T626 storage area over a 100 m^2 area. Figures 3 and 7 indicate sampling locations.

Miscellaneous Sampling

Because available field instrumentation cannot detect tritium surface activity at the guideline levels, a limited number of miscellaneous samples were collected in order to provide a quantitative indication of total tritium surface activity. Paint samples were collected from five randomly selected 100 cm^2 area on the walls of the western portion of Building T030, where the accelerator was formerly located. Sampling locations are shown in Figure 4.

SAMPLE ANALYSIS AND DATA INTERPRETATION

Samples and data were returned to ORISE's ESSAP laboratory in Oak Ridge, Tennessee for analysis and interpretation. Soil samples were analyzed by solid state gamma spectrometry. Spectra were reviewed for U-238, U-235, Th-232, Cs-137, Co-60 and any other identifiable photopeaks, particularly additional activation and fission products. Gamma spectrometry data were reported in picocuries per gram (pCi/g). Smears were analyzed for gross alpha and gross beta activity using a low background proportional counter, and for tritium by liquid scintillation. Miscellaneous samples were analyzed for tritium by liquid scintillation counting. Smear results, miscellaneous sample results, and direct measurement data were converted to units of disintegrations per minute per 100 square centimeters (dpm/100 cm^2). Exposure rates are reported in microroentgens per hour (μR/h).

FINDINGS AND RESULTS

DOCUMENT REVIEW

Based on the review of the project documents, it is ESSAP's opinion that the documentation was inadequate to satisfactorily demonstrate that each building or area meet the DOE guidelines for release to unrestricted use. Overall, the documentation for each building or area does not provide a clear description of the sequence of events necessary for demonstrating that the subject areas meet the requirements for release to unrestricted use. That is, the specification of contaminants present, selection of the appropriate guidelines, development of a sampling and analysis plan that provides adequate data for guideline interpretation, and presentation of the data in a manner that can be directly compared with the guidelines. The types of deficiencies noted in the reports included the following: all potential contaminants were not identified, final surveys were not designed to identify residual contamination of all suspected radionuclides, residual surface activity data was either absent or not reported in units of dpm/100 cm^2, radionuclide-specific sample analyses were not performed (i.e., gross beta analysis of soil samples was performed and the data used for demonstrating compliance), and appropriate guidelines were not always cited or unapproved site-specific guidelines were used.

UNAFFECTED AREAS

The results of the verification surveys for unaffected buildings and areas are discussed below.

Surface Scans

Surface scans did not identify any areas of elevated alpha, beta, or gamma direct radiation.

Surface Activity Levels

Surface activity levels are summarized in Table 1. Total surface activity levels in Building T013 were less than 55 dpm/100 cm^2 for alpha and less than 1,400 dpm/100 cm^2 for beta. For the paved portion of the NW Area, surface activity levels were less than 100 dpm/100 cm^2 and less than 1,400 dpm/100 cm^2 for alpha and beta, respectively. Removable activity levels were less than 12 dpm/100 cm^2 for gross alpha and less than 16 dpm/100 cm^2 for gross beta.

Exposure Rates

Exposure rate measurement data is provided in Tables 2 and 3. Background exterior exposure rates ranged from 12 to 16 μR/h and averaged 14 μR/h. Exposure rates in the NW Area ranged from 14 to 16 μR/h. Exposure rates inside of Building T013 ranged from 8 to 11 μR/h.

Radionuclide Concentration In Soil

Radionuclide concentrations in soil samples are summarized in Table 4. Background concentration ranges were as follows: Cs-137, less than 0.1 to 0.2 pCi/g; Ra-226, less than 0.2 to 1.2 pCi/g; Th-228, 0.6 to 1.4 pCi/g; Th-232, 0.6 to 1.7 pCi/g; U-235, less than 0.1 pCi/g; and U-238, less than 2.2 to 2.5 pCi/g. Radionuclide concentrations in samples collected from the NW Area were: Cs-137, less than 0.1 to 0.5 pCi/g; Ra-226, 0.8 to 1.0 pCi/g; Th-228, 1.2 to 1.5 pCi/g; Th-232, 1.5 to 1.7 pCi/g; U-235, less than 0.1 pCi/g; and U-238, less than 1.5 to 1.9 pCi/g.

AFFECTED AREAS

The survey results for Buildings T030, T641 loading dock, the storage yard west of T626 and T038, and the ISF are discussed below.

Surface Scans

Surface scans for alpha, beta and gamma activity did not identify any locations of elevated direct radiation indicative of residual contamination.

Surface Activity Levels

Surface activity levels are summarized in Table 1. Surface activity levels for Building T030 were less than 55 dpm/100 cm^2 for total alpha and less than 1,400 dpm/100 cm^2 for total beta. Of the five miscellaneous samples collected from Building T030, four were less than the minimum detectable activities of the tritium procedure which ranged from 132 to 209 dpm/100 cm^2. One sample, location #2 on Figure 4, had a total tritium activity level of 6,600 dpm/100 cm^2. Activity levels for the Building T641 loading dock were less than 100 dpm/100 cm^2 for alpha and less than 1,400 dpm/100 cm^2 for beta. Total surface activity for the storage yard west of Building T626 and T038 was less than 55 dpm/100 cm^2 for alpha and ranged from less than 1,000 to 1,800 dpm/100 cm^2 for beta. Removable activity levels were less than 12 dpm/100 cm^2 for gross alpha and less than 16 dpm/100 cm^2 for gross beta. Removable tritium activity in Building T030 was less than 221 dpm/100 cm^2.

Exposure Rates

Exposure rates are summarized in Tables 2 and 3. Exposure rates ranged from 10 to 12 μR/h for the interior of Building T030 and the loading dock of Building T641. Rockwell determined that the average interior background exposure rate was approximately 8 μR/h. Exterior exposure rates for the ISF, ranged from 10 to 15 μR/h. Exterior background exposure rates ranged from 12 to 16 μR/h, and averaged 14 μR/h.

Radionuclide Concentrations in Soil

Radionuclide concentrations in soil samples are summarized in Table 4. Background concentration ranges were as follows: Cs-137, less than 0.1 to 0.2 pCi/g; Th-232, 0.6 to 1.7 pCi/g; Th-228, 0.6 to 1.4 pCi/g; Ra-226, less than 0.2 to 1.2 pCi/g; U-235, less than 0.1 pCi/g; and U-238, less than 2.2 to 2.5 pCi/g. Radionuclide concentrations in samples collected from the ISF and the area adjacent to the storage yard west of Buildings T626 and T038 were: Cs-137, less than 0.1 to 0.4 pCi/g; Th-232, 1.5 to 1.7 pCi/g; Th-228, 1.2 to 1.6 pCi/g; Ra-226, 0.7 to 1.2 pCi/g; U-235, less than 0.1 pCi/g; and U-238, less than 2.0 pCi/g.

COMPARISON OF RESULTS WITH GUIDELINES

Surface activity levels in each area were compared to the appropriate residual radioactive material guidelines specified in DOE Order 5400.5 for uranium and mixed fission and activation products. These guidelines are summarized in Appendix C. The applicable guidelines for uranium are as follows:

Total Activity

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

Removable Activity

1000 α dpm/100 cm^2

and the guidelines for beta-gamma emitters are:

Total Activity

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

Removable Activity

1,000 β-γ dpm/100 cm^2

In Building T030, the total tritium activity at sample location # 2 (Figure 4) on the north wall exceeded the average guideline for beta-gamma emitters. The activity (6,600 dpm/100 cm^2) in this sample was less than the maximum guideline. The sampling methodology (limited random sampling rather than systematic) was intended to provide a means of determining whether or not tritium contamination was present rather than characterizing the tritium activity levels in the area. Therefore, an overall conclusion of guideline compliance, relative to tritium activity, can not be made for this area. All other total and removable activity levels were found to be less than the guideline levels.

The DOE's exposure rate guideline is 20 μR/h above background, although Rockwell/Rocketdyne 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.

Other than the DOE's generic residual soil concentration guidelines for thorium and radium of 5 pCi/g in the first 15 cm of soil and 15 pCi/g in 15 cm thick layers of subsurface soil, guidelines for other radionuclides are developed on a site-specific basis. Currently, there are no approved site-wide guidelines at SSFL for the radionuclides of concern. As a result, radionuclide concentrations in soils were compared to the background concentration levels. There were no radionuclides identified in excess of background levels.

SUMMARY

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education conducted verification activities for Buildings T013, T030, the loading dock of Building T641, the NW Area, the ISF, and the storage area west of Buildings T626 and T038 at the Santa Susana Field Laboratory in Ventura County, California. Verification activities included document reviews and during the period September 9 through 12, 1995 ESSAP personnel visited the site and performed independent surface scans, surface activity measurements, exposure rate measurements, miscellaneous material sampling, and soil sampling.

The results of the independent verification measurements and sampling identified residual tritium contamination, in the room of Building T030 where an accelerator was formerly housed, that was in excess of the 1 m^2 average guideline for this radionuclide. There was no removable tritium activity identified in this area. It is ESSAP's recommendation that additional sampling be performed in this area to determine whether or not significant tritium contamination is present. All remaining surface activity levels were less than the guidelines. Radionuclide concentrations in soils from sampled areas and exposure rates were comparable to background levels.

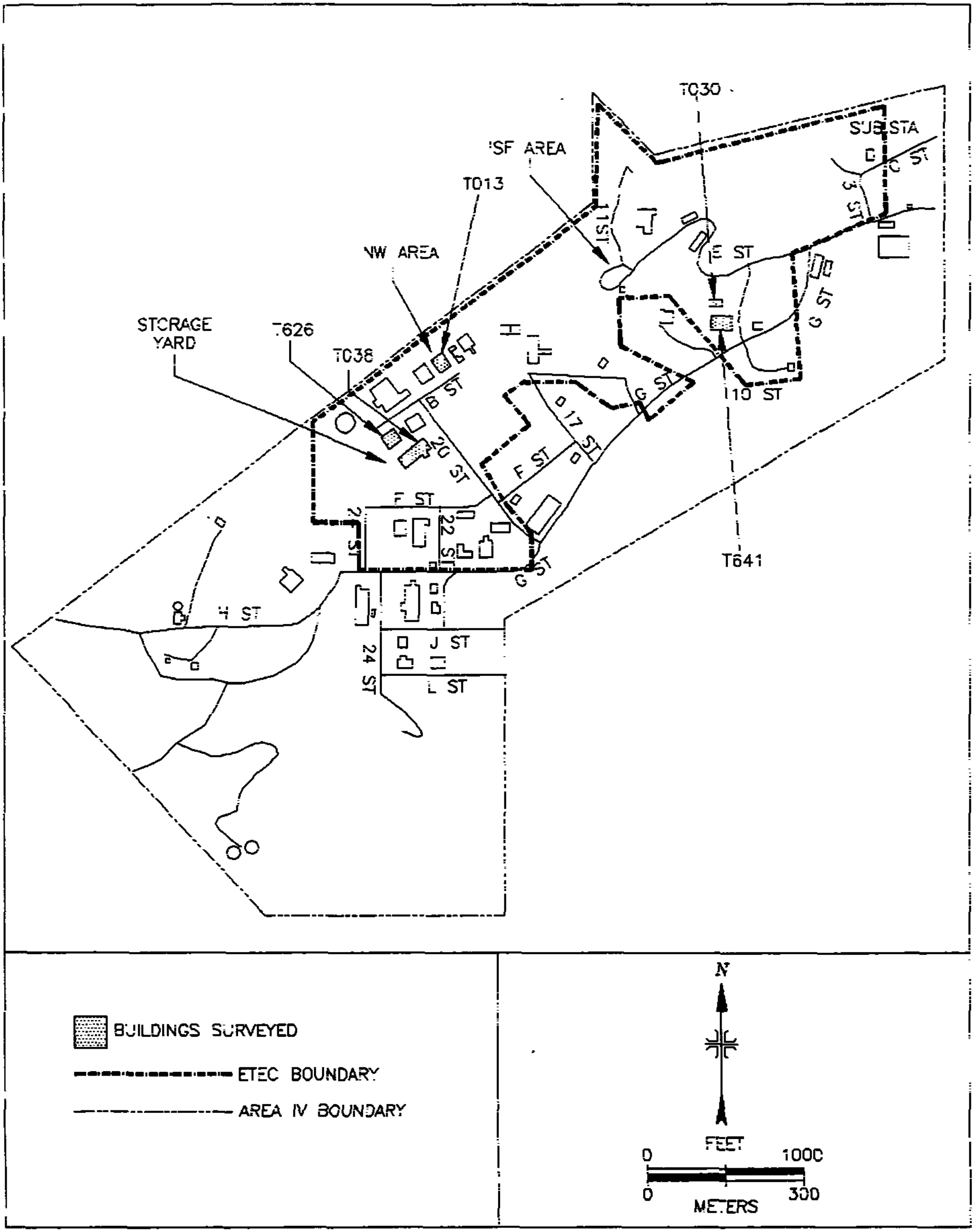

FIGURE 2: Santa Susana Field Laboratory Area IV, Plot Plan – Location of Surveyed Areas

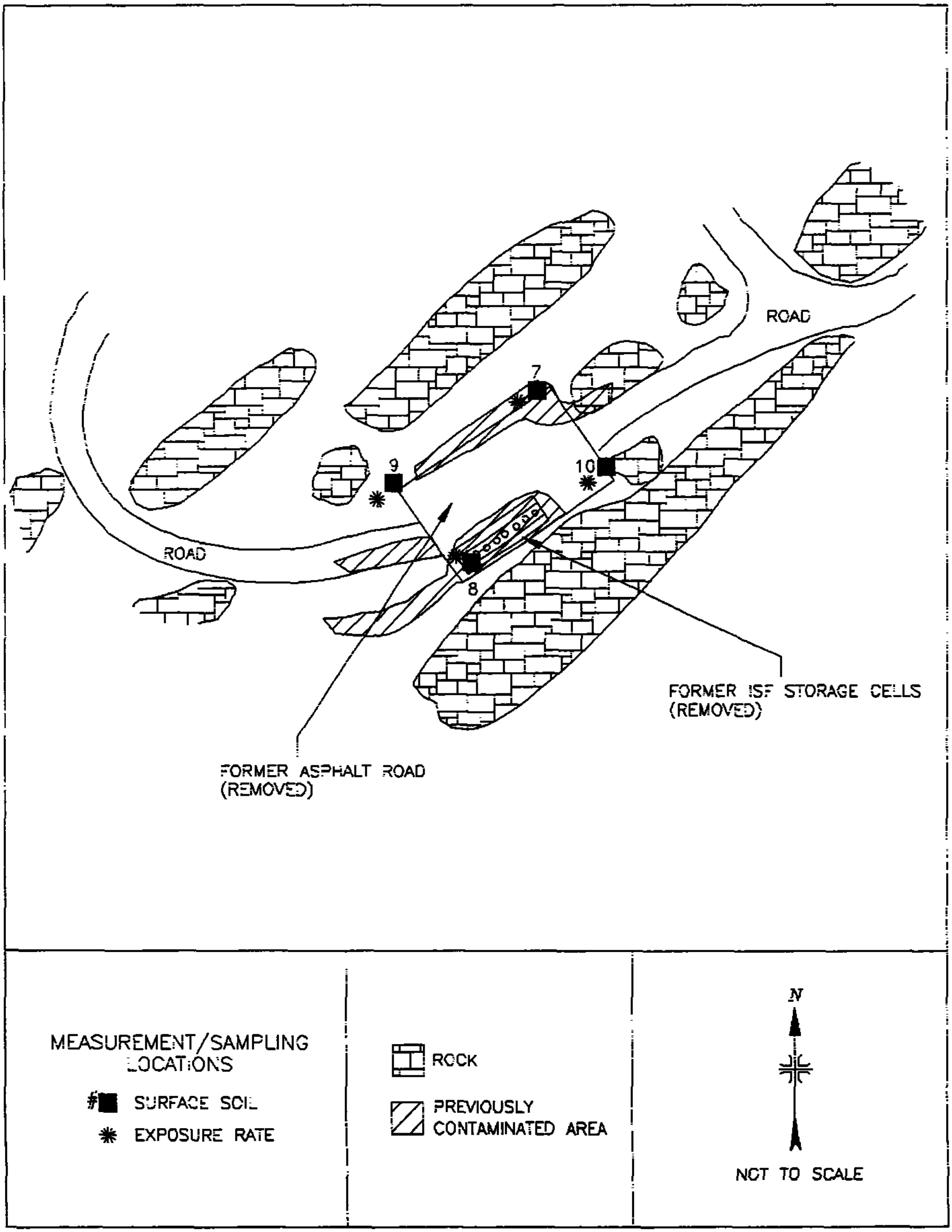

FIGURE 3: Interim Storage Facility – Plot Plan and Measurement and Sampling Locations

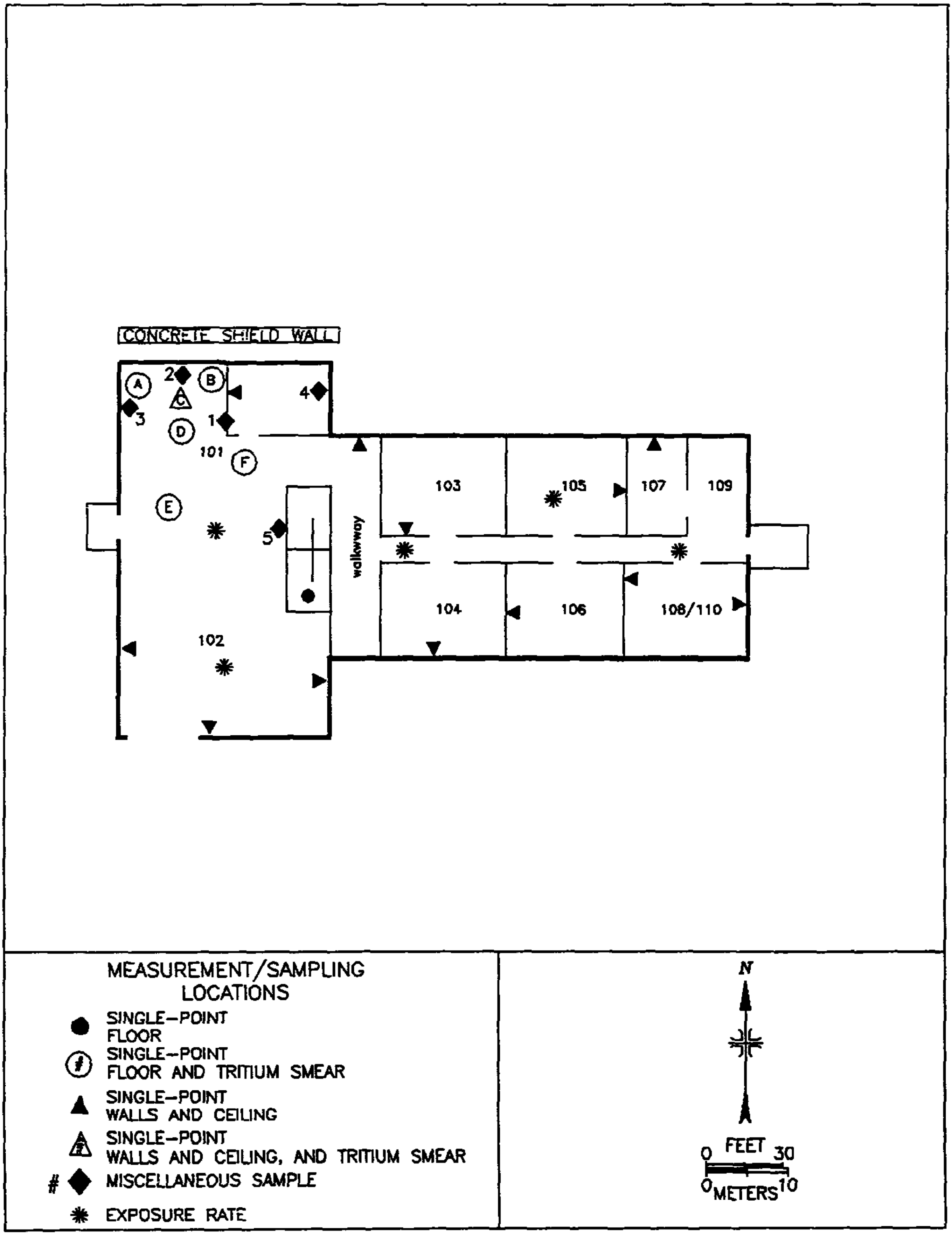

FIGURE 4: Building T030 – Floor Plan and Measurement and Sampling Locations

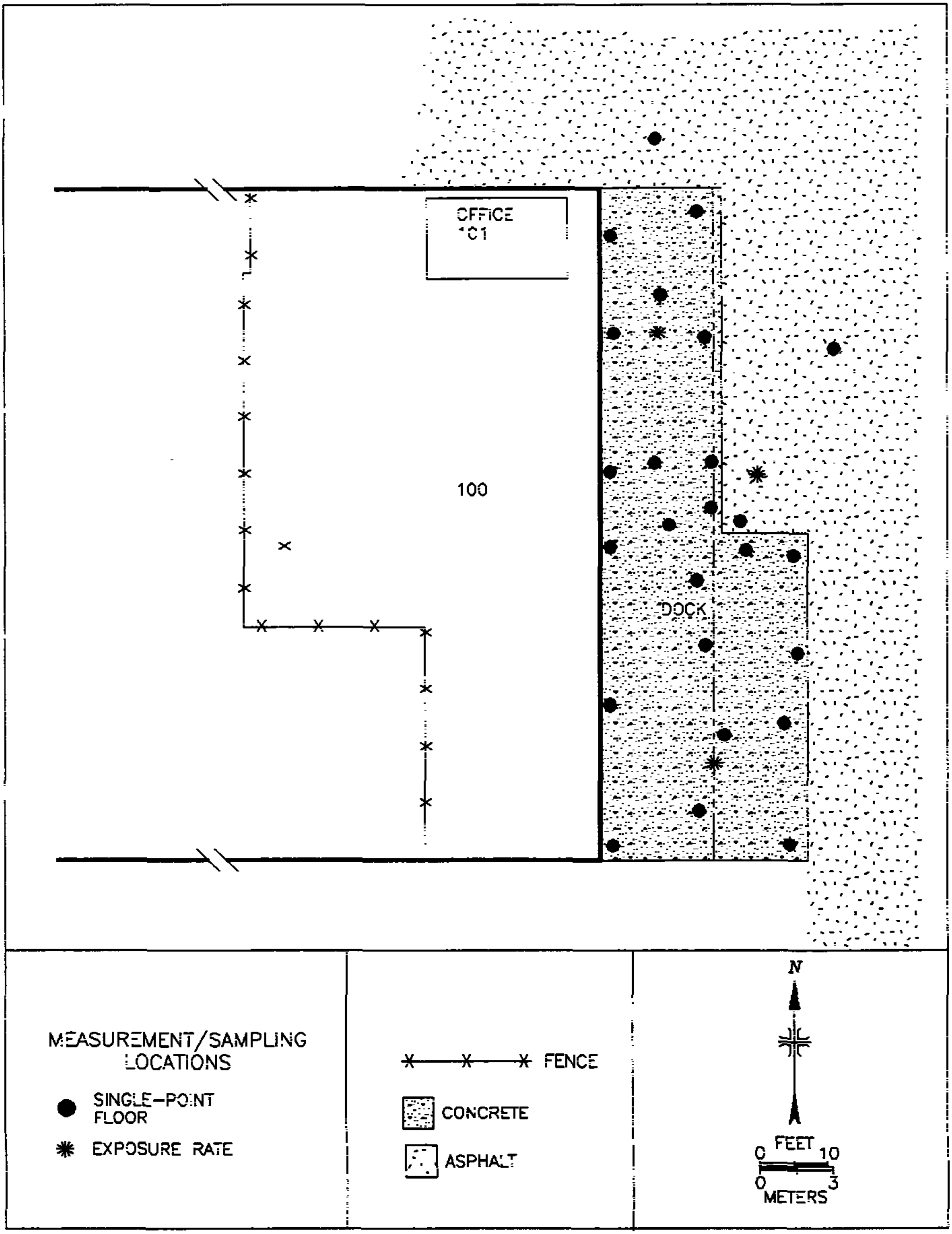

FIGURE 5: Building T641 – Floor Plan and Measurement and Sampling Locations

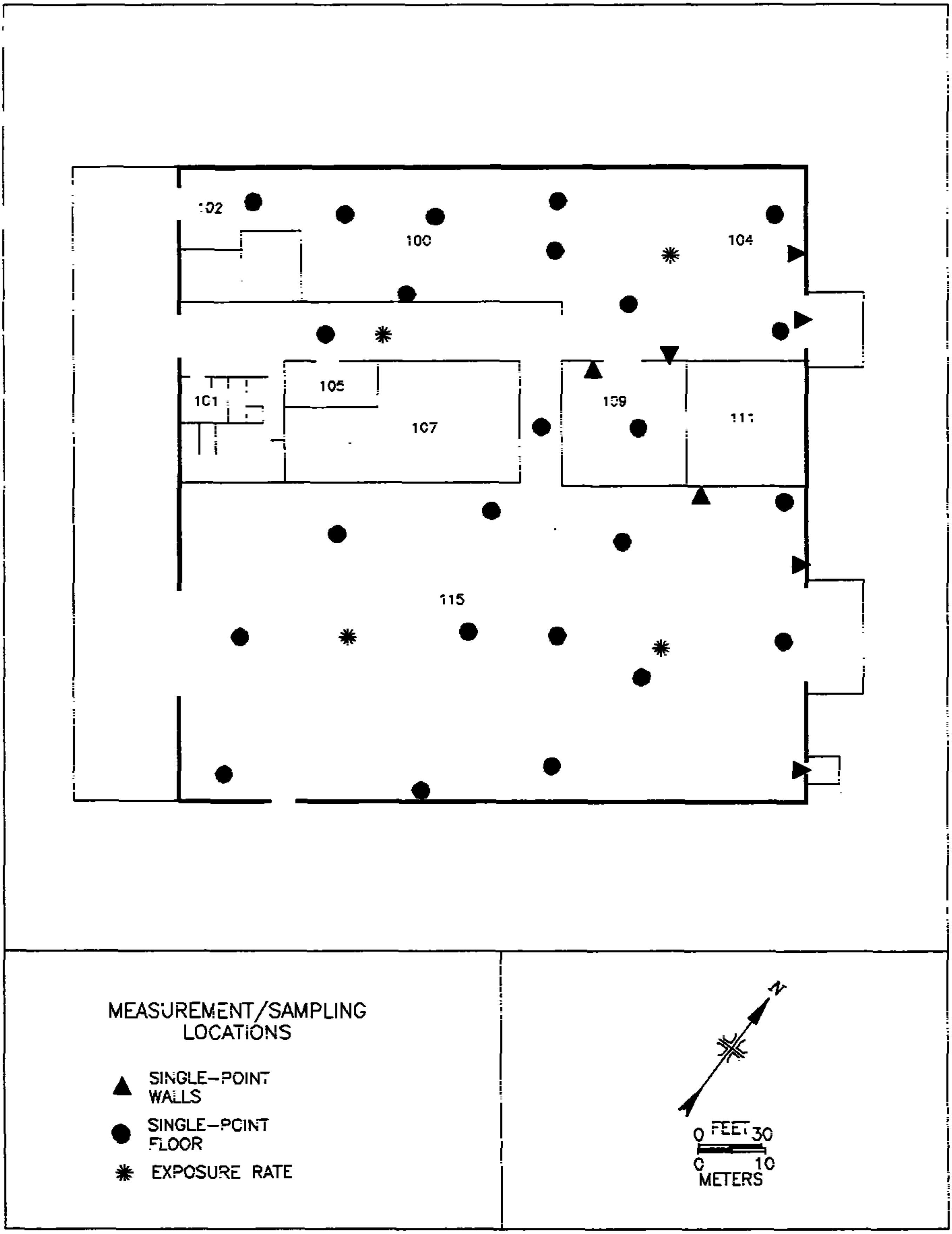

FIGURE 6: Building T013 – Floor Plan and Measurement and Sampling Locations

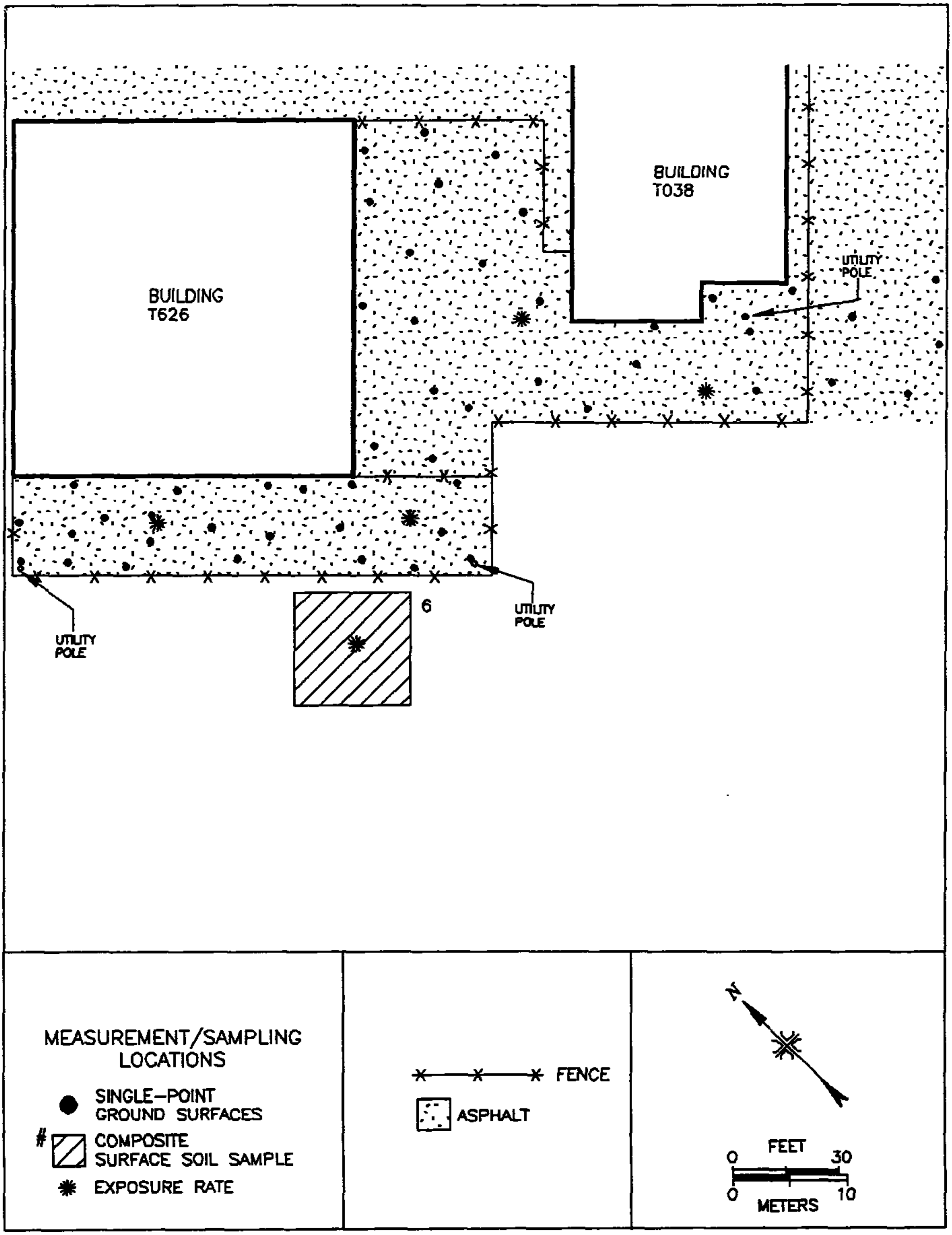

FIGURE 7: Building T626 and T038 Storage Yard – Plot Plan and Measurement and Sampling Locations

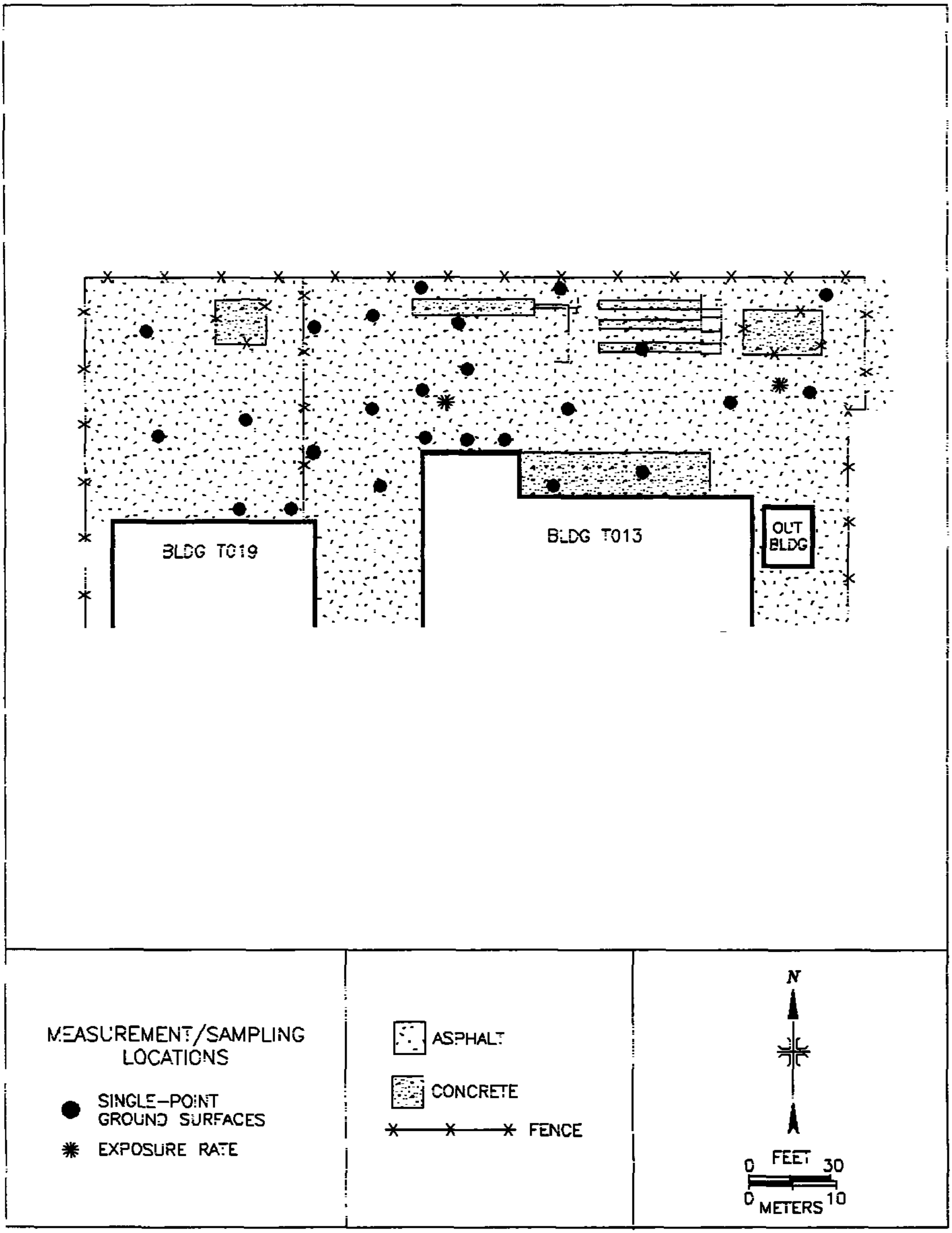

FIGURE 8: Paved Portion of the Northwest Area – Plot Plan and Measurement and Sampling Locations

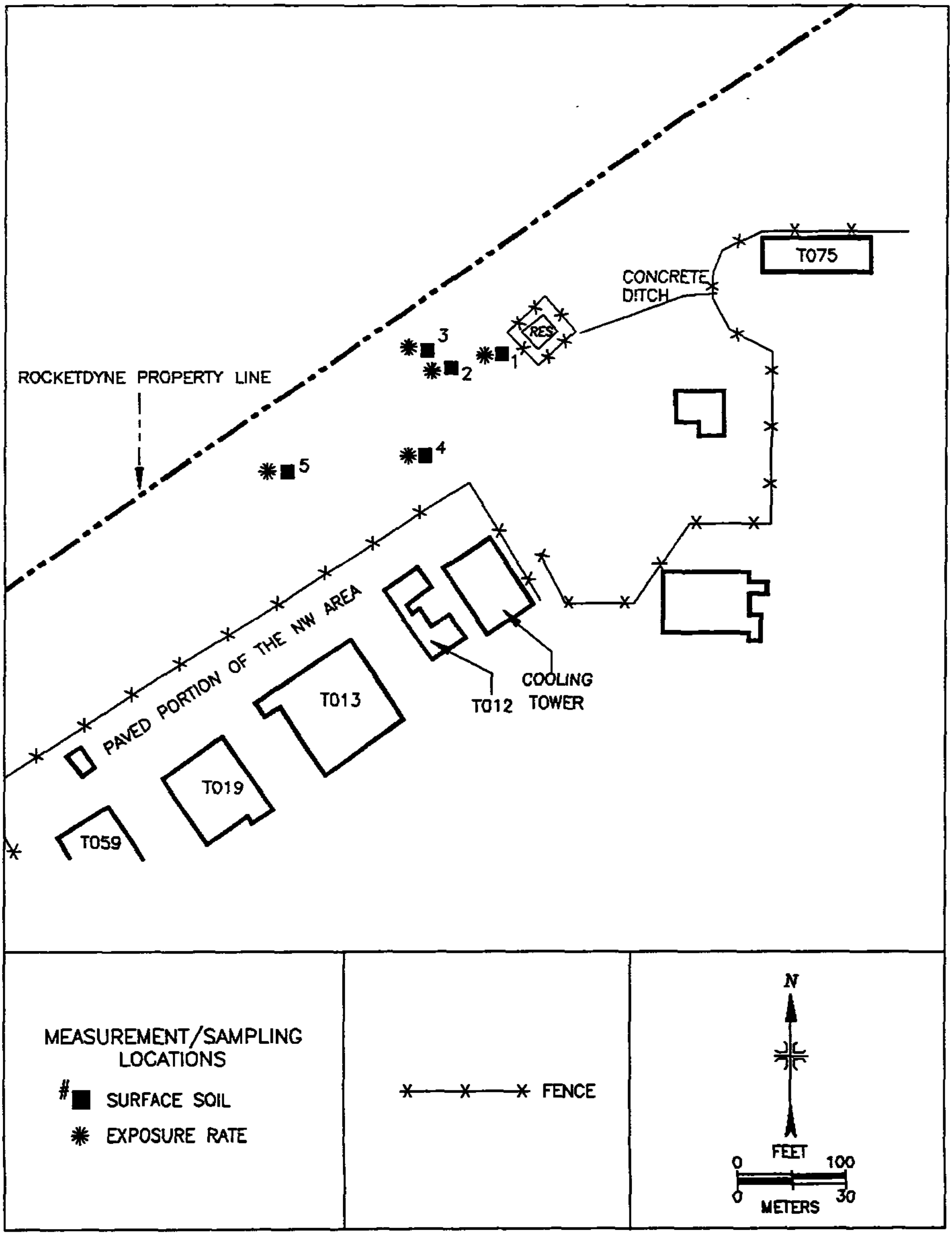

FIGURE 9: Soil Portion of the Northwest Area – Plot Plan and Measurement and Sampling Locations

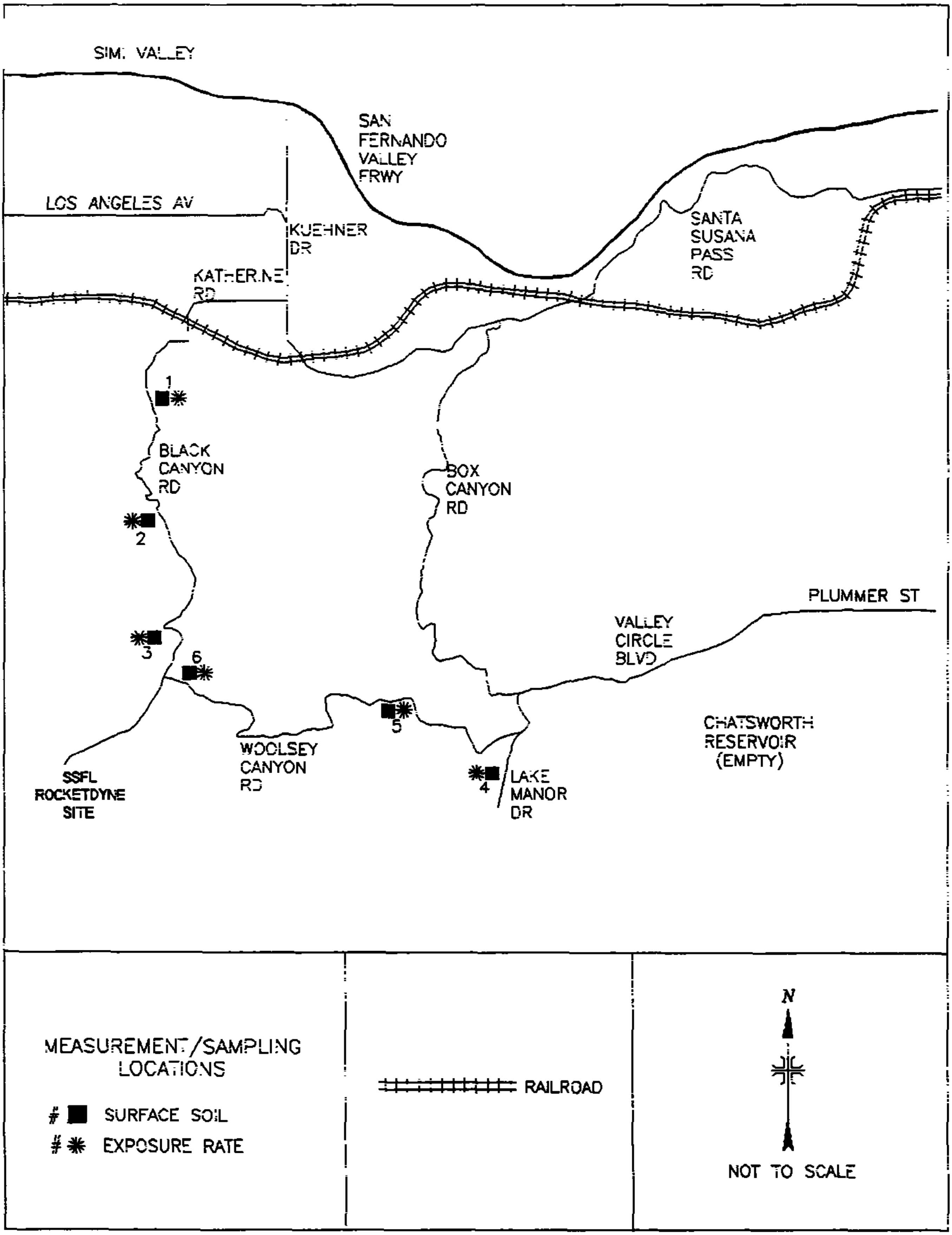

FIGURE 10: Santa Susana Field Laboratory, Ventura County, California — Background Measurement and Sampling Locations

TABLE 1

SUMMARY OF SURFACE ACTIVITY LEVELS
BUILDINGS T013, T030, T641 LOADING DOCK, NW AREA,
AND STORAGE YARD WEST OF T626 AND T038
SANTA SUSANA FIELD LABORATORY
ROCKWELL INTERNATIONAL
VENTURA COUNTY, CALIFORNIA

Location[a]	Number of Measurement Locations	Total Activity Range (dpm/100 cm^2)		Removable Activity Range (dpm/100 cm^2)	
	Single-Pt.	Alpha[b]	Beta[c]	Alpha[d]	Beta[e]
INTERIOR					
T013					
Floor	24	<55	<1,000 - <1,400	<12	<16
Lower Wall	7	<55	<900	<12	<16
T030					
Floor	6	<55	<1,000	<12	<16
Lower Wall	11	<55	<900 - <1,400	<12	<16
Upper Wall and Ceiling	2	<55	<1,000	<12	<16
EXTERIOR					
Storage Yard West of T626 and T038	50	<55	<1,000 - 1,800	<12	<16
T641 Dock	25	<100	<1,400	<12	<16
NWArea	25	<100	<1,400	<12	<16

[a]Refer to Figures 4, 5, 6, 7, and 8.
[b]Guidelines = 5,000 α dpm/100 cm^2 average in a 1 m^2 area and 15,000 α dpm/100 cm^2 maximum
[c]Guidelines = 5,000 β-γ dpm/100 cm^2 average in a 1 m^2 area and 15,000 β-γ dpm/100 cm^2 maximum
[d]Guideline = 1,000 α dpm/100 cm^2
[e]Guideline = 1,000 β-γ dpm/100 cm^2

TABLE 2

TRITIUM ACTIVITY IN MISCELLANEOUS SAMPLES FOR BUILDING T030 SANTA SUSANA FIELD LABORATORY ROCKWELL INTERNATIONAL VENTURA COUNTY, CALIFORNIA

Location[a]	Type	Activity (dpm/100 cm^2)
Room 101, East Wall	Paint	<200[b]
Room 101, North Wall	Paint	6,600 ± 220[b]
Room 101, West Wall	Paint	<200[b]
Room 101B, East Wall	Paint	<200[b]
Room 101, W Restroom Wall	Paint	<160[b]
Location A	Smear	<30[c]
Location B	Smear	<33[c]
Location C	Smear	<36[c]
Location D	Smear	<57[c]
Location E	Smear	<44[c]
Location F	Smear	<65[c]
Location G	Smear	<220[c]

[a]Refer to Figure 4.
[b]Total Activity
[c]Removable Activity

TABLE 3

BACKGROUND EXPOSURE RATES FOR THE SANTA SUSANA FIELD LABORATORY ROCKWELL INTERNATIONAL VENTURA COUNTY, CALIFORNIA

Location[a]	Exposure Rate at 1 m above Surface (μR/h)
#1 Gaston Road	13
#2 Black Canyon Road	16
#3 Black Canyon Road	14
#4 Valley Circle Road	15
#5 Woolsey Canyon Road	12
#6 Woolsey Canyon Road	14

[a]Refer to Figure 10.

TABLE 4

SITE EXPOSURE RATES FOR BUILDINGS T013, T030, STORAGE YARD WEST OF T626, T641 DOCK, PAVED YARD OF NORTHWEST AREA, AND INTERIM STORAGE FACILITY SANTA SUSANA LABORATORY ROCKWELL INTERNATIONAL VENTURA COUNTY, CALIFORNIA

Location[a]	Exposure Rate Ranges at 1 m above Surface (μR/h)
Building T013	8 to 11
Building T030	10 to 11
Storage Yard West of T626 and T038	10 to 13
Building T641 Dock	10 to 12
Soil Portion of the NW Area	14 to 16
Paved Yard of NW Area	12
Interim Storage Facility	15

[a]Refer to Figures 4 through 8.

TABLE 5

RADIONUCLIDE CONCENTRATIONS IN SOIL
SANTA SUSANA FIELD LABORATORY
ROCKWELL INTERNATIONAL
VENTURA COUNTY, CALIFORNIA

Location[a]	Radionuclide Concentrations pCi/g					
	Cs-137	Ra-226	Th-228	Th-232	U-235	U-238
BACKGROUND						
#1 Gaston Rd.	<0.1	1.2 ± 0.2[b]	1.4 ± 0.1	1.6 ± 0.4	<0.1	2.5 ± 1.6
#2 Black Canyon	0.2 ± 0.1	1.0 ± 0.2	1.4 ± 0.2	1.7 ± 0.3	<0.1	1.4 ± 1.5
#3 Sage Ranch Park	0.2 ± 0.1	1.0 ± 0.2	1.4 ± 0.1	1.3 ± 0.3	<0.1	1.6 ± 1.1
#4 Valley Circle Road	0.2 ± 0.1	1.0 ± 0.2	1.2 ± 0.1	1.1 ± 0.4	<0.1	<2.2
#5 Woolsey Canyon 386S017	<0.1	0.9 ± 0.2	1.1 ± 0.1	1.2 ± 0.3	<0.1	2.1 ± 1.2
#6 Woolsey Canyon 386S018	<0.1	<0.2	0.6 ± 0.1	0.6 ± 0.3	<0.1	<1.0
SSFL AREAS						
NW Area #1	0.5 ± 0.1	1.0 ± 0.2	1.5 ± 0.1	1.6 ± 0.3	<0.1	0.8 ± 1.3
NW Area #2	<0.1	1.0 ± 0.2	1.4 ± 0.1	1.5 ± 0.4	<0.1	1.2 ± 1.4
NW Area #3	<0.1	1.0 ± 0.2	1.3 ± 0.1	1.7 ± 0.4	<0.1	1.9 ± 1.3
NW Area #4	<0.1	0.8 ± 0.2	1.2 ± 0.1	1.5 ± 0.3	<0.1	1.0 ± 0.9
NW Area #5	0.2 ± 0.1	1.0 ± 0.2	1.2 ± 0.1	1.6 ± 0.3	<0.1	<1.5
Storage Yard #6	0.1 ± 0.1	0.7 ± 0.2	1.2 ± 0.1	1.7 ± 0.4	<0.1	<2.0
ISF #7	<0.1	1.2 ± 0.2	1.6 ± 0.1	1.6 ± 0.3	<0.1	1.0 ± 1.5
ISF #8	0.4 ± 0.1	0.8 ± 0.2	1.4 ± 0.2	1.7 ± 0.4	<0.1	1.2 ± 1.3
ISF #9	0.1 ± 0.1	0.8 ± 0.2	1.4 ± 0.1	1.6 ± 0.4	<0.1	1.7 ± 1.4
ISF #10	0.1 ± 0.1	1.0 ± 0.2	1.3 ± 0.2	1.5 ± 0.4	<0.1	<1.5

[a]Refer to Figures 3, 7, 9, and 10.
[b]Uncertainties represent the 95% confidence level, based only on counting statistics.

REFERENCES

Rockwell International, 1985. Interim Storage Facility Decommissioning Final Report. March 15, 1995.

Rockwell International, 1988a. Radiological Survey of Shipping/Receiving and Old Accelerator Area - Buildings T641 and T030. August 19, 1988.

Rockwell International, 1988b. Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013, and T012; and A Storage Yard West of Buildings T626 and T038. August 26, 1988.

Vitkus, T. J. 1995. Letter to Don Williams (DOE/HQ). September 6, 1995.

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)

Eberline "Rascal" Ratemeter-Scaler
Model PRS-1
(Eberline, Santa Fe, NM)

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

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

Detectors

Eberline GM Detector
Model HP-260
Physical Area, 20 cm^2
(Eberline, Santa Fe, NM)

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

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

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

Reuter-Stokes Pressurized Ion Chamber
Model RSS-112
(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

High Purity Extended Range Intrinsic Detectors
Model No: ERVDS30-25195
(Tennelec, Oak Ridge, TN)
Used in conjunction with:
Lead Shield Model G-11
(Nuclear Lead, Oak Ridge, TN) and
Multichannel Analyzer
3100 Vax Workstation
(Canberra, Meriden, CT)

High-Purity Germanium Detector
Model GMX-23195-S, 23% Eff.
(EG&G ORTEC, Oak Ridge, TN)
Used in conjunction with:
Lead Shield Model G-16
(Gamma Products, Palos Hills, IL) and
Multichannel Analyzer
3100 Vax Workstation
(Canberra, Meriden, CT)

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

Tri-Carb Liquid Scintillation Analyzer
Model 1900CA
(Packard Instrument Co., Meriden, CT)

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. A large surface area, gas proportional floor monitor was used to scan the floors and paved portions of the surveyed areas. Other surfaces were scanned using small area (20 cm^2, 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
Beta	-	gas proportional detector with ratemeter-scaler
	-	GM detector with ratemeter-scaler

Surface Activity Measurements

Measurements of total alpha and total beta activity levels were performed using ZnS scintillation and GM 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. Because different building materials (poured concrete, concrete block, steel, etc.) can have very different background levels, average background counts were determined for each material encountered in the surveyed area at a location of similar construction and having no known radiological history. The beta activity background count rates for the GM detectors averaged 95 cpm for concrete, 36 cpm for sheet rock, 33 cpm for structural steel, 96 cpm for cinder block, and 92 cpm for asphalt. Alpha background count rates for the ZnS detectors averaged 7 cpm for concrete, 1 cpm for sheet rock, 2 cpm for structural steel, 3 cpm for cinder block, and 2 cpm for asphalt. Net count rates were determined by subtracting the appropriate material background from the gross count rate for each measurement location. Beta efficiency factors ranged from 0.17 to 0.18 for the GM detector calibrated to Tc-99. The beta minimum detectable activities (MDA) for the GM detectors varied by material and ranged from 870 to 1,400 dpm/100cm^2. Alpha efficiency factors ranged from 0.18 to 0.19 for the ZnS detectors calibrated to Pu-239 and MDAs ranged from 50 to 100 dpm/100cm^2. The physical window area for the GM and ZnS detectors were 20 cm^2 and 74 cm^2, respectively.

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. Tritium smears were first moistened with deionized water before 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 (PIC). The instrument was adjusted to one meter above the surface and allowed to stabilize. The measurement was read directly in μR/h.

Soil Sampling

Approximately 1 kg of soil was collected at each sample location. Collected samples were placed in a plastic bag, sealed, and labeled in accordance with ESSAP survey procedures.

Paint Sampling

Paint samples were obtained by chipping the paint from 100 cm^2 of surface area. The sample was then placed in a plastic specimen cup sealed, and labeled in accordance with ESSAP survey procedures.

ANALYTICAL PROCEDURES

Removable Activity

Gross Alpha/Beta

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

Liquid Scintillation

Smears were counted in a liquid scintillation counter for low-energy beta activity to determine H-3 activity.

Gamma Spectrometry

Soil samples were dried, mixed, crushed, and/or homogenized as necessary, and a portion sealed in 0.5-liter Marinelli beaker or other appropriate container. The quantity placed in the beaker was chosen to reproduce the calibrated counting geometry. Net material weights were determined and the samples counted using intrinsic germanium detectors coupled to a pulse height analyzer system. Background and Compton stripping, peak search, peak identification, and concentration calculations were performed using the computer capabilities inherent in the analyzer system. All photopeaks associated with the radionuclides of concern were reviewed for consistency of activity. Energy peaks used for determining the activities of radionuclides of concerns were:

Co-60	1.173 MeV
Cs-137	0.662 MeV
Eu-152	0.344 MeV
Eu-154	0.723 MeV
Ra-226	0.351 MeV from Pb-214*
Th-228	0.239 MeV from Pb-212*
Th-232	0.911 MeV from Ac-228*
U-235	0.143 MeV (or 0.186 MeV)
U-238	0.063 MeV from Th-234* (or 1.001 MeV from Pa-234 m)*

*Secular equilibrium assumed.

Spectra were also reviewed for other identifiable photopeaks.

Tritium

Tritium in solid samples was exchanged with water by refluxing and the resulting liquid was distilled to remove other radionuclides and organic materials. The samples were spiked with a standard tritium solution to evaluate quenching and counted in a liquid scintillation counter.

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 activity (MDA), 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 MDA of the measurement procedure, the result was reported as less than MDA. 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 standard/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 Manful, 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 Quality Assurance 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.

SOIL GUIDELINES

Radionuclides	Soil Concentration (pCi/g) Above Background[i,j,k]
Uranium and mixed fission and activation products	Soil guidelines are calculated on a site-specific basis, using the DOE manual developed for this use.

[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.

[i]These guidelines take into account ingrowth of radium-226 from thorium-230 or thorium-232 and radium-228 and assume secular equilibrium. If either Th-230 and Ra-226 or Th-232 and Ra-228 are both present, not in secular equilibrium, the guidelines apply to the higher concentration. If other mixtures of radionuclides occur, the concentrations of individual radionuclides shall be reduced so that (1) the dose for the mixtures will not exceed the basic dose limit, or (2) the sum of ratios of the soil concentration of each radionuclide to the allowable limit for that radionuclide will not exceed 1 ("unity").

[j] These guidelines represent allowable residual concentrations above background averaged across any 15-cm-thick layer to any depth and over any contiguous 100 m^2 surface area.

[k] If the average concentration in any surface or below-surface area, less than or equal to 25 m^2, exceeds the authorized limit of guideline by a factor of $(100/A)^{1/2}$, where A is the area or the elevated region in square meters, limits for "hot spots" shall also be applicable. Procedures for calculating these hot spot limits, which depend on the extent of the elevated local concentrations, are given in the DOE Manual for Implementing Residual Radioactive Materials Guidelines, DOE/CH/8901. In addition, every reasonable effort shall be made to remove any source of radionuclide that exceeds 30 times the appropriate limit for soil, irrespective of the average concentration in the soil.

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," February 1990.

EXHIBIT IV

BUILDING T030 FACILITY FINAL REPORT

ENERGY TECHNOLOGY ENGINEERING CENTER

No. 030-AR-0002 Rev. ___
Page 1 of 17
Orig. Date Nov. 13,1997
Rev. Date ________

OPERATED FOR THE U.S. DEPARTMENT OF ENERGY
ROCKETDYNE DIVISION, Boeing North American, Inc.

FINAL REPORT

DRR 26084

TITLE: DECONTAMINATION & DECOMMISSIONING OF BUILDING T030

- APPROVALS -

Originator A. L. Pascolla *A. L. Pascolla*

P. H. Horton *[signature]*
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CONTENTS

FIGURES

1. INTRODUCTION

Boeing North American'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 performed 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 were under license by the Nuclear Regulatory Commission (NRC) and the State of California Radiological Health Branch of the Department of Health Services.

Several buildings and land areas, became radiologically contaminated as a result of the various operations which included ten developmental 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 normal, depleted, and enriched isotopic abundance's), plutonium, Am-241, fission products (primarily Cs-137, and Sr-90 present as a mixed fission product that has not been separated), activation products (tritium [H-31], Co-60, Eu-152, Eu-154, Ni-63, Pm-147, and Ta-182).

Decontamination and decommissioning (D&D) of contaminated facilities began in the late 1960's and continue as the remaining DOE nuclear program operations have been terminated. As part of this D&D program, Rocketdyne performed decommissioning and final status surveys of a number of facilities that supported the various nuclear-related operations during the latter part of the 1950's and have 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.

2. BACKGROUND

2.1 LOCATION

Building T030 is located within Rocketdyne's Santa Susana Field Laboratory (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. The SSFL location relative to the Los Angeles area and surrounding vicinity is shown in Figure 1. An enlarged map of the neighboring SSFL communities is presented in Figure 2. The Santa Susana Field Laboratory which includes Area IV, shown in Figure 3. The layout of Building T030, Figure 4 . Photograph of Building T030 looking west at the east wall , Figure 5. Photograph of Building T030 northern concrete shielding wall is shown in Figure 6.

2.2 BUILDING CHARACTERISTICS AND SITE TOPOGRAPHY

Building T030 was constructed in 1958 as a "Particle Accelerator Facility". The building has a total enclosed area of 2,311 ft^2. The facility consists of two connecting sections, both with steel framing, siding, and roofs. The rear open (west) section was constructed at a right angle to the front office (east) section. The rear section was configured to accommodate a low-voltage particle accelerator used as a proton on tritium (P-T) neutron source. An outside concrete wall, north of the west section, provided shielding for the accelerator beam. Men's and women's restrooms were built into the facility so that the facility provided a complete self-contained accelerator test installation. A fenced-in (asphalt area) between Building T030 and Building T641 was previously used as a palletized material holding area. To the north of Building T030, south of Building T641, and west of both buildings are outcroppings of Chatsworth sandstone formation. This formation is only about 50 ft from the north and west sides of Building T030.

2.3 OPERATING HISTORY

After construction in 1958, a Van de Graaf accelerator was moved into the facility in 1960. The accelerator could provide a proton beam of up to tens of microamperes in current, with continuously adjustable energies from a few hundred KeV up to a maximum of about 1 MeV. The particle beam was well focused, with a diameter of a few millimeters Neutrons were generated using a tritium target via the $^3H(p,n)^3He$ reaction. Five -gallon cans of borated water were used for neutron shielding around the machine.

2.3 OPERATING HISTORY (cont.)

The accelerator was operated from 1960 through 1964, at which time the facility was decommissioned. Even though the facility was not in use, the accelerator remained in the facility after 1964. In 1966, a smear survey of the accelerator (Ref. 4) showed significant tritium contamination. It was believed that the tritium contamination had not spread to surrounding areas. Following removal of the accelerator in 1966, the building was surveyed and no residual contamination was found. The building was released for other uses, and had subsequently been used as an office building for purchasing and on-site traffic. In 1988 a second radiological survey was performed (Ref 1) confirming the 1966 survey results. The Building was utilized as an office area until 1995.

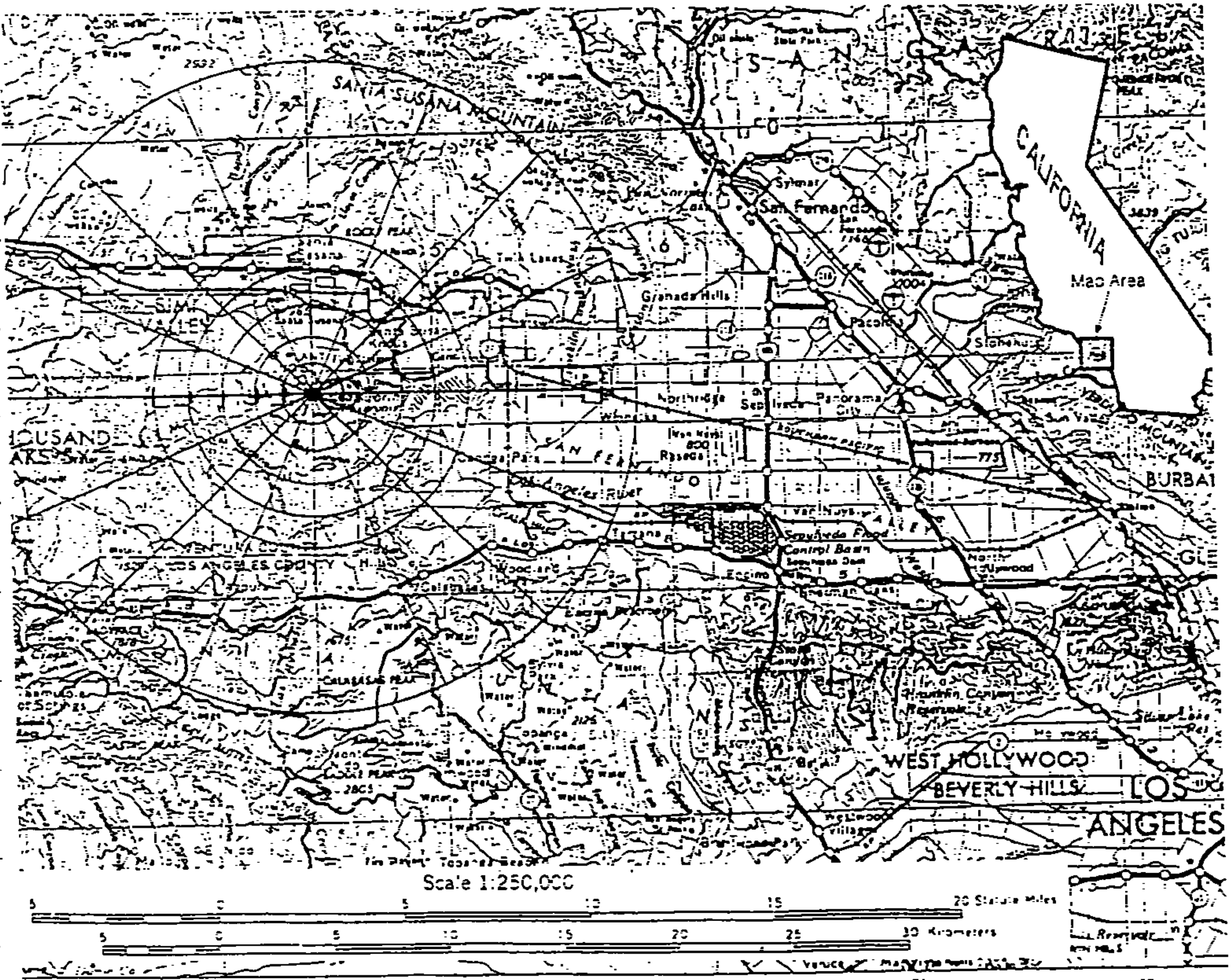

Figure 1 Location of SSFL Relative to Los Angeles Area

Figure 2 Neighboring SSFL Communities

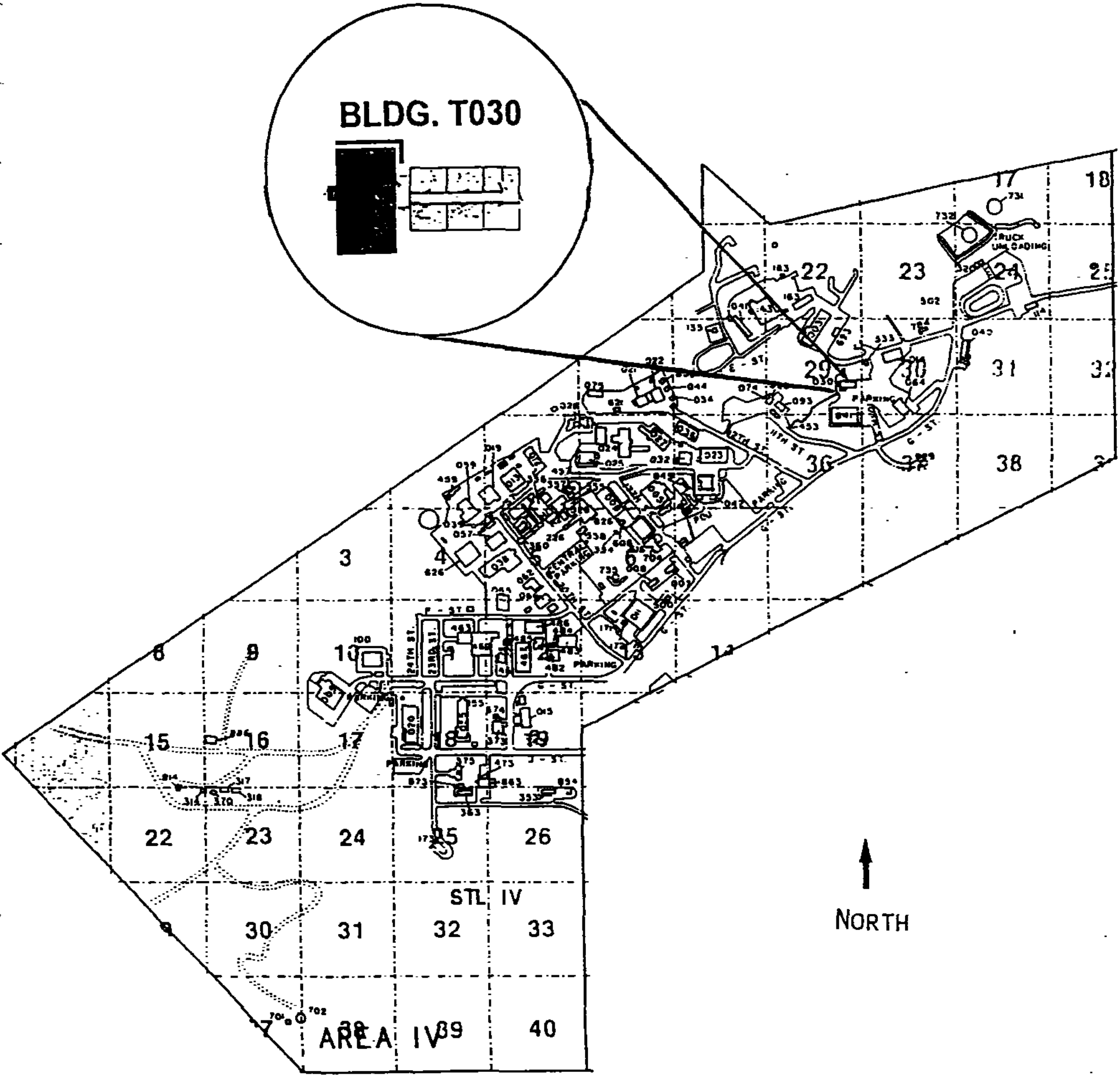

Figure 3 Santa Susana Field Laboratory (Area IV)

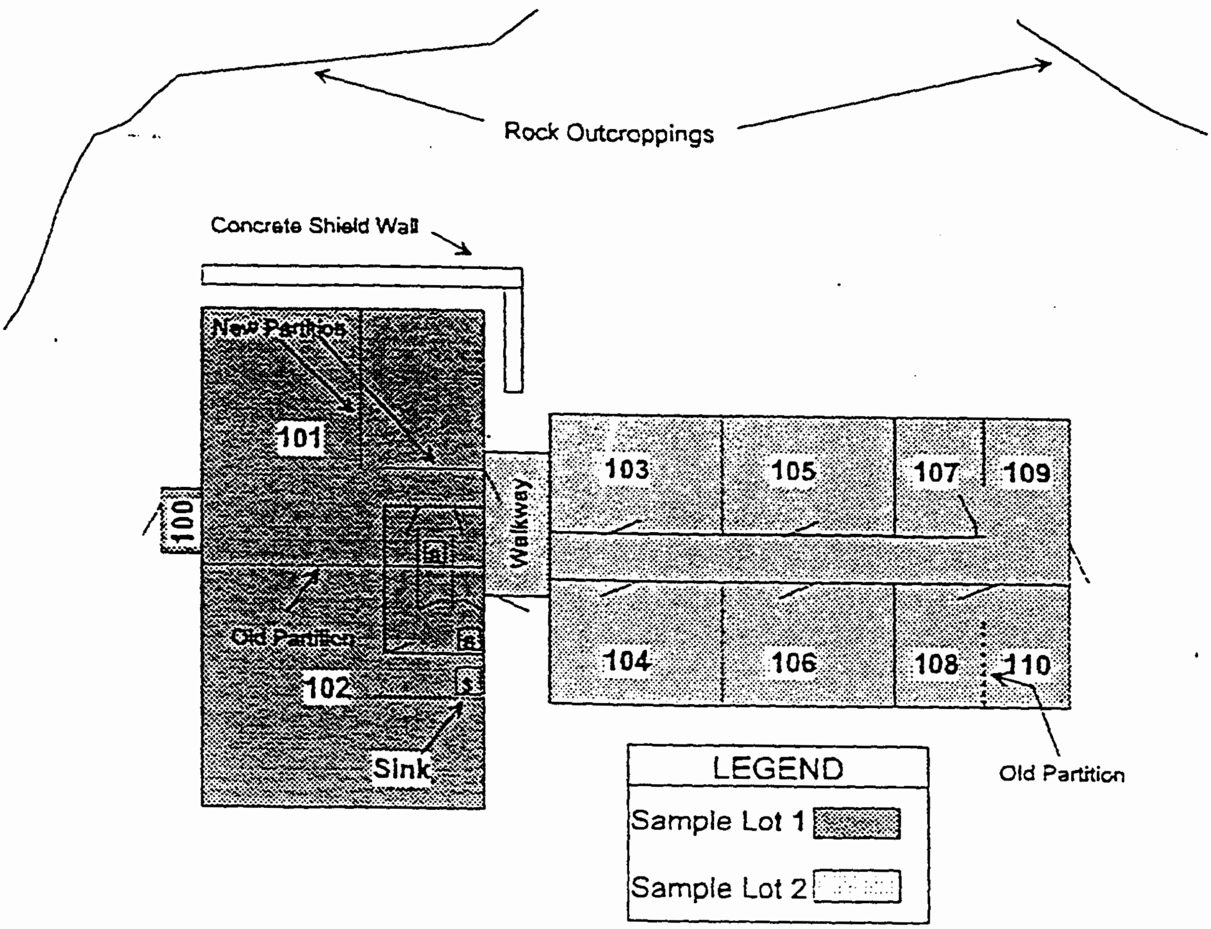

Figure 4 Layout of Building T030

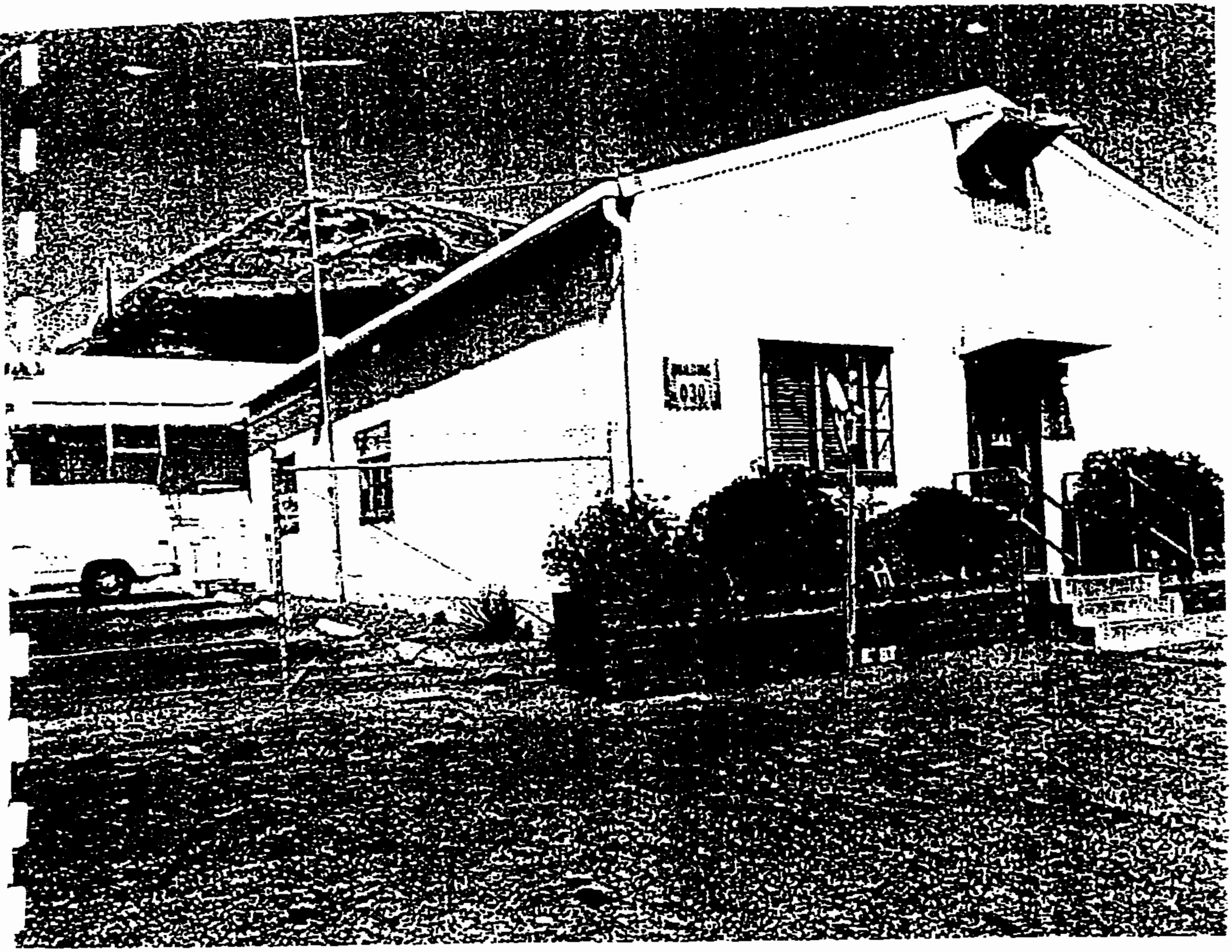

Figure 5 Photograph of Building T030 Looking West at East Wall

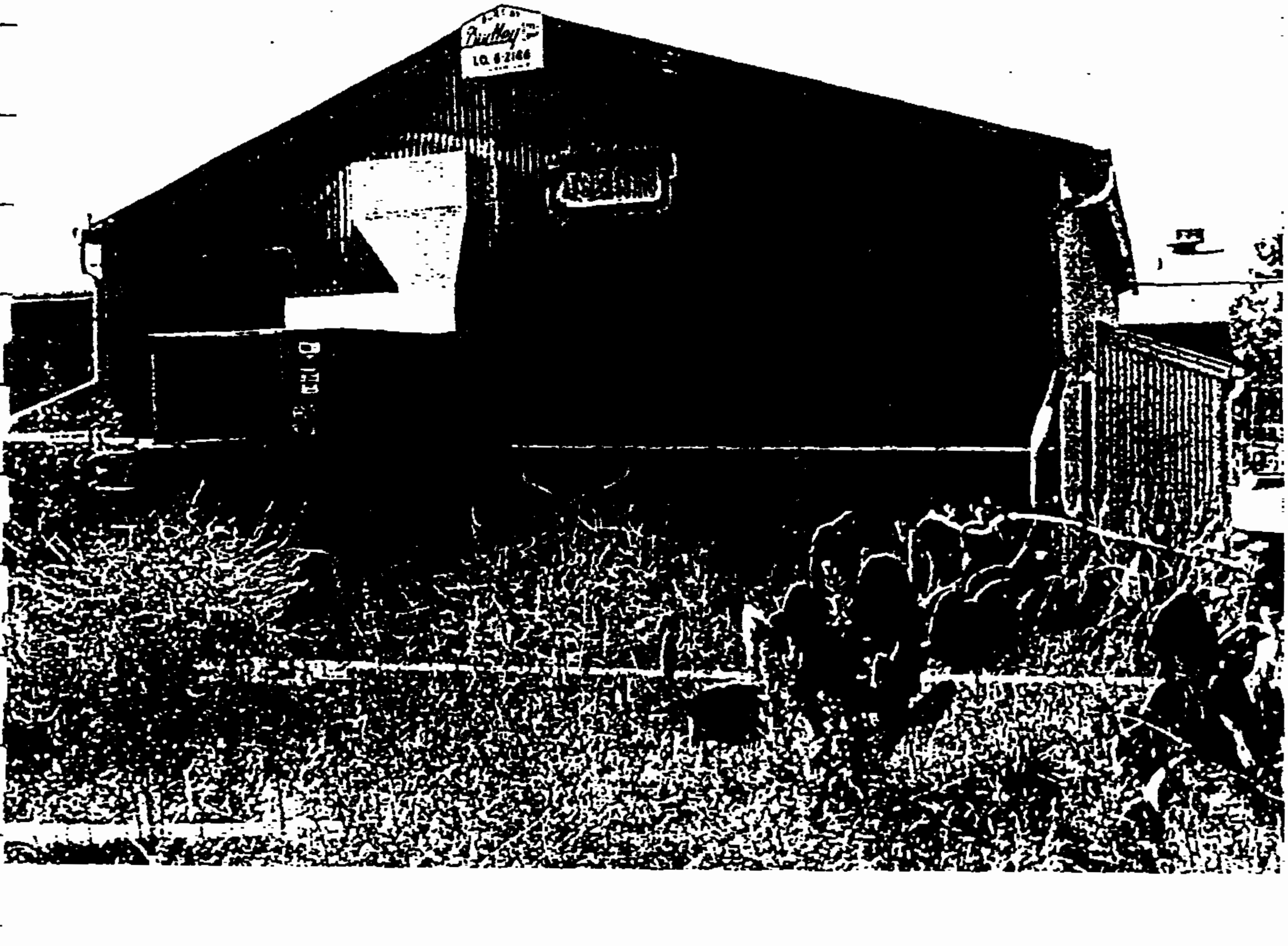

Figure 6 Photograph of Building T030 Looking at Northern Concrete Wall

3. SUMMARY

Building T030, located at Rocketdyne's SSFL, was used for testing, utilizing the Van de Graaf accelerator, between the years of 1960 and 1964.

In the latter part of 1965 through the early part of 1966, Building T030 was decommissioned including the removal of the accelerator.

In 1996 a Final Radiological Survey (REF. 6) was performed and demonstrates that Building T030 meets the requirements of DOE, NRC, and the State of California for release without radiological restrictions.

4. PRIOR DECONTAMINATION

In 1988, a general radiological survey was conducted to clarify and identify areas at the Rocketdyne SSFL requiring further radiological inspection or remediation (Reference 1). Building T030 was included in this survey. The scope of the Building T030 survey included ambient gamma exposure rate measurements, "indication" beta surveys of the accelerator room and outside paved area used for storing palletized containers, and exterior soil samples for tritium content. The result of that survey showed no detectable contamination in the facility. Tritium analyses on ten soil samples, and the beta survey, showed no detectable activity. Background-corrected gamma measurements were all less than the acceptance limit of 5 μR/hr.

In September 1995, the Oak Ridge Institute for Science and Education (ORISE) conducted a confirmatory survey of several facilities at the SSFL, including Building T030 (Ref. 2). With the exception of a single finding for removable tritium contamination of 6,600 dpm/100 cm^2 (below the acceptance limit of 10,000 dpm/100 cm^2) found on the north wall of the accelerator room, no unusual findings were noted. However, ORISE did question the completeness of the 1988 survey. Specifically, ORISE recommended complete measurements of total and removable surface activity, and additional sampling for tritium activity in the accelerator area. In view of ORISE's advice, a comprehensive final survey of Building T030 was conducted in 1996. (Ref. 2)

3. 5. PROJECT ACTIVITIES

3.1

3.2 PHASE I (1988)

Buildings T030 and T641 and the surrounding area were inspected for radioactive contaminants. Gamma exposure rate measurements indicated that no residual radioactive contamination existed in T030's accelerator room; Building T030's palletized container storage area; Building T641's shipping dock; or in the nearby area. Gaussian probability plots of these data and of "background" areas show the great difficulty in assessing the radiological condition of a clean facility based on an acceptance requirement relative to "background". Variability of gamma exposure rates is quite large and depends on whether the measurement was made indoors, outdoors, or near a large sandstone outcropping. Accounting for these variations and deviations, and subtracting a value that represents "natural" background gamma radiation at SSFL, it was concluded through inspection by variables that the area is clean of any residual radioactive contamination, with a consumer's risk of acceptance of 0.1 at an LTPD of 10%. Ten surface soil samples collected randomly in locations near Building T030 all show tritium (^{3}H) concentrations less than the overall error reported by the analytical laboratory. No statistically significant tritium activity was found. Further radiological investigation of the T030 accelerator room and palletized-container storage area using a beta probe showed in all cases no detectable activity. Within the limits prescribed by the Site Survey Plan, this area was judged to be clean of radioactive contaminants. Further radiological investigation and remedial action was not indicated.

3.3 PHASE II (1996)

Survey measurements were made for alpha, beta-gamma, and tritium surface contamination on the interior walls, floors, and ceilings in Building T030, and for ambient gamma exposure rate at 1 meter above the interior floors For the radiological survey, interior rooms in Building T030 were divided into two areas, Affected Areas and Unaffected Area. Affected Areas were defined as those areas which have known or suspected contamination based on either past measurements or site history. Unaffected Areas included all areas of a facility not classified as Affected, and were those areas which were not expected to contain any contamination based on previous measurements or site history. Statistical interpretation of the survey data was separated between Affected (Lot 1) and Unaffected Areas (Lot 2). Lot 1 included Rooms 100, 101, 102, and adjacent restrooms. Lot 2 included all other areas in the eastern section of the facility, including the walkway, Rooms 103 through 108, and the connecting aisles. All measurements were 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.

4. 6. WASTE

4.1 PHASE I (1966)

The Van de Graaf Accelerator was removed from Building T030. Disposition of the accelerator could not be determined.

4.2 PHASE II (1996)

Approximately 2,311 ft^2 of asbestos floor tile was removed and disposed of as non-radioactive hazardous waste.

7. PERSONNEL EXPOSURE

No files or documents could be located to determine personnel radiation or chemical exposure. Radioactivity in this facility was so low that radiation doses would have been negligible.

8. PROJECT COST

The radiological survey was the only cost associated with Building T030. This cost cannot be isolated from total radiological facility survey's. Costs associated with the removal of the asbestos floor tile was approximately $9,200.

9. REFERENCES

1. Rockwell Document GEN-ZR-0007, "Radiological Survey of Shipping/Receiving and Old Accelerator Area - Buildings T641 and T030," August 19, 1988.

2. T. J. Vitkus and T. L. Bright, "Verification Survey of the Interim Storage Facility; Buildings T030, T641, and T013; An Area Northwest of Buildings T019, T012, and T059; and a Storage Yard West of Buildings T626 and T038; Santa Susana Field Laboratory, Rockwell International, Ventura County, California," Oak Ridge Institute for Science and Education (ORISE) Final Report, February 1996.

3. Rockwell Document SSWA-AR-0007, "Building T030 Final Radiological Survey Plan," June 25, 1996.

4. Rockwell Internal Letter, "Tritium Smear Survey, Building T030 Van de Graaf Accelerator," A. R. Mooers to W. F. Heine, March 29, 1966.

5. Rockwell Document 030-SP-0004, "Building T030 Final Survey Procedure," June 16, 1995.

6. "Final Radiological Survey" of Building T030, 030-AR-0001, January 22, 1997.

EXHIBIT V

FINAL DOCUMENTATION AND RADIOLOGICAL SURVEY OF BUILDING T030

ENERGY TECHNOLOGY ENGINEERING CENTER	No. 030-AR-0001 Rev.
OPERATED FOR THE U.S. DEPARTMENT OF ENERGY ROCKETDYNE DIVISION, BOEING NORTH AMERICAN, INC.	Page 1 of 73 Orig. Date 1/22/97 Rev. Date

TITLE: FINAL RADIOLOGICAL SURVEY REPORT FOR BUILDING T030

- APPROVALS -

Originator	E.R. McGinnis B. M. Oliver/ E.R. McGinnis	ER	P. D. Rutherford
Prog. Mgr.	M. E. Lee	QA	S. Reeder

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CONTENTS

FIGURES

TABLES

ABSTRACT

In 1988, a general radiological survey was conducted to clarify and identify areas at the Santa Susana Field Laboratories (SSFL) requiring further radiological inspection or remediation (Reference 1). Building T030 was included in this survey, and the results showed no detectable contamination in the facility. Background-corrected gamma measurements conducted outside of the facility were all less than the acceptance limit of 5 μR/hr.

In September 1995, the Oak Ridge Institute for Science and Education (ORISE) conducted a confirmatory survey of several facilities at the SSFL, including Building T030 (Reference 2). With the exception of a single finding for removable tritium contamination of 6,600 dpm/100 cm^2 (below the acceptance limit of 10,000 dpm/100cm^2) found on the north wall of the accelerator room, no unusual findings were noted. However, ORISE did question the completeness of the 1988 survey. Specifically, ORISE recommended complete measurements of total or removable surface activity, and additional sampling for tritium activity in the accelerator area. In view of ORISE's advice, a comprehensive final survey of Building T030 was conducted in 1996.

The results of the 1996 survey are presented in this report. The results demonstrate that Building T030 meets the requirements of DOE, NRC, and State of California for the release of facilities 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 Rocketdyne'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 these 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.

This report describes the final release survey performed for Building T030, and 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, beta-gamma, and tritium surface contamination on the interior walls, floors, and ceilings in Building T030, and for ambient gamma exposure rate at 1 meter above the interior floors.

For the radiological survey, interior rooms in Building T030 were divided into two areas, Affected Areas and Unaffected Areas. Affected Areas were defined as those areas which have known or suspected contamination based on either past measurements or site history. Unaffected Areas included all areas of a facility not classified as Affected, and were those areas which were not expected to contain any contamination based on previous measurements or site history. Statistical interpretation of the survey data was separated between Affected (Lot 1) and Unaffected areas (Lot 2): Lot 1 included Rooms 100, 101, 102 and adjacent restrooms; Lot 2 included all other areas in the eastern section of the facility, including the walkway, Rooms 103 through 108, and the connecting aisles.

All measurements were 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.

3. BACKGROUND INFORMATION

3.1 Location

Building T030 is located within Rocketdyne'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 vicinity 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 T030 is located. A plan view of Building T030 and its adjoining areas is shown in Figure 4. Building T030 is located on government-optioned land.

3.2 Topography and Building Characteristics

Building T030 is situated on 10th Street, off the west side of G Street, among several adjacent buildings on paved ground. The building was constructed in 1958 for research with a small accelerator neutron source. The building has a total enclosed area of 2,311 ft^2. The facility consists of two connected sections, both with steel framing, siding and roofs. The rear section (west) was constructed at a right angle to the front office (east) section. The rear section was configured to house a Van de Graaff accelerator used as a proton on tritium neutron source. An outside concrete wall was constructed on the north and east sides of the west section to provide shielding for the proton beam. Men's and women's restrooms were built into the west section of the building. Rock outcroppings extend from near the building to the west, northwest, and northeast.

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

Figure 2. Neighboring SSFL Communities

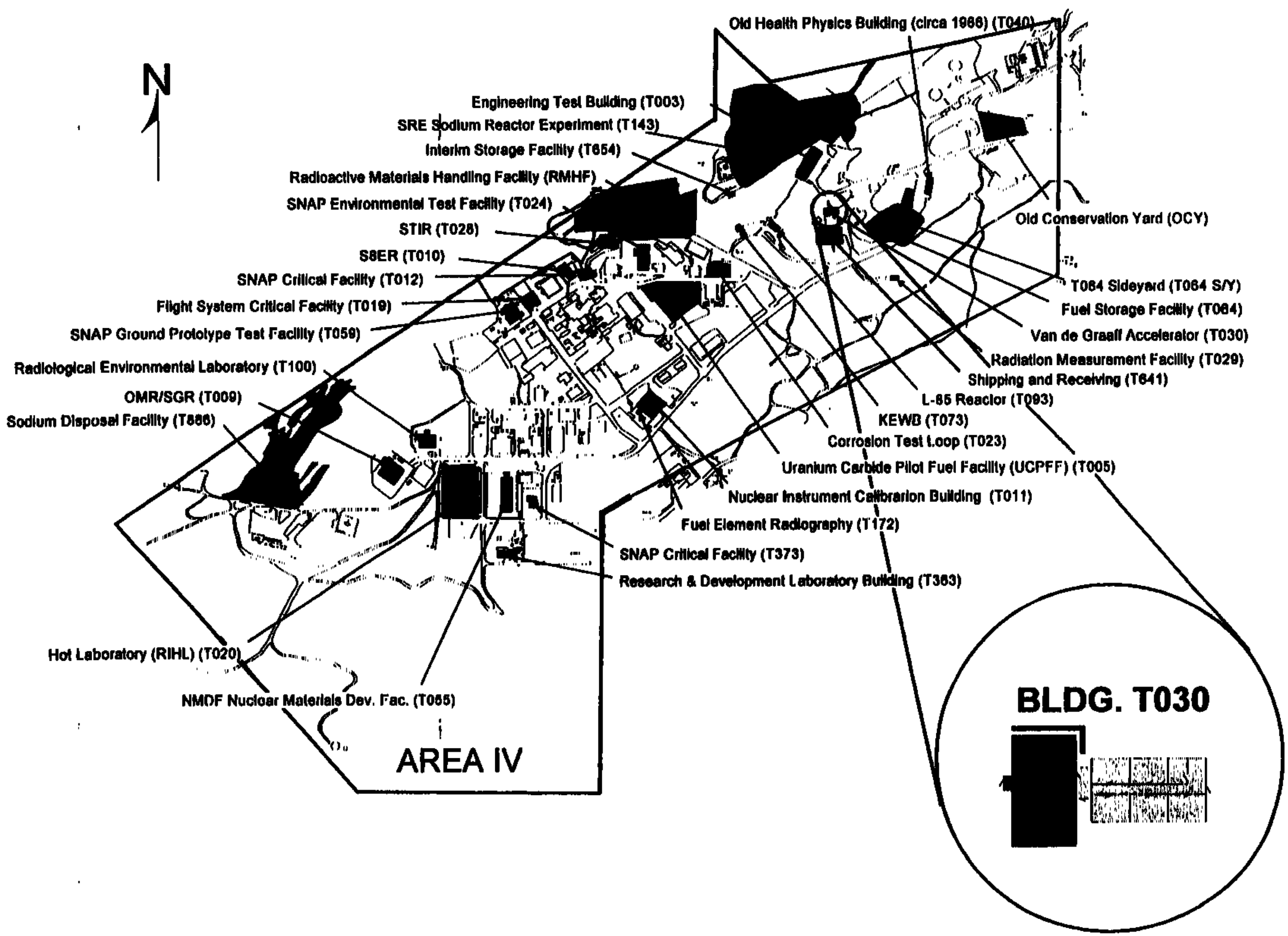

Figure 3. Santa Susana Field Laboratory (SSFL) Area IV

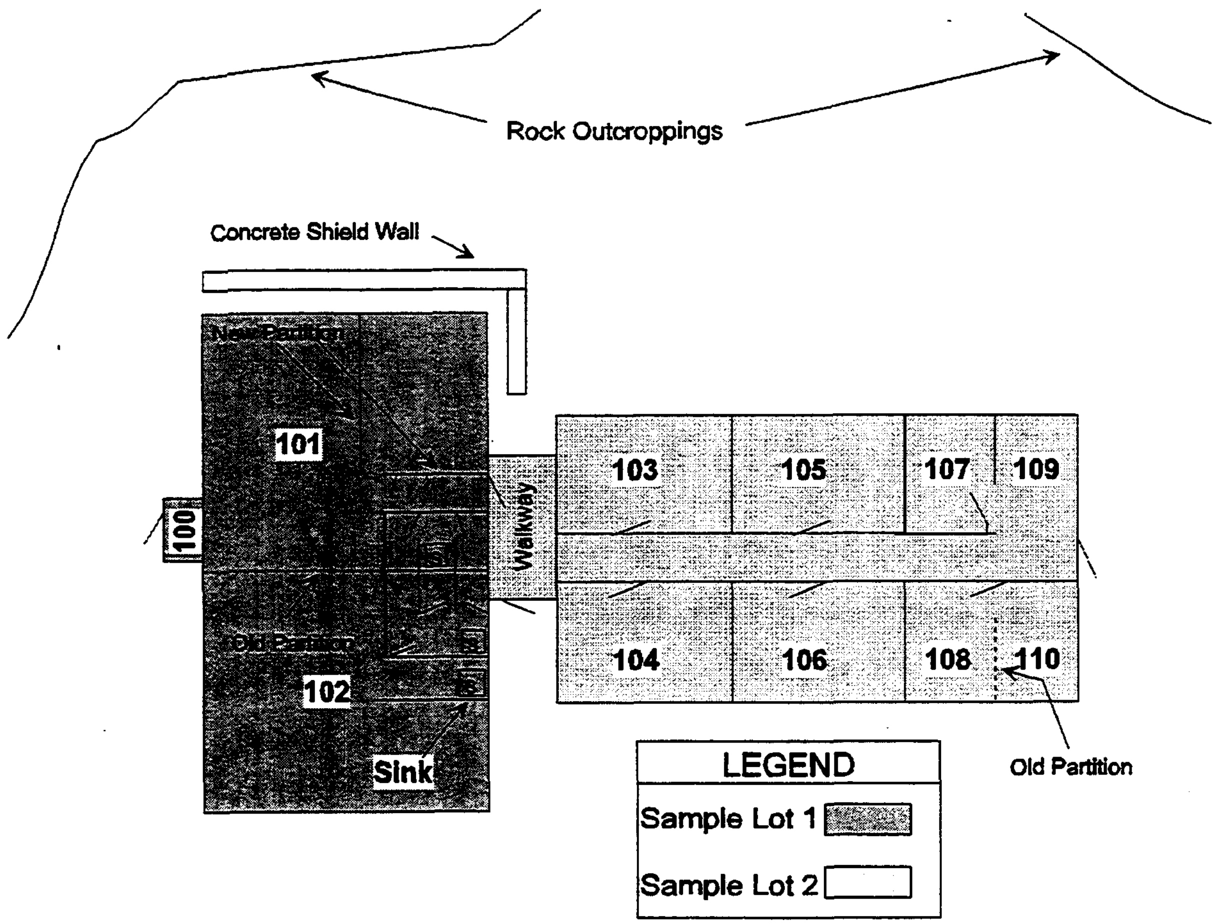

Figure 4. Layout of Building T030, with Identification of Sample Lots

3.3 Operating History

After construction in 1958, a Van de Graaff accelerator was moved into the facility in 1960. The accelerator could provide a proton beam of up to tens of microamperes in current, with continuously adjustable energies from a few hundred keV up to a maximum of about 1 MeV. The particle beam was well focused, with a diameter of a few millimeters. Neutrons were generated using a tritium target via the $^{3}H(p,n)^{3}He$ reaction. Five-gallon cans of borated water were used for neutron shielding around the machine. The accelerator was operated from 1960 through 1964, at which time the facility was decommissioned.

3.4 Decommissioning Efforts

Even though it was not in use, the accelerator remained in the facility after 1964. In March 1966, a smear survey of the accelerator (Reference 4) showed significant tritium contamination on the accelerator. It was believed that the tritium contamination had not spread to surrounding areas. Following removal of the accelerator around 1966, the building was surveyed and no residual contamination was found.

In 1988, a general radiological survey was conducted to clarify and identify areas at the Santa Susana Field Laboratories (SSFL) requiring further radiological inspection or remediation (Reference 1). Building T030 was included in this survey. The scope of the Building T030 survey included ambient gamma exposure rate measurements, "indication" beta surveys of the accelerator room and outside paved area used for storing palletized containers, and exterior soil samples for tritium content. The results of that survey showed no detectable contamination in the facility. Tritium analyses on ten soil samples, and the beta survey, showed no detectable activity. Background-corrected gamma measurements were all less than the acceptance limit of 5 μR/hr.

In September 1995, the Oak Ridge Institute for Science and Education (ORISE) conducted a confirmatory survey of several facilities at the SSFL, including Building T030. The survey included a review of the Rocketdyne survey data and methodology for Building T030, and a confirmatory survey for alpha, beta and gamma contamination. With the exception of a single finding for removable tritium contamination of 6,600 dpm/100 cm^2 found on the north wall of the accelerator room, no indications of contamination were noted. The 6,600 dpm/100 cm^2 value is below the release criteria of 10,000 dpm/100cm^2.

Notwithstanding the above findings, ORISE did question the suitability of the 1988 survey as a final status release survey. Specifically, ORISE recommended complete measurements of total or removable surface activity, and additional sampling for tritium activity in the accelerator area. In view of ORISE's advice, a complete final survey for T030 was conducted, and that is the subject of the present report.

4. SURVEY RESULTS

4.1 Overview

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 T030 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 T030 final survey file in SSFL, Building 4100.

4.2 Scope of the Survey

For the final radiological survey of Building T030, the interior rooms were separated into two sample lots as shown in Figure 4. The sample lots were treated separately for the purposes of statistical data analyses. The distinguishable property for selecting the sample lots was the potential tritium contamination in areas formerly used to house the proton accelerator in the 1960's. The two sample lots are shown in Table 1, with the corresponding type of surveys performed on each.

Table 1. Sample Lots Surveyed

Sample Lot No.	Room or Area	*Type of Survey Performed*					
		Total		Removable			
		Alpha	Beta	Alpha	Beta	Tritium	Ambient Gamma[a]
1	Rooms 100, 101, 102, and adjacent restrooms	x	x	x	x	x	x
2	Rooms 103 through 110, hallway and walkway	x	x	x	x	x	x

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

4.3 Survey Methods

4.3.1 Sampling Methods

The method and type of survey measurement depended on the type of surfaces involved. For both Sample Lots, a uniform 1-m by 1-m grid was superimposed on the floors, walls, and ceilings of the entire sample lot area. For grid surfaces less than 1-m x 1-m, an area of 1-m^2 was surveyed by combining them with other adjacent remnant areas. Survey methods meet or exceed NRC (NUREG/CR-5489, Reference 6) and State of California guidelines (DECON-1, Reference 7) for final release surveys.

4.3.1.1 Sample Lot 1 (Affected Area)

A 100% direct qualitative frisk of the floor, walls, and ceiling was performed using an alpha scintillation probe and a G-M pancake probe. Based on any identification of higher activity areas (or otherwise in the surveyor's judgment) in the qualitative scan, one 1-m x 1-m area within each 3-m x 3-m grid was selected for quantitative surveying, including removable tritium activity. A total of 68 data points were surveyed. For grid surfaces less than 1-m x 1-m, an area of 1m^2 was surveyed by combining them with other adjacent remnant areas.

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. Sink traps were removed and qualitatively analyzed on a multichannel analyzer with a thin window, high purity germanium detector. Twenty percent of all other structural surfaces (pipes, conduit, light fixtures, etc.) were surveyed for total and removable alpha and beta activity. A survey method of 6 inches per 2.5 feet was utilized for the frisks.

4.3.1.2 Sample Lot 2 (Unaffected Area)

A 10% direct qualitative frisk of each surface (walls, floor, ceiling) was performed using an alpha scintillation probe and a G-M pancake probe. The surfaces were frisked in one direction. The probe was then shifted a distance of 10 times the probe diameter and a frisk was performed in the opposite direction. This procedure was continued until the entire 10% was covered. Additional readings were taken where contamination was more likely to have accumulated, such as floor baseboards, window sills, and door thresholds, etc. Within each two 3-m x 3-m grids, one 1-m x 1-m was selected for quantitative sampling, including removable tritium activity. For grid surfaces less than 1-m x 1-m, an area of 1m^2 was surveyed by combining them with other adjacent remnant areas.

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. Ten percent of all other structural surfaces (pipes, conduit, light fixtures, etc.) were surveyed for total and removable alpha and beta activity. A survey method of 6 inches per 5 feet was utilized for the frisks.

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. A 5-min integrated count time was used for both alpha and beta detectors.

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 8 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 SSFL, Building 4100 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 Cs-137 source, placed 1-m from the detector. A 1-min integrated count time was used.

The multi-channel analyzer used for scanning the sink traps is calibrated annually with two NIST traceable, multi-isotopic sources. In addition, it is checked weekly against the sources to insure the deviation is within ± 5% of the original calibration.

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 NRC, State of California, and DOE guidelines (References 6,7, 9, and 13). For remediation of facilities at Rocketdyne's SSFL and DeSoto sites, DOE and the State have approved a set of release guidelines (Reference 10). In determining these guidelines, generally the lowest (most conservative) limits were chosen from the various agency guidelines.

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 might exist, the limits established for alpha- and beta-gamma-emitting radionuclides would be applied independently. Beta-gamma emitters 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 T030.

Measurements of average contamination were averaged over an area of 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.

Measurements of removable tritium activity were made by wiping approximately 100 cm^2 of surface area using moistened polyfoam smear discs. After the smear was made, the smear disc was sealed in a liquid scintillator counter (LSC) vial. Loaded vials were sent to an outside laboratory for analysis by scintillation counting.

Table 2. Building T030 Contamination Limit Criteria

Radionuclides	Contamination in dpm/100cm²		
	Average	**Maximum**	**Removable**
Sr-90 (separated or enriched), Th-natural, Th-232	<1,000	<3,000	<200
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), including Sr-90 as mixed fission product	<5,000 β-γ	<15,000 β-γ	<1,000 β-γ
Tritium	-	-	<10,000 β
Surface gamma exposure rate	≤ 5 μR/h above background at 1 m		

Table 3. Observed Detection Limits versus Established Limit Criteria

	Alpha[a]		Beta[a]		Tritium[a]	Ambient Gamma[b]
	Total	Removable	Total	Removable	Removable	
Limit criteria	5,000	1,000	5,000	1,000	10,000	<5.0 above background
Average observed detection limit (SSA)[c]	9.8	6.3	293	11.3	5	0.32
Observed detection limit range	9.8	3.8 - 7.2	289 - 293	11.1 - 11.7	~5	0.31 - 0.32
Ratio of detection limit to criteria[d]	0.20%	0.63%	5.9%	1.1%	0.05%	6.4%

[a]Alpha, beta, and tritium activity in dpm/100 cm^2.
[b]Ambient gamma exposure rate in μR/hr at 1 meter from surface.
[c]SSA = 1.645 x √(2 x background counts) x area factor x efficiency factor/time, in units of dpm/100 cm^2. Tritium SSA was provided by the outside laboratory.
[d]Ratio of average observed detection limit to established limit criteria (in percent).

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 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 12). Values of *k* for each sample size are calculated in accordance with the following equations:

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

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)[1], and
n = number of samples.

The statistical criteria for acceptance of the Building T030 interior final survey are presented below.

a) Acceptance: If the test statistic ($\bar{x} \div ks$) 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 5 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 6 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 ($\bar{x} \div ks$) is greater than the limit (U) and $\bar{x} \geq$ U, the region is contaminated and must be remediated. Figure 7 gives an example of sample lot rejection by the test.

Thus, based on sampling inspection, it is a reasonable 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 T030 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.

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[1] 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 7).

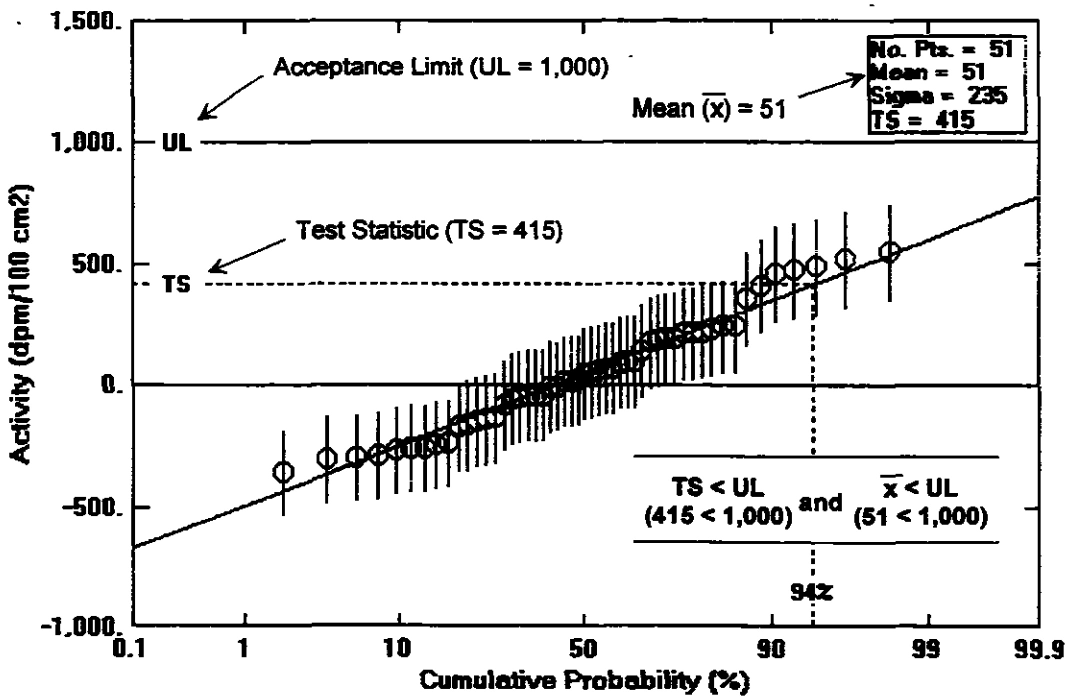


Figure 5. Example of Sample Lot Acceptance, where TS ($=\overline{x}+ks$) ≤ UL and $\overline{x}$ ≤ UL

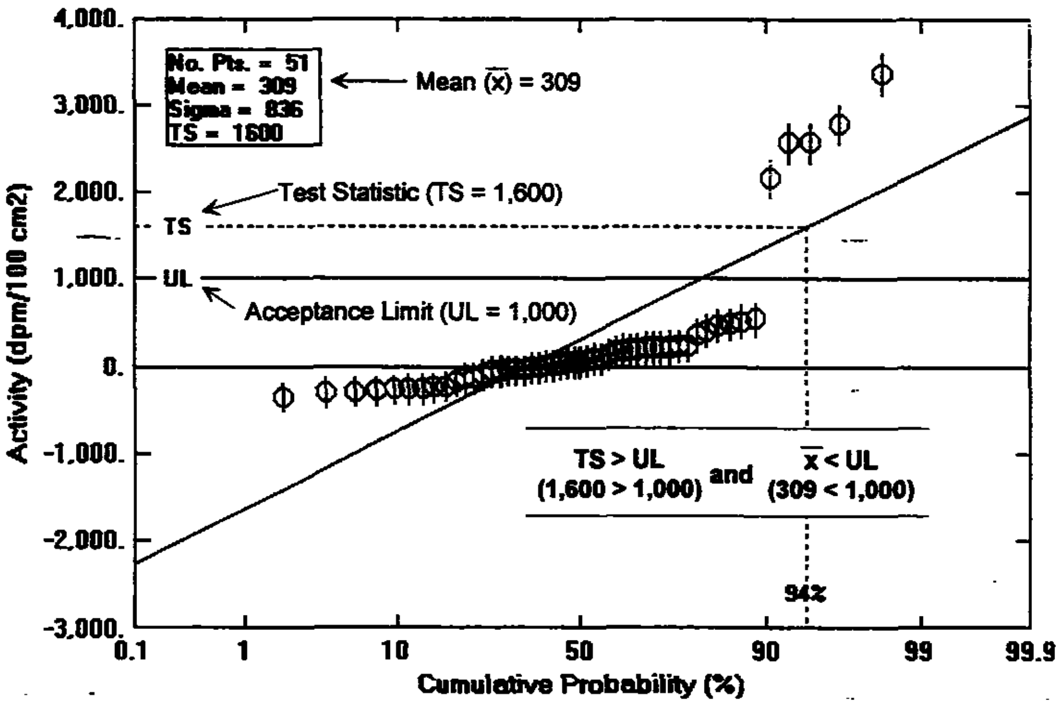


Figure 6. Example of Sample Lot Requiring Additional Measurements, where TS ($=\overline{x}+ks$) > UL and $\overline{x}$ < UL.

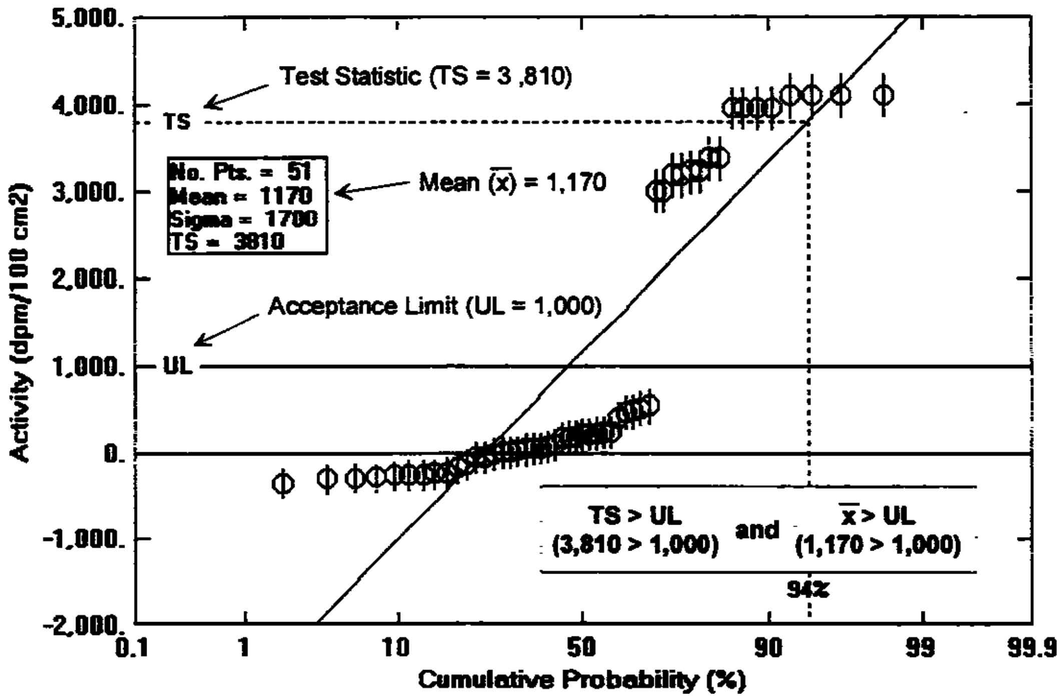


Figure 7. Example of Sample Lot Rejection, where TS (= $\bar{x}$ + ks) > UL and $\bar{x}$ > UL

4.5 Building T030 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 100, 101, 102 and adjacent bathrooms. Survey data for Lot 1 were taken in September 1996.

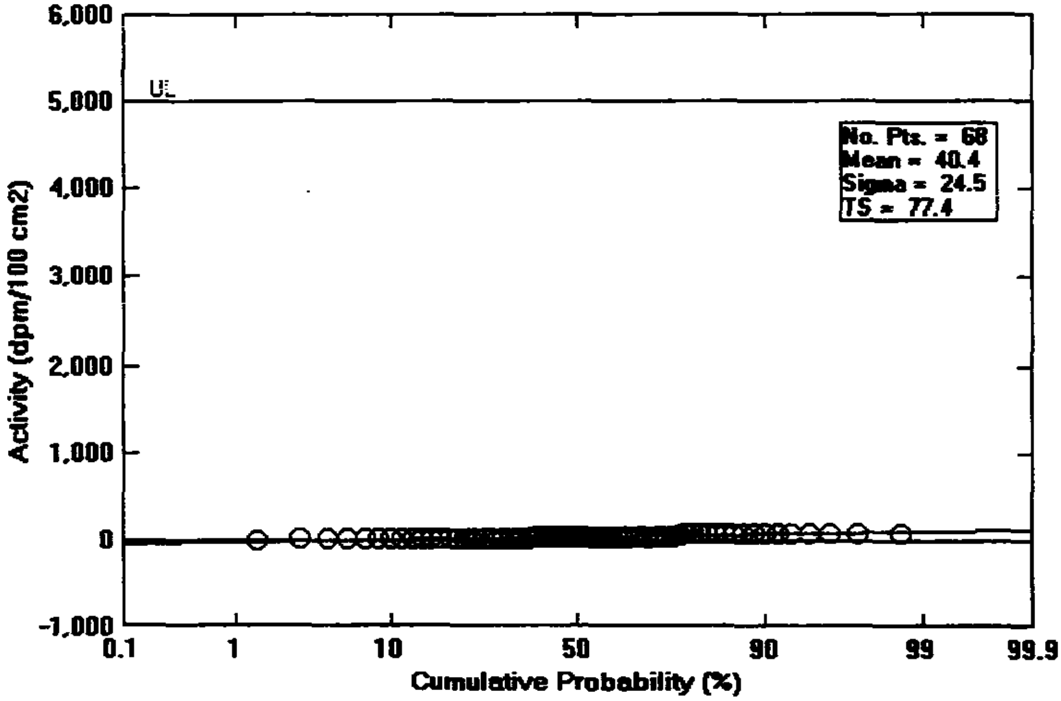
4.5.1.2 Analyses of Sample Lot 1 Data

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.

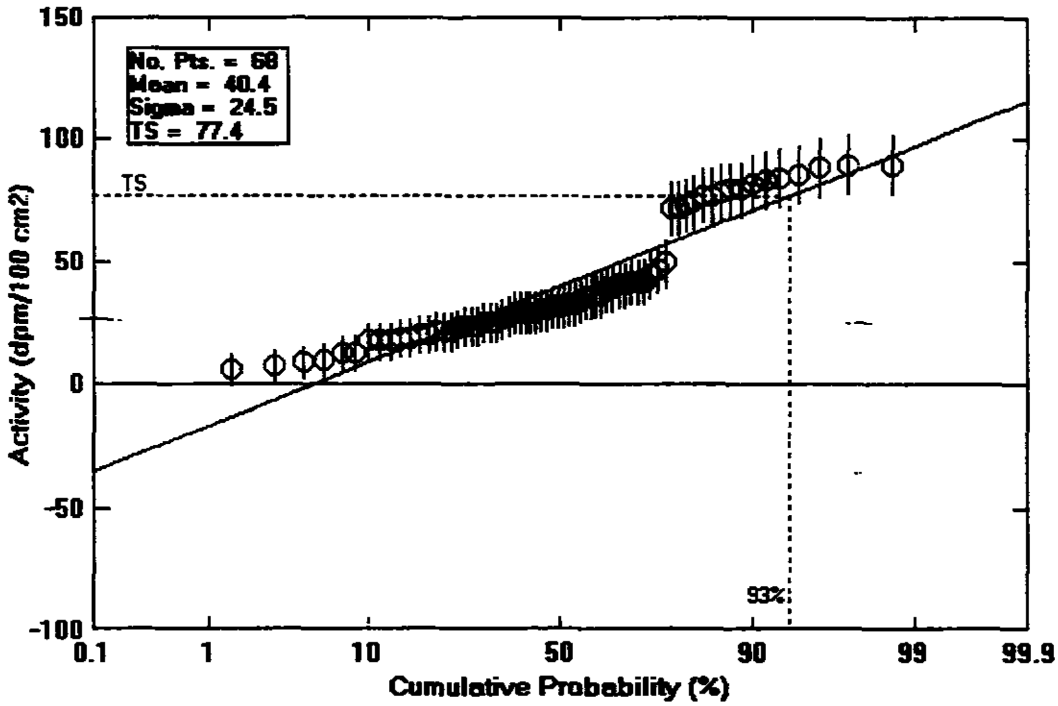
The cumulative plots for alpha, beta, and tritium survey data are shown in Figure 8 through Figure 11. These plots are shown on two scales; a normal scale to show all the data relative to the acceptance limit, and an expanded scale showing only the data and test statistic values. The purpose of the expanded 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.

The gamma survey data are shown in Figure 13. 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 T030, a background value of 8.11 μR/h was used based on measurements conducted in a similarly constructed non-radiological building (T038) located at the SSFL. The gamma exposure rate data for Building T038 is shown in Figure 14.

Sample Lot 1 statistical results are tabulated in Table 4 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 Building T030 are given in Appendix C.

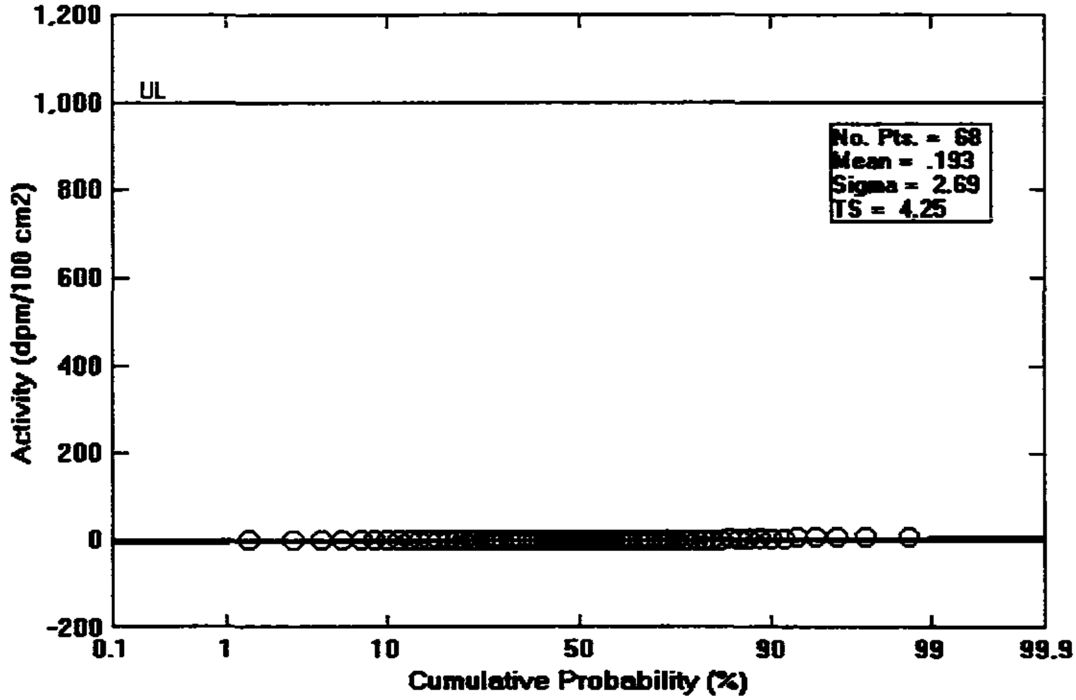


a) Normal Scale



b) Expanded Scale

Figure 8. Building T030 - Lot 1 Total Alpha Activity



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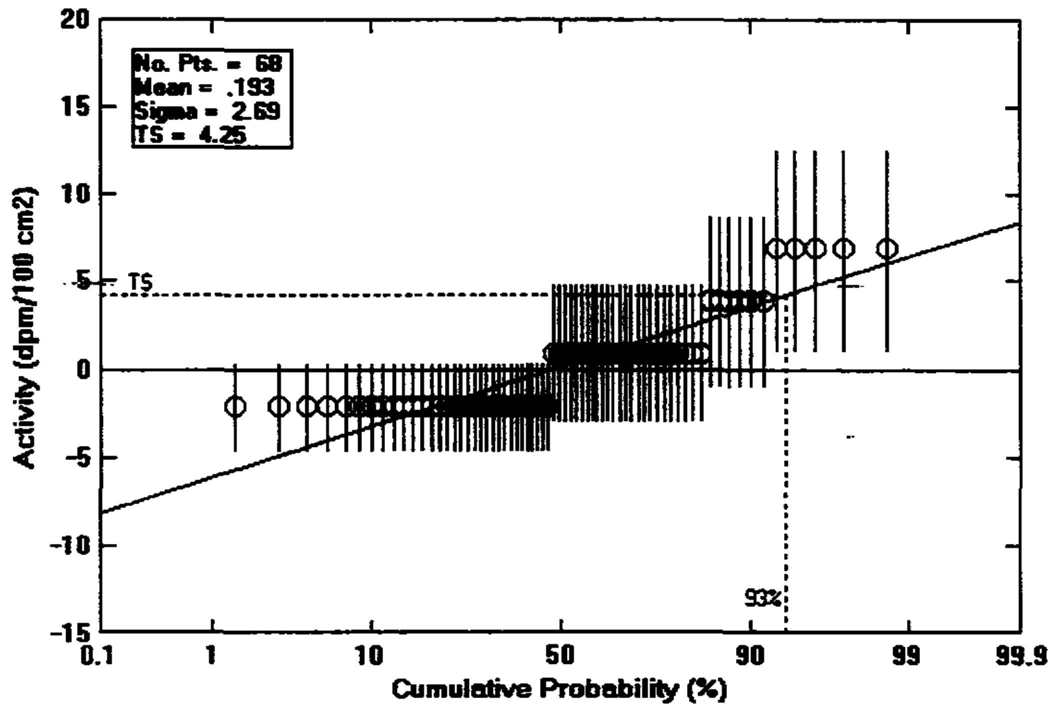
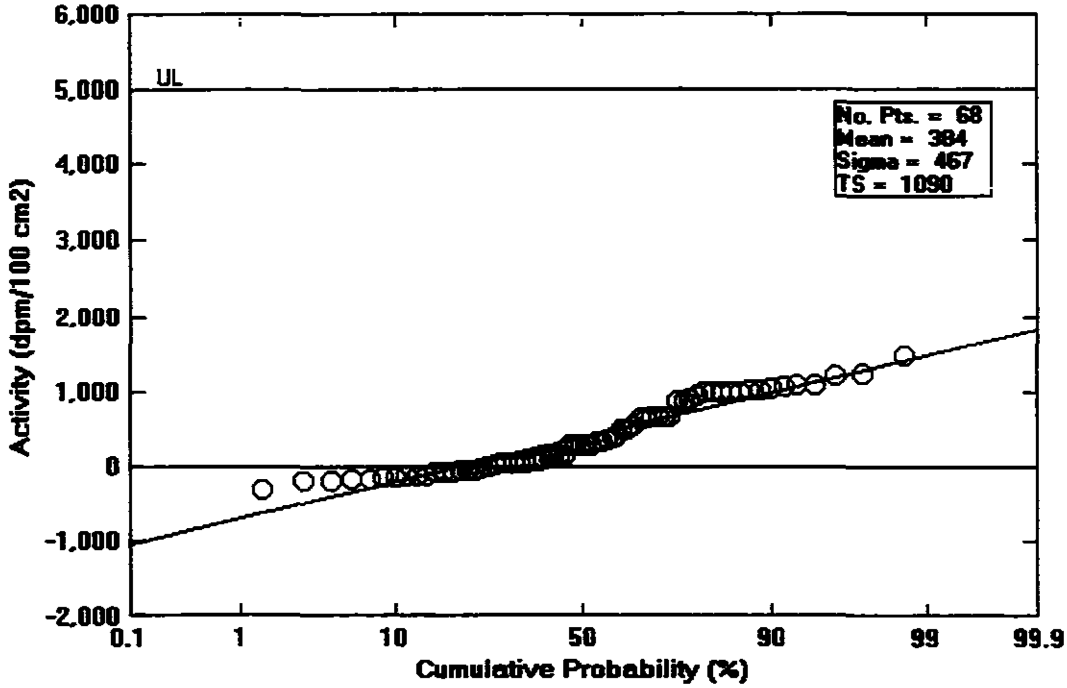
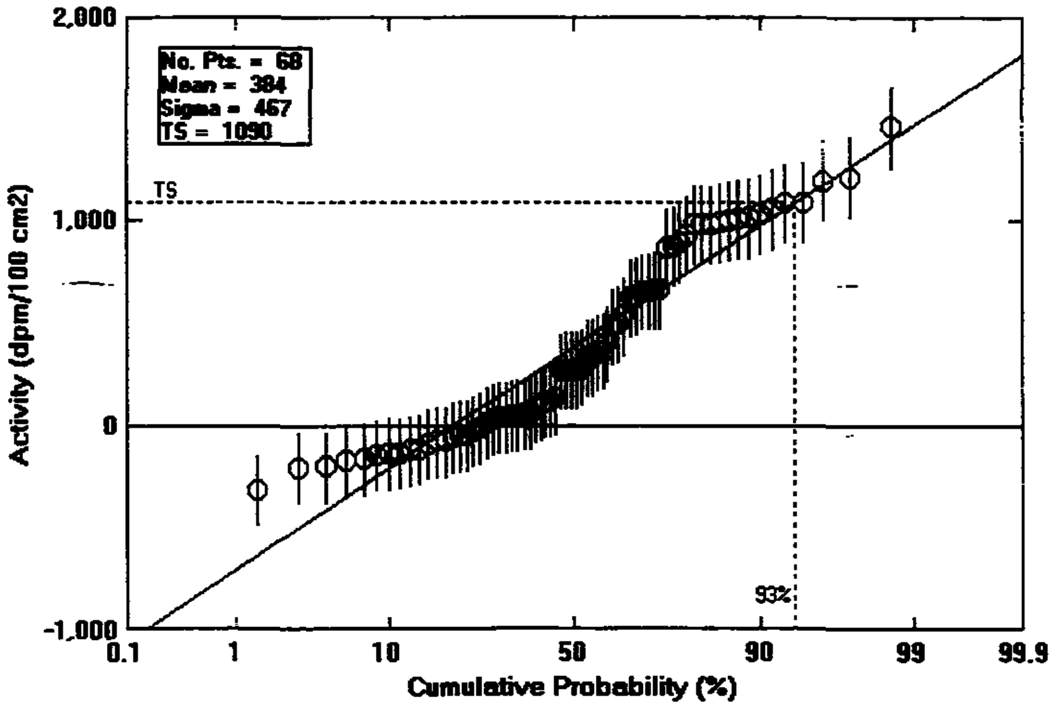


b) Expanded Scale

Figure 9. Building T030 - Lot 1 Removable Alpha Activity

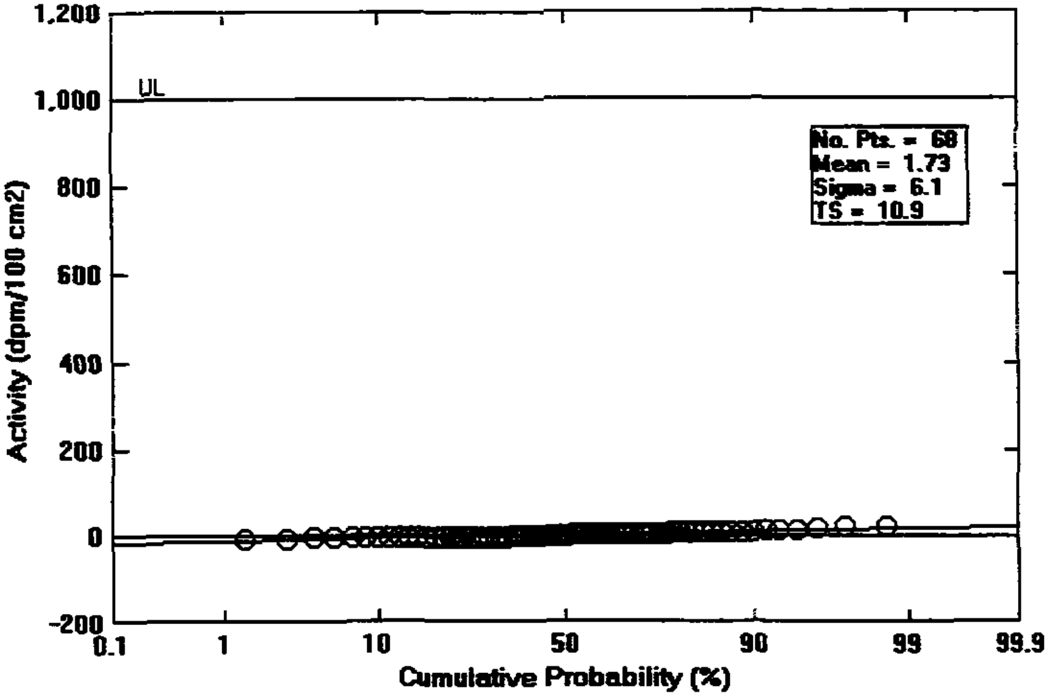


a) Normal Scale

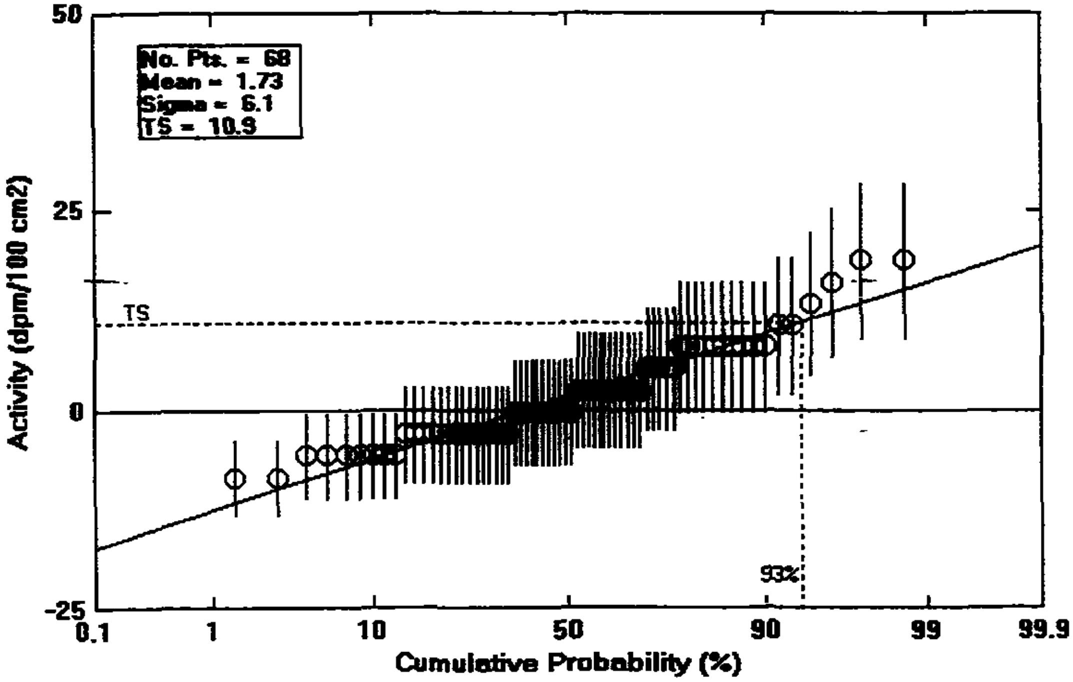


b) Expanded Scale

Figure 10. Building T030 - Lot 1 Total Beta Activity

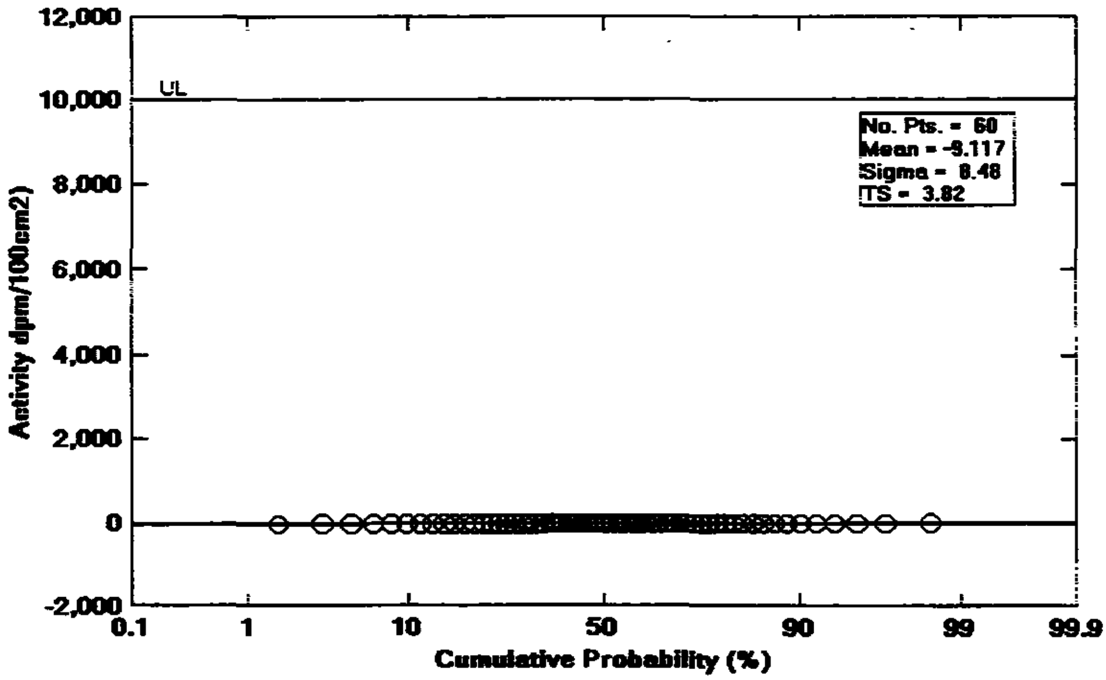


a) Normal Scale

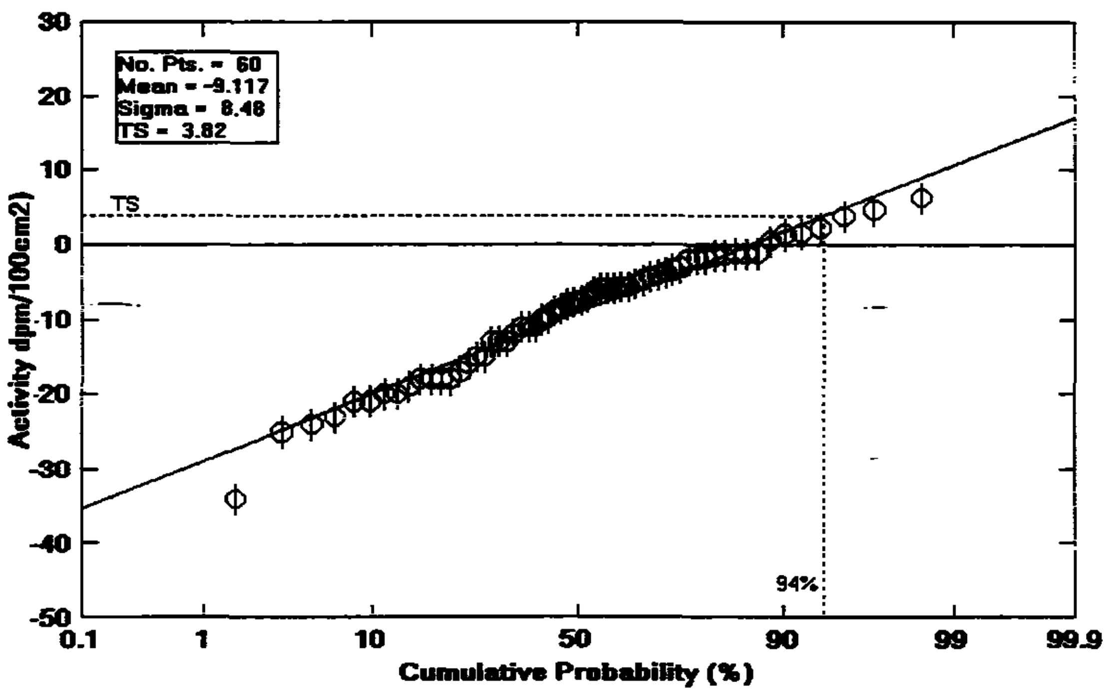


b) Expanded Scale

Figure 11. Building T030 - Lot 1 Removable Beta Activity

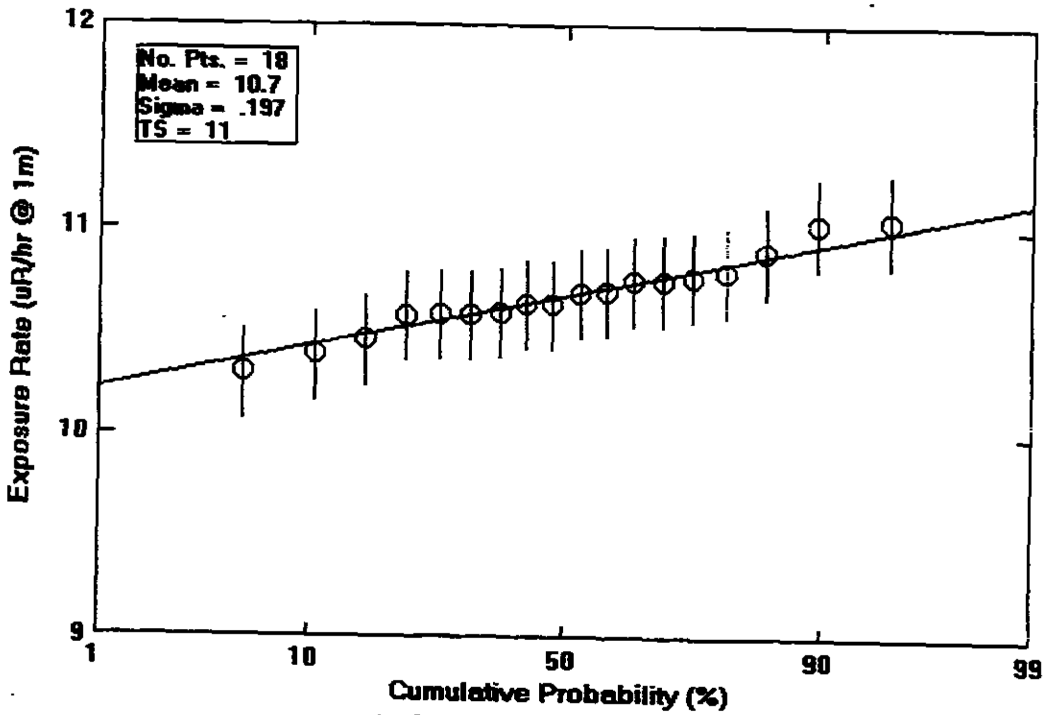


a) Normal Scale

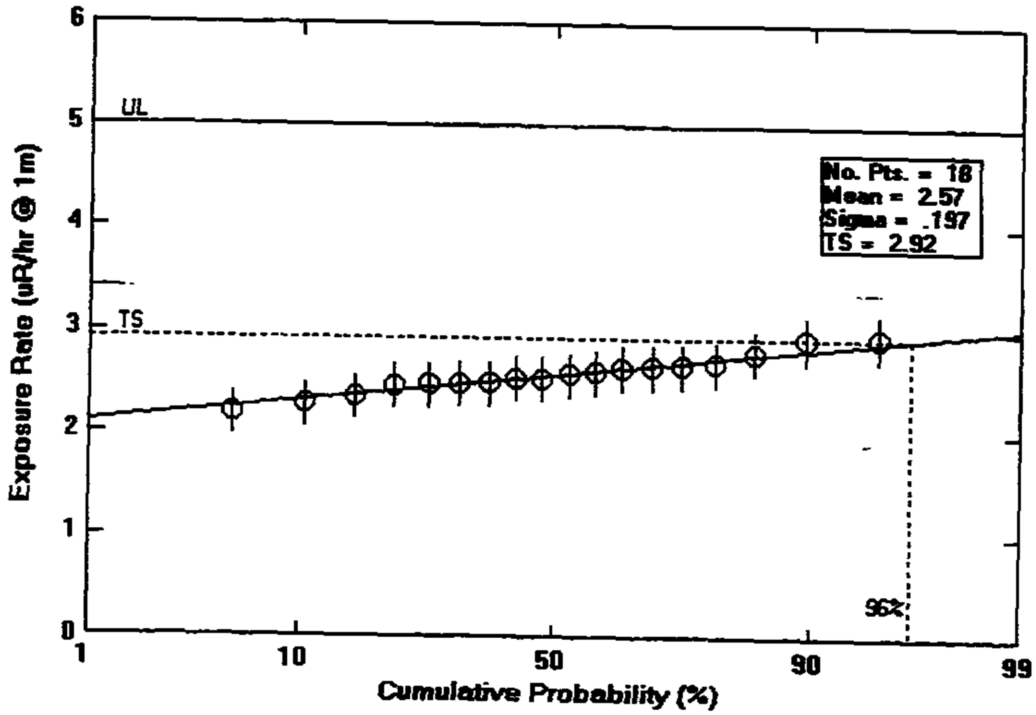


b) Expanded Scale

Figure 12. Building T030 - Lot 1 Removable Tritium Activity



a) Gross Exposure Rate



b) Net Exposure Rate

Figure 13. Building T030 - Lot 1 Gamma Exposure Rate

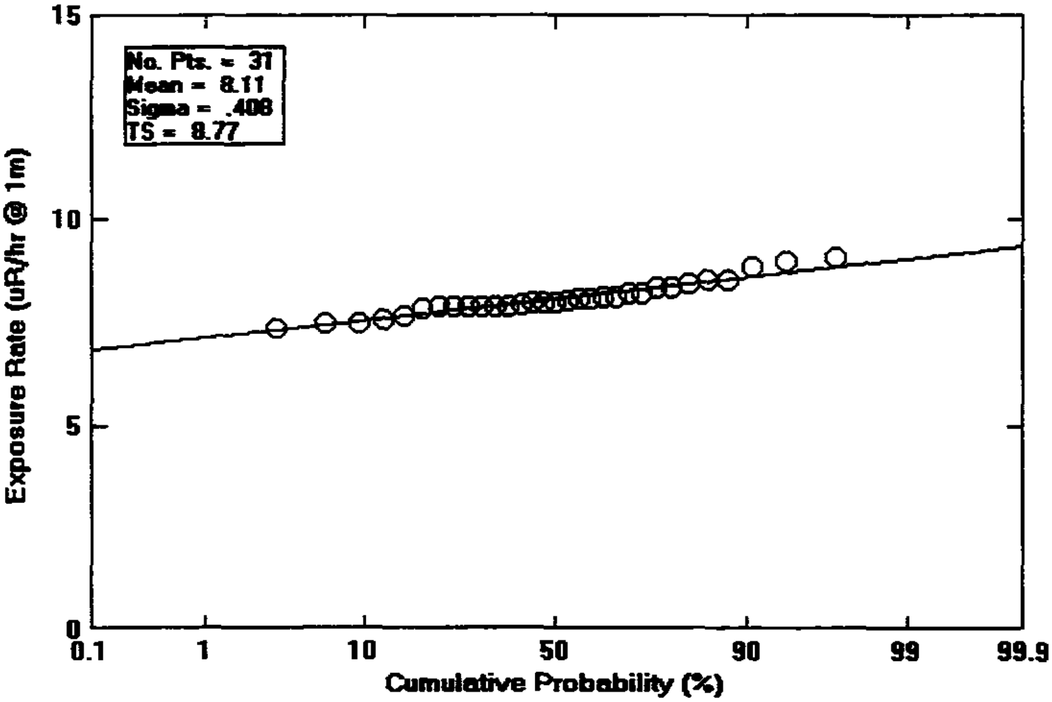


Figure 14. Background Gamma Exposure Rate Measured in Building T038

Table 4. Sample Lot 1 Statistical Results

	Total[a]		Removable[a]		Removable[a]	Ambient
	Alpha	Beta	Alpha	Beta	Tritium	Gamma[b]
Acceptance Limit (UL)	5,000	5,000	1,000	1,000	10,000	5
Calculated Test Statistic (*TS* = *x* + *ks*)						
Entire area - floors, walls, ceiling, & structure	77.4 (Fig. 8)	1,090 (Fig. 10)	4.25 (Fig. 9)	10.9 (Fig. 11)	3.82 (Fig. 12)	2.92 (Fig. 13)

[a]Alpha, beta, and tritium activity in dpm/100 cm^2.

[b]Ambient gamma exposure rate in μR/hr at 1 meter from the surface.

4.5.1.3 Interpretation of Results for Sample Lot 1

The survey data in Table 4, and Figure 8 through Figure 13, 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 T030 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.

The MCA scan results on all sink traps indicated no presence of detectable man-made radioactivity.

4.5.2 Sample Lot 2

4.5.2.1 Description

Sample Lot 2 consists of all surface areas in Rooms 103 through 108, interconnecting aisle, and walkway to the west end of the building. Survey data for Lot 2 were taken in September 1996.

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 5 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.

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 T030 are given in Appendix C.

Table 5. Sample Lot 2 Statistical Results

	Total[a]		Removable[a]		Removable[a]	Ambient
	Alpha	Beta	Alpha	Beta	Tritium	Gamma[b]
Acceptance Limit (UL)	5,000	5,000	1,000	1,000	10,000	5
Calculated Test Statistic (*TS* = *x* + *ks*)						
Entire area - floors, walls, ceiling, & structure	70.9 (Fig. 15)	884 (Fig. 17)	4.36 (Fig. 16)	10.1 (Fig. 18)	3.73 (Fig. 19)	3.02 (Fig. 20)

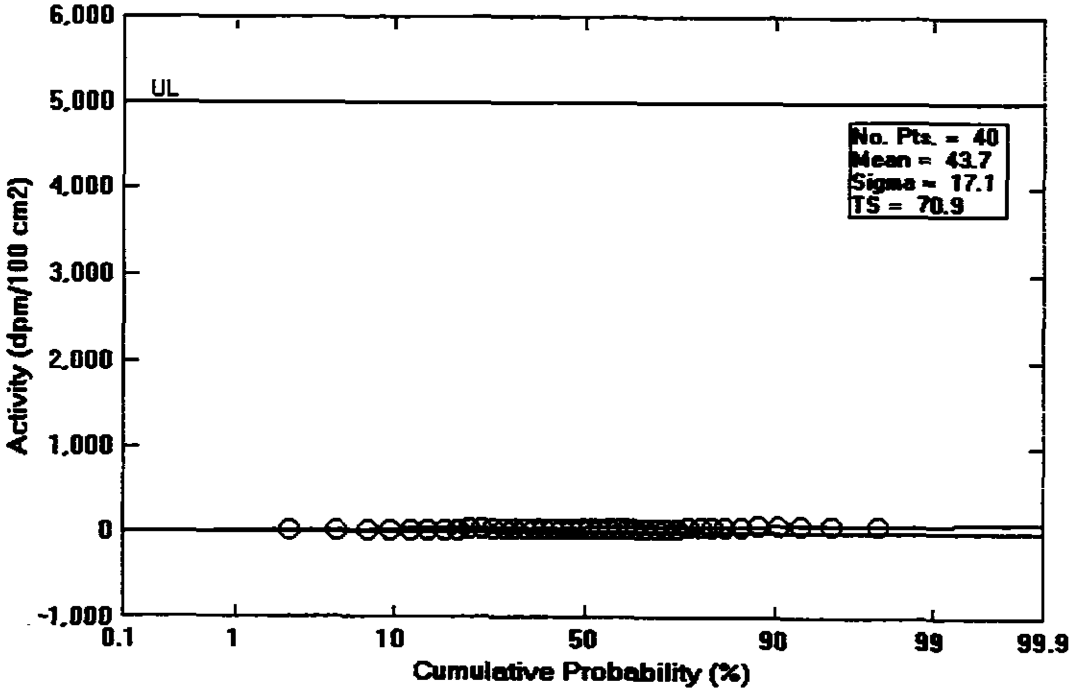
[a]Alpha, beta, and tritium activity in dpm/100 cm^2.

[b]Ambient gamma exposure rate in μR/hr at 1 meter from the surface.

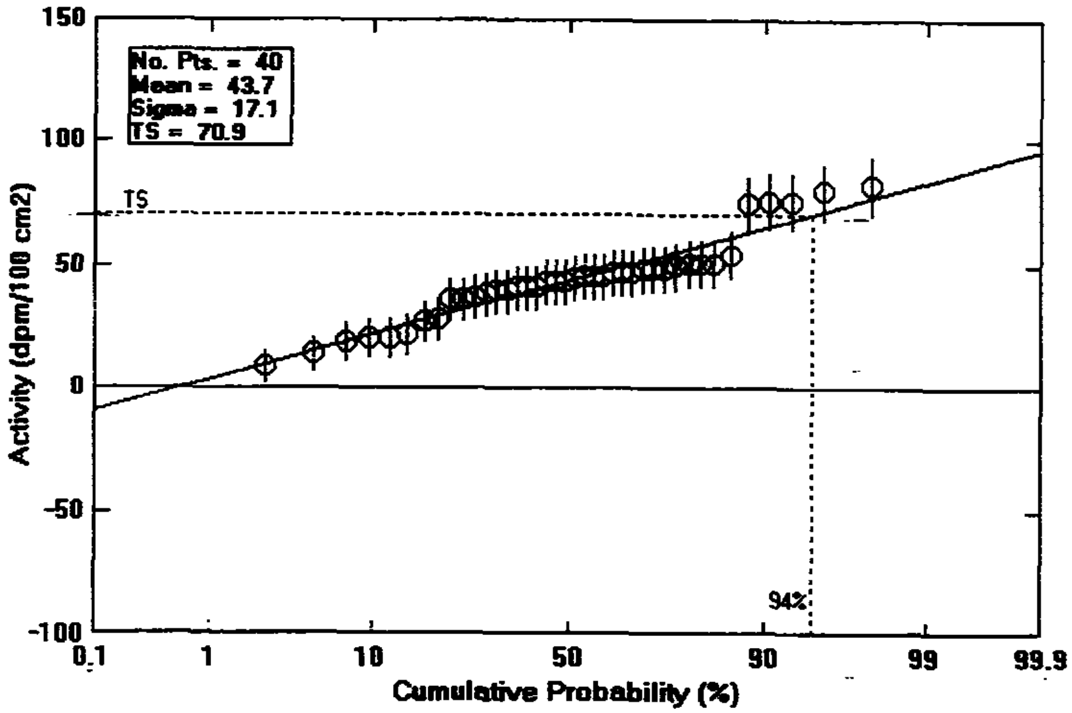
4.5.2.3 Interpretation of Results for Sample Lot 2

Table 5 and Figure 15 through Figure 20 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 T030 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.

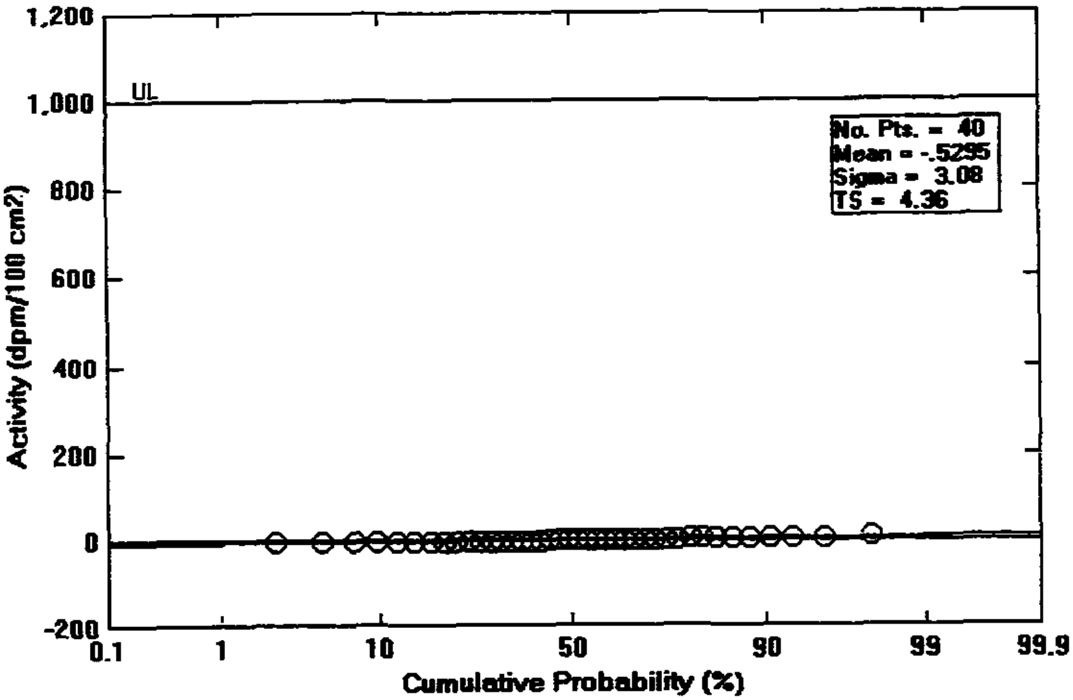


a) Normal Scale

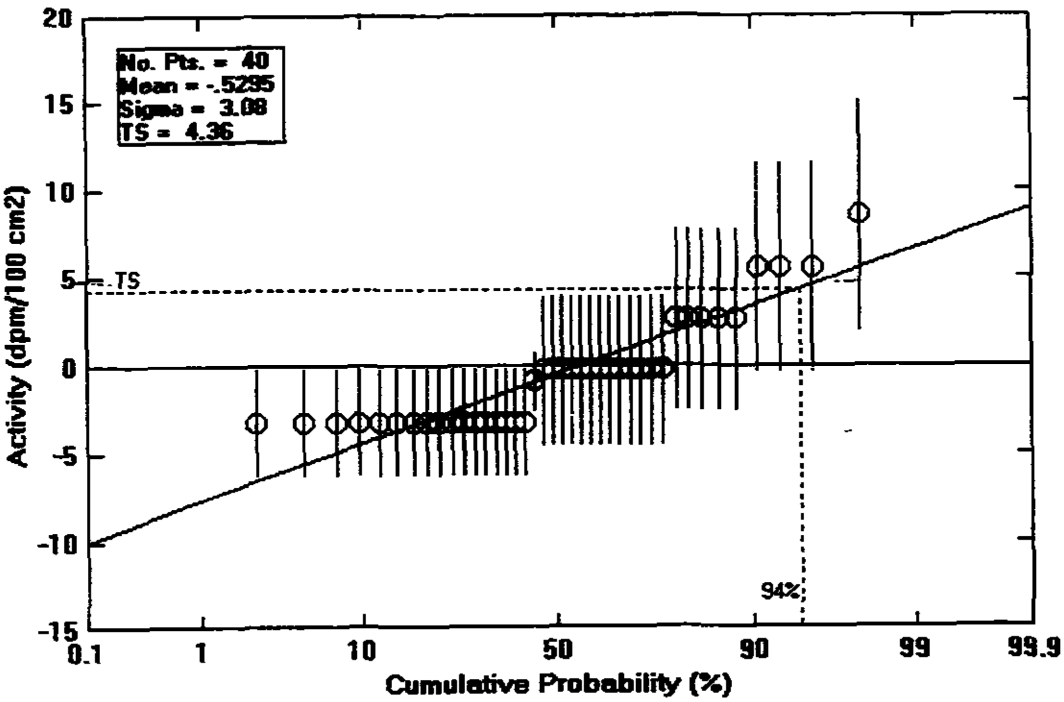


b) Expanded Scale

Figure 15. Building T030 - Lot 2 Total Alpha Activity

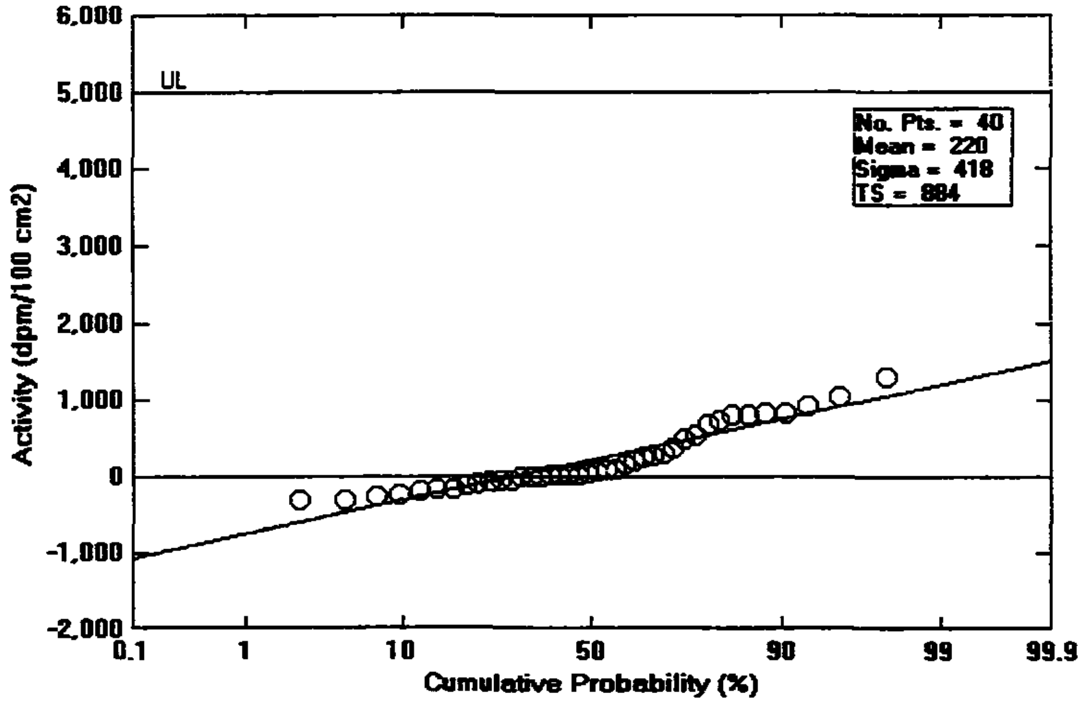


a) Normal Scale

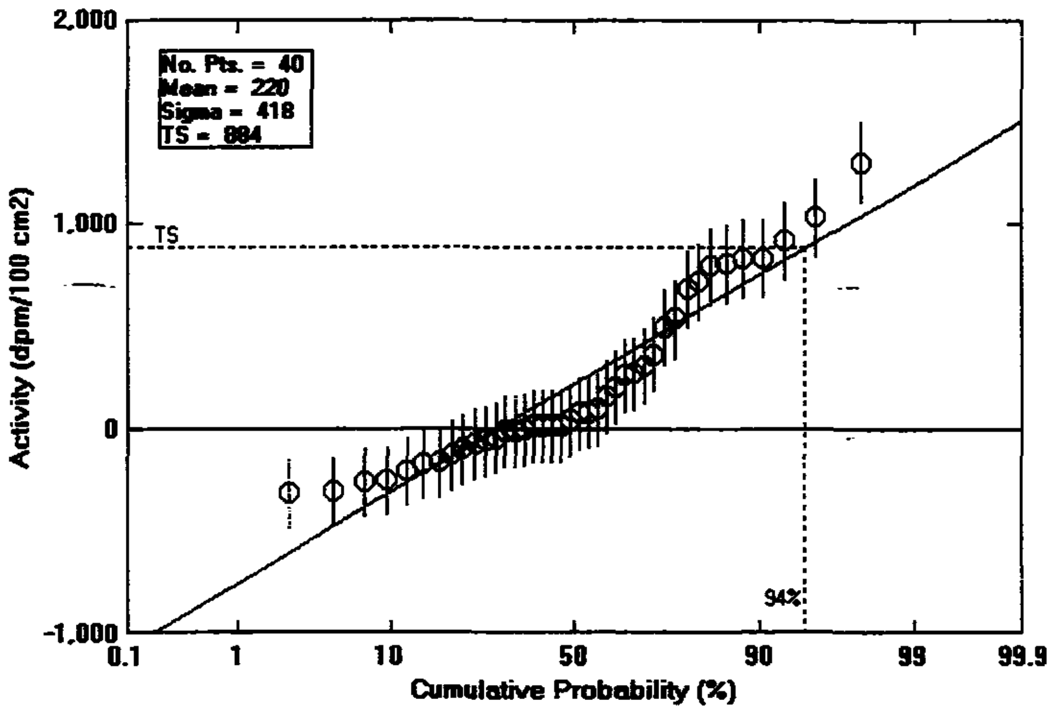


b) Expanded Scale

Figure 16. Building T030 Lot 2 Removable Alpha Activity

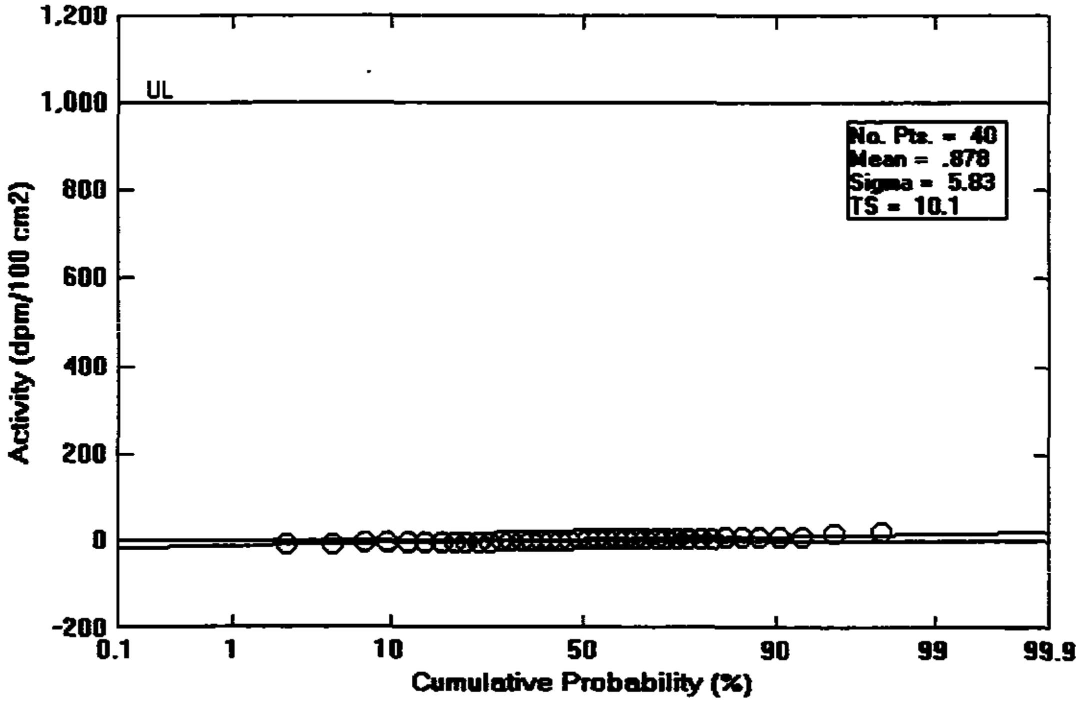


a) Normal Scale

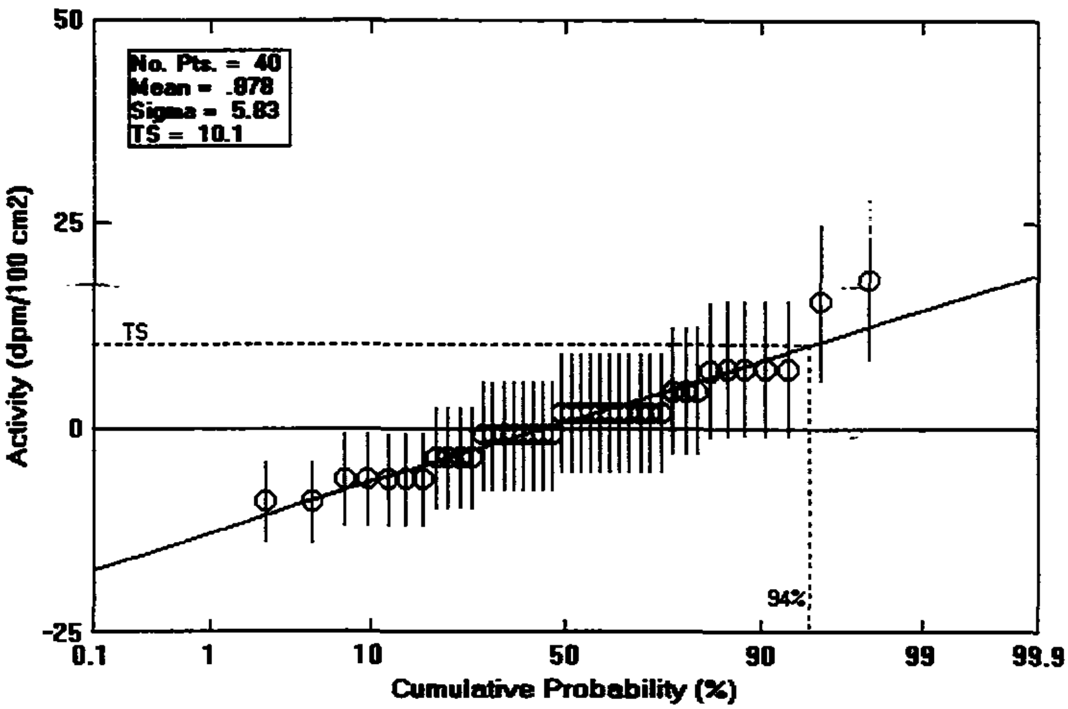


b) Expanded Scale

Figure 17. Building T030 - Lot 2 Total Beta Activity

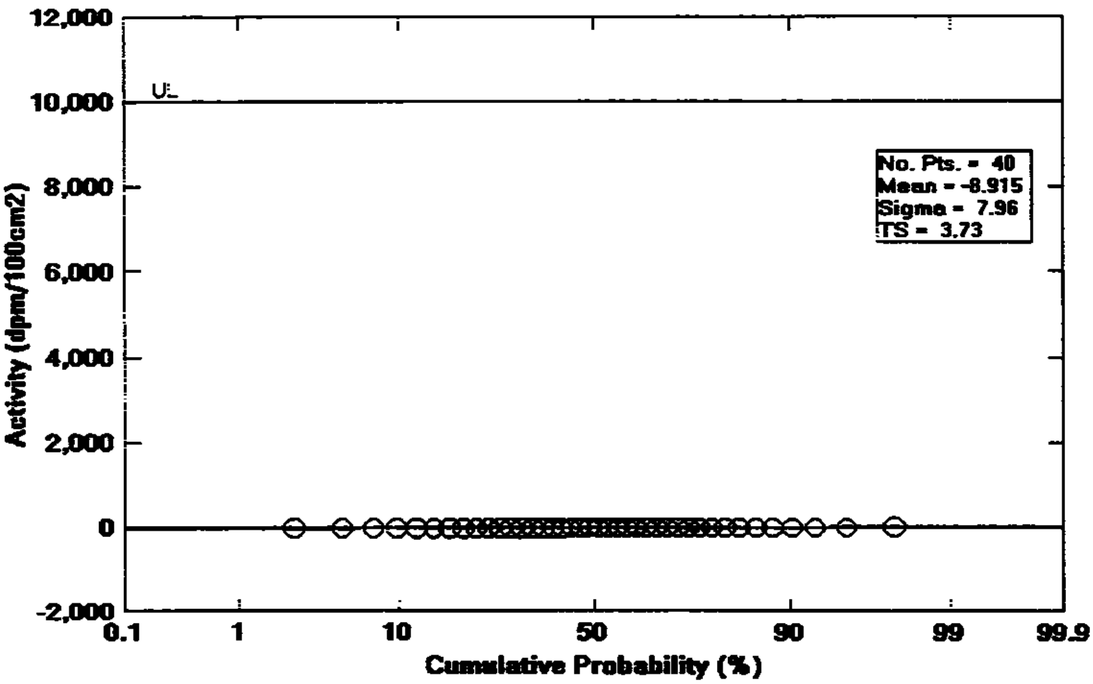


a) Normal Scale

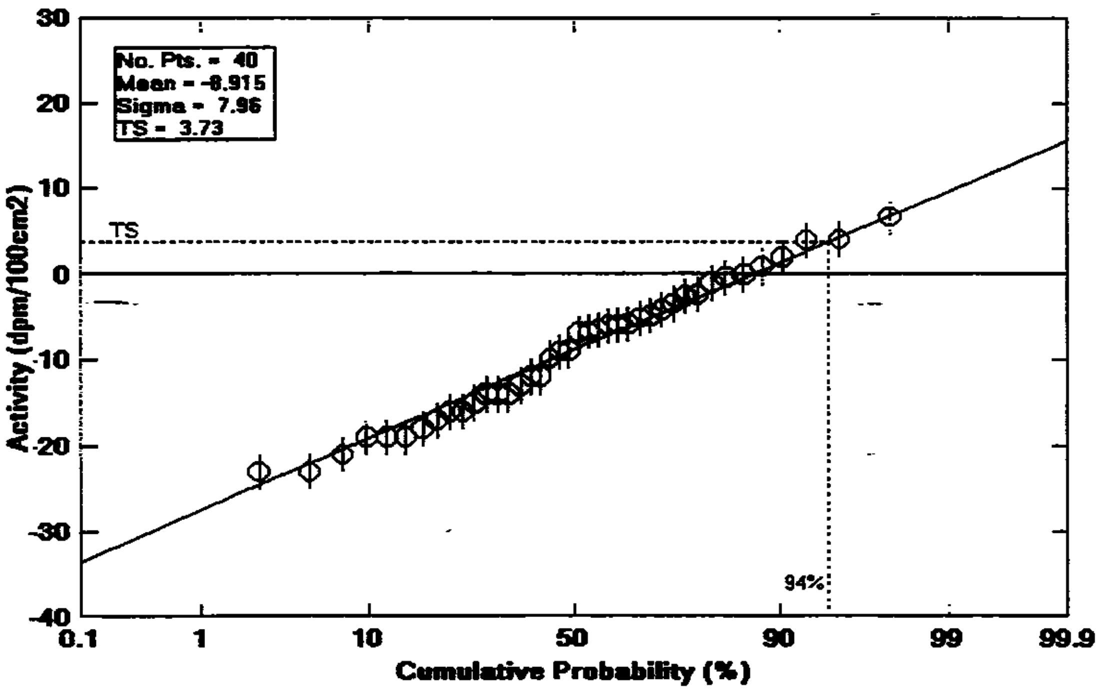


b) Expanded Scale

Figure 18. Building T030 - Lot 2 Removable Beta Activity

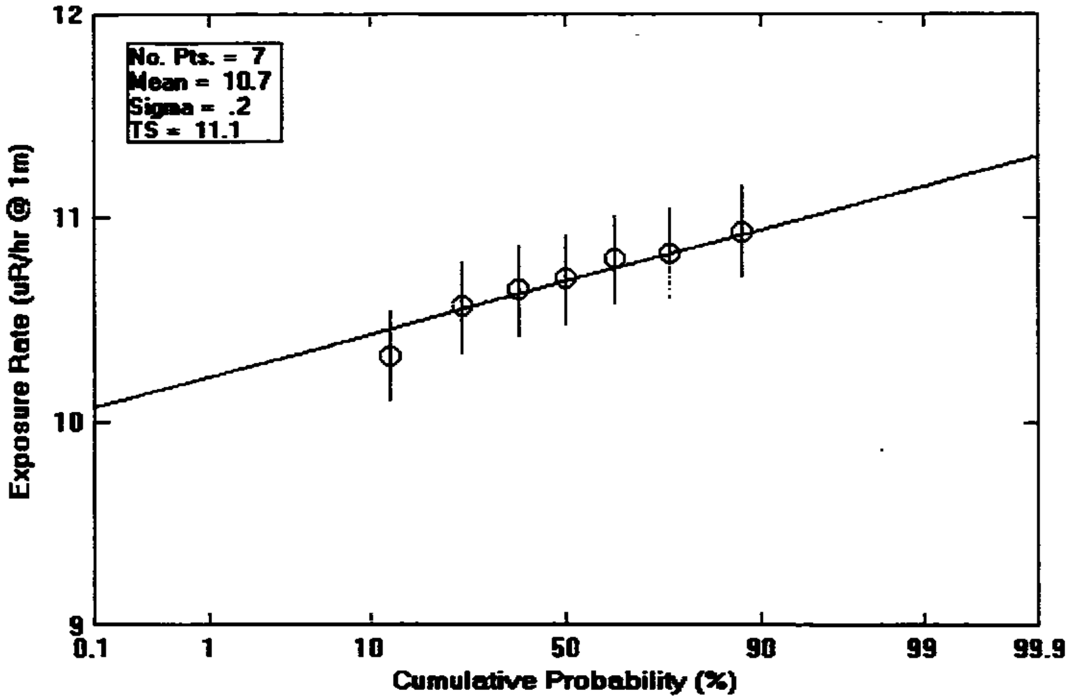


a) Normal Scale

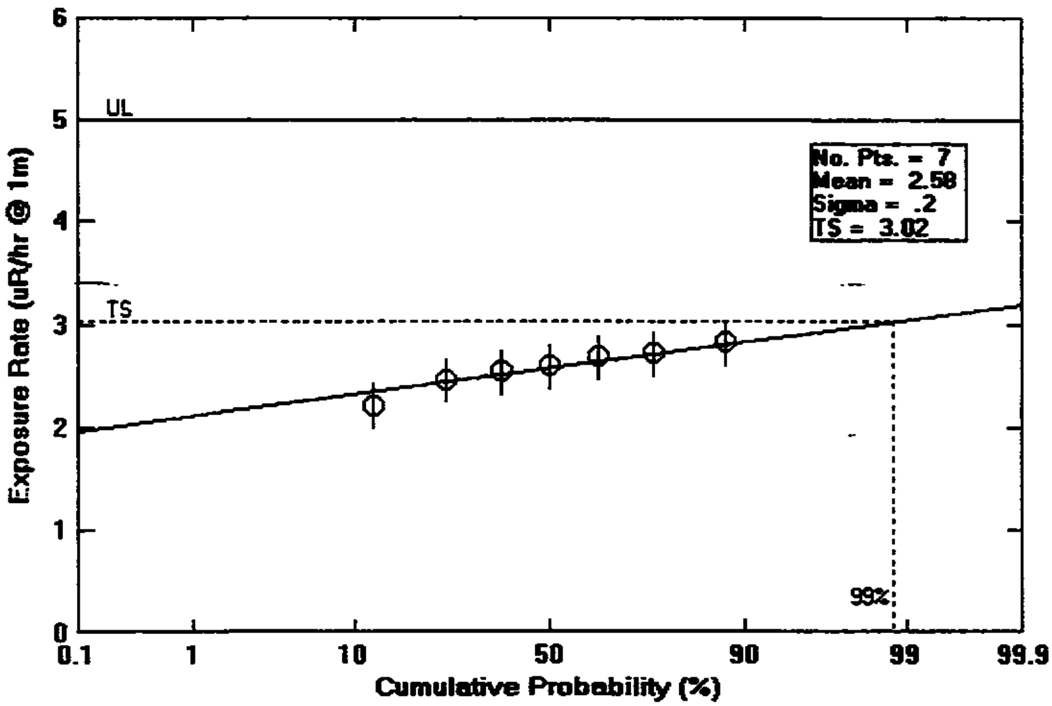


b) Expanded Scale

Figure 19. Building T030 - Lot 2 Removable Tritium Activity



a) Gross Exposure Rate



b) Net Exposure Rate

Figure 20. Building T030 - Lot 2 Gamma Exposure Rate

5. REFERENCES

1. Rockwell Document GEN-ZR-0007, "Radiological Survey of Shipping/Receiving and Old Accelerator Area - Buildings T641 and T30", August 19, 1988

2. T. J. Vitkus and T. L. Bright, "Verification Survey of the Interim Storage Facility; Buildings T30, T641, and T013; An Area Northwest of Buildings T019, T012, and T059; and a Storage Yard West of Buildings T626 and T038; Santa Susana Field Laboratory, Rockwell International, Ventura County, California", Oak Ridge Institute for Science and Education (ORISE) Final Report, February 1996.

3. Rockwell Document SSWA-AR-0007, "Building T30 Final Radiological Survey Plan", June 25, 1996.

4. Rockwell Internal Letter "Tritium Smear Survey, Building 030 Van de Graaf Accelerator", A. R. Mooers to W. F. Heine, March 29, 1966.

5. Rockwell Document 012-SP-0004, "Building T30 Final Survey Procedure", June 16, 1995.

6. U.S. NRC Draft Report for Comment NUREG/CR-5489, "Manual for Conducting Radiological Surveys in Support of License Termination", 1992

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

8. N001OP000033, Methods and Procedures for Radiological Monitoring.

9. NRC Dismantling Order for the L-85 Reactor Decommissioning, NRC to M. E. Remley, dated March 1, 1983.

10. Rockwell Document N001SRR140127, "Proposed Sitewide Release Criteria for Remediation of Facilities at the SSFL", August 22, 1996.

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

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

13. DOE Order 5400.5, "Radiation Protection of the Public and the Environment", Februrary 8, 1990

Appendix A.

Building T030

Sample Lots 1 and 2

Final Survey Data

T030, Lot 1 Survey Data, Affected Area

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 (1 MIN) INSTRUMENT BACKG	ALPHA (1 MIN) INSTRUMENT EFACT	ALPHA (1 MIN) INSTRUMENT AFACT	ALPHA (1 MIN) SMEAR BACKG	ALPHA (1 MIN) SMEAR EFACT	BETA (1 MIN) INSTRUMENT BACKG	BETA (1 MIN) INSTRUMENT EFACT	BETA (1 MIN) INSTRUMENT AFACT	BETA (1 MIN) SMEAR BACKG	BETA (1 MIN) SMEAR EFACT	GAMMA (1 MIN) BACKG	GAMMA (1 MIN) EFACT
Walkway																				
North Wall	3	37		0	272		5		2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		
East Wall	13	28		1	296		6		2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		
South Wall	22	44		1	327		3		2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		
West Wall	33	34		1	288		4		2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		
Floor	41	25		1	455		4	2214	2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		0.0047
Ceiling	49	74		0	335		6		2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		
N. Walkway Pad																				
Pad	1	25		0	407		0	2372	2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		0.0047
Womens RR Foyer																				
North Wall	5	46		0	276		3		2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		
South Wall	15	40		0	298		9		2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		
Womens RR																				
North Wall	2	43		1	327		1		2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		
East Wall	10	50		0	307		6		2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		
West Wall	19	42		0	282		6		2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		
Floor	24	17		2	423		4	2298	2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		0.0047
Ceiling	27	68		1	357		5		2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		
Mens RR																				
East Wall	8	36		1	263		2		2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		
South Wall	15	44		1	284		10		2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		
West Wall	21	34		0	327		4		2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		
Floor	30	19		1	438		1	2316	2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		0.0047
Ceiling	35	69		0	335		7		2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		
Room 100																				
North Wall	3	39		1	297		3		2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		
South Wall	12	29		0	268		5		2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		
Floor	19	28		1	423		2	2288	2.2	4.5	1.41	0.7	2.99	58	7.4	5	3.1	2.72		0.0047
Room 101																				
North Wall	13	40		1	276		1		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
North Wall	16	43		2	263		7		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
North Wall	18	31		1	294		4		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
North Wall	28	34		3	305		5		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
NE Wall	37	25		2	289		2		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
NE Wall	43	34		1	293		4		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		

T030, Lot 1 Survey Data, Affected Area

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 (1 MIN) INSTRUMENT BACKG	ALPHA (1 MIN) INSTRUMENT EFACT	ALPHA (1 MIN) INSTRUMENT AFACT	ALPHA (1 MIN) SMEAR BACKG	ALPHA (1 MIN) SMEAR EFACT	BETA (1 MIN) INSTRUMENT BACKG	BETA (1 MIN) INSTRUMENT EFACT	BETA (1 MIN) INSTRUMENT AFACT	BETA (1 MIN) SMEAR BACKG	BETA (1 MIN) SMEAR EFACT	GAMMA (1 MIN) BACKG	GAMMA (1 MIN) EFACT
SE Wall	51	32		0	270		3		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
South Wall	60	36		0	283		2		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
West Wall	76	44		0	268		5		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
West Wall	85	35		1	259		3		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
Floor	101	31		0	430		3	2275	2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		0.0047
Floor	105	26		1	423		2	2278	2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		0.0047
Floor	107	30		1	434		1	2276	2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		0.0047
Floor	122	26		0	413		3	2313	2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		0.0047
Floor	124	18		1	449		2	2321	2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		0.0047
Floor	126	37		0	405		8	2342	2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		0.0047
Floor	141	27		0	427		2	2249	2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		0.0047
Ceiling	156	82		1	371		4		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
Ceiling	160	77		0	376		2		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
Ceiling	162	81		0	323		0		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
Ceiling	177	68		0	325		2		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
Ceiling	179	78		0	341		4		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
Ceiling	181	72		0	372		2		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
Ceiling	196	74		1	375		1		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
Room 102																				
NE Wall	7	48		0	303		4		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
North Wall	13	38		3	267		10		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
North Wall	19	34		1	291		6		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
SE Wall	27	30		1	271		4		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
South Wall	47	33		0	244		6		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
South Wall	52	31		1	280		6		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
South Wall	58	35		3	299		6		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
West Wall	74	36		0	276		4		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
West Wall	78	39		0	292		3		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
West Wall	87	42		3	301		4		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
Floor	102	27		0	420		6	2312	2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		0.0047
Floor	104	21		0	407		3	2288	2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		0.0047
Floor	119	16		0	421		1	2273	2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		0.0047
Floor	121	28		0	424		2	2233	2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		0.0047
Floor	124	21		2	422		3	2376	2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		0.0047
Floor	138	30		1	465		3	2301	2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		0.0047
Ceiling	157	70		3	359		2		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
Ceiling	159	82		1	375		1		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
Ceiling	174	73		0	335		0		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
Ceiling	176	79		2	352		2		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		

T030, Lot 1 Survey Data, Affected Area

SAMPLE NAME	GRID NAME	5 MIN ALPHA		1 MIN ALPHA	5 MIN BETA		1 MIN BETA	1 MIN GAM	ALPHA (1 MIN) INSTRUMENT			ALPHA (1 MIN) SMEAR		BETA (1 MIN) INSTRUMENT			BETA (1 MIN) SMEAR		GAMMA (1 MIN)	
		TOTAL	MAX	REM	TOTAL	MAX	REM	TOTAL	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT
Ceiling	179	76		0	376		2		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		
Ceiling	195	72		2	336		2		2.2	4.5	1.41	0.7	2.99	57.3	7.4	5	3.1	2.72		

T030, Lot 2 Survey Data, Unaffected Area

		5 MIN		1 MIN	5 MIN		1 MIN	1 MIN	ALPHA (1 MIN)					BETA (1 MIN)					GAMMA	
SAMPLE	GRID	ALPHA			BETA			GAM	INSTRUMENT			SMEAR		INSTRUMENT			SMEAR		(1 MIN)	
NAME	NAME	TOTAL	MAX	REM	TOTAL	MAX	REM	TOTAL	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT	AFACT	BACKG	EFACT	BACKG	EFACT
Office Hallway																				
North Wall	13	46		0	290		3		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
North Wall	22	47		3	310		4		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
East Wall	32	42		0	325		4		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
South Wall	38	43		1	361		1		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
South Wall	58	45		1	316		10		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
Floor	74	18		0	401		4	2328	2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		0.0047
Ceiling	95	70		1	381		0		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
Room 103																				
North Wall	8	39		2	247		5		2.2	4.5	1.41	1.1	2.94	56.2	7.4	5	3.3	2.72		
East Wall	25	51		2	271		6		2.2	4.5	1.41	1.1	2.94	56.2	7.4	5	3.3	2.72		
South Wall	39	49		1	292		3		2.2	4.5	1.41	1.1	2.94	56.2	7.4	5	3.3	2.72		
Floor	57	22		0	458		3	2301	2.2	4.5	1.41	1.1	2.94	56.2	7.4	5	3.3	2.72		0.0047
Room 104																				
North Wall	9	47		1	291		6		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
East Wall	21	48		0	288		9		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
South Wall	39	50		0	301		3		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
West Wall	47	49		0	287		0		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
Floor	53	28		0	401		2	2321	2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		0.0047
Ceiling	75	74		0	324		6		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
Room 105																				
North Wall	6	51		1	275		5		2.2	4.5	1.41	1.1	2.94	56.2	7.4	5	3.3	2.72		
East Wall	20	48		0	291		2		2.2	4.5	1.41	1.1	2.94	56.2	7.4	5	3.3	2.72		
South Wall	38	47		4	283		4		2.2	4.5	1.41	1.1	2.94	56.2	7.4	5	3.3	2.72		
West Wall	43	45		1	267		4		2.2	4.5	1.41	1.1	2.94	56.2	7.4	5	3.3	2.72		
Floor	55	32		0	406		6	2351	2.2	4.5	1.41	1.1	2.94	56.2	7.4	5	3.3	2.72		0.0047
Ceiling	72	71		3	330		4		2.2	4.5	1.41	1.1	2.94	56.2	7.4	5	3.3	2.72		
Room 106																				
North Wall	6	40		3	294		2		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
East Wall	19	41		0	287		3		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
South Wall	30	45		1	266		1		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
West Wall	45	43		2	291		1		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
Floor	61	27		1	396		1	2290	2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		0.0047
Room 107																				
East Wall	13	51		0	273		4		2.2	4.5	1.41	1.1	2.94	56.2	7.4	5	3.3	2.72		
West Wall	33	43		0	246		3		2.2	4.5	1.41	1.1	2.94	56.2	7.4	5	3.3	2.72		
Room 108/110																				

T030, Lot 2 Survey Data, Unaffected Area

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 (1 MIN) INSTRUMENT BACKG	ALPHA (1 MIN) INSTRUMENT EFACT	ALPHA (1 MIN) INSTRUMENT AFACT	ALPHA (1 MIN) SMEAR BACKG	ALPHA (1 MIN) SMEAR EFACT	BETA (1 MIN) INSTRUMENT BACKG	BETA (1 MIN) INSTRUMENT EFACT	BETA (1 MIN) INSTRUMENT AFACT	BETA (1 MIN) SMEAR BACKG	BETA (1 MIN) SMEAR EFACT	GAMMA (1 MIN) BACKG	GAMMA (1 MIN) EFACT
North Wall	9	39		1	246		4		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
South Wall	33	42		2	247		3		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
West Wall	50	49		1	271		1		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
Floor	57	33		1	386		2		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
Ceiling	68	71		0	330		3		2.2	4.5	1.41	1.1	2.94	57.7	7.4	5	3.3	2.72		
Room 109																				
East Wall	14	54		0	253		4		2.2	4.5	1.41	1.1	2.94	56.2	7.4	5	3.3	2.72		
West Wall	21	48		2	258		4		2.2	4.5	1.41	1.1	2.94	56.2	7.4	5	3.3	2.72		
Floor	35	26		0	421		4	2220	2.2	4.5	1.41	1.1	2.94	56.2	7.4	5	3.3	2.72		0.0047
Ceiling	38	76		1	348		5		2.2	4.5	1.41	1.1	2.94	56.2	7.4	5	3.3	2.72		
East Entrance																				
Pad	1	27		0	399		6	2272	2.2	4.50	1.41	0.3	2.98	58	7.4	5	3.4	2.73		0.0047

Appendix B.

Building T030

Sample Lots 1 and 2

Final Survey Results

T030, Lot 1 Survey Data, Affected Area

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
Walkway															
North Wall	3	32.99	8.79			-2.09	2.50	-133.20	175.43			5.17	7.74		
East Wall	13	21.57	7.92			0.90	3.90	44.40	179.14			7.89	8.21		
South Wall	22	41.88	9.41			0.90	3.90	273.80	183.81			-0.27	6.72		
West Wall	33	29.19	8.51			0.90	3.90	-14.80	177.91			2.45	7.25		
Floor	41	17.77	7.61			0.90	3.90	1221.00	201.98			2.45	7.25	10.30	
Ceiling	49	79.95	11.70			-2.09	2.50	333.00	185.00			7.89	8.21		
N. Walkway Pad															
Pad	1	17.77	7.61			-2.09	2.50	865.80	195.37			-8.43	4.79	11.03	0.23
Womens RR Foyer															
North Wall	5	44.42	9.58			-2.09	2.50	-88.80	176.36			-0.27	6.72		
South Wall	15	36.80	9.06			-2.09	2.50	59.20	179.44			16.05	9.46		
Womens RR															
North Wall	2	40.61	9.33			0.90	3.90	273.80	183.81			-5.71	5.51		
East Wall	10	49.49	9.91			-2.09	2.50	125.80	180.81			7.89	8.21		
West Wall	19	39.34	9.24			-2.09	2.50	-59.20	176.98			7.89	8.21		
Floor	24	7.61	6.71			3.89	4.91	984.20	197.60			2.45	7.25	10.69	0.22
Ceiling	27	72.33	11.28			0.90	3.90	495.80	188.23			5.17	7.74		
Mens RR															
East Wall	8	31.73	8.70			0.90	3.90	-199.80	174.02			-2.99	6.14		
South Wall	15	41.88	9.41			0.90	3.90	-44.40	177.29			18.77	9.84		
West Wall	21	29.19	8.51			-2.09	2.50	273.80	183.81			2.45	7.25		
Floor	30	10.15	6.95			0.90	3.90	1095.20	199.66			-5.71	5.51	10.77	0.22
Ceiling	35	73.60	11.35			-2.09	2.50	333.00	185.00			10.61	8.64		
Room 100															
North Wall	3	35.53	8.97			0.90	3.90	51.80	179.29			-0.27	6.72		
South Wall	12	22.84	8.03			-2.09	2.50	-162.80	174.80			5.17	7.74		
Floor	19	21.57	7.92			0.90	3.90	984.20	197.60			-2.99	6.14	10.64	0.22
Room 101															
North Wall	13	36.80	9.06			0.90	3.90	-77.70	175.51			-5.71	5.51		
North Wall	16	40.61	9.33			3.89	4.91	-173.90	173.47			10.61	8.64		
North Wall	18	25.38	8.22			0.90	3.90	55.50	178.29			2.45	7.25		
North Wall	28	29.19	8.51			6.88	5.75	136.90	179.97			5.17	7.74		
NE Wall	37	17.77	7.61			3.89	4.91	18.50	177.52			-2.99	6.14		
NE Wall	43	29.19	8.51			0.90	3.90	48.10	178.14			2.45	7.25		

T030, Lot 1 Survey Data, Affected 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
SE Wall	51	26.65	8.32			-2.09	2.50	-122.10	174.57			-0.27	6.72		
South Wall	60	31.73	8.70			-2.09	2.50	-25.90	176.60			-2.99	6.14		
West Wall	76	41.88	9.41			-2.09	2.50	-136.90	174.25			5.17	7.74		
West Wall	85	30.46	8.61			0.90	3.90	-203.50	172.83			-0.27	6.72		
Floor	101	25.38	8.22			-2.09	2.50	1061.90	198.08			-0.27	6.72	10.56	0.22
Floor	105	19.04	7.72			0.90	3.90	1010.10	197.11			-2.99	6.14	10.60	0.22
Floor	107	24.11	8.13			0.90	3.90	1091.50	198.63			-5.71	5.51	10.59	0.22
Floor	122	19.04	7.72			-2.09	2.50	936.10	195.72			-0.27	6.72	10.76	0.22
Floor	124	8.88	6.83			0.90	3.90	1202.50	200.69			-2.99	6.14	10.80	0.22
Floor	126	32.99	8.79			-2.09	2.50	876.90	194.59			13.33	9.06	10.89	0.23
Floor	141	20.30	7.82			-2.09	2.50	1039.70	197.66			-2.99	6.14	10.46	0.22
Ceiling	156	90.10	12.24			0.90	3.90	625.30	189.76			2.45	7.25		
Ceiling	160	83.75	11.90			-2.09	2.50	662.30	190.47			-2.99	6.14		
Ceiling	162	88.83	12.17			-2.09	2.50	270.10	182.69			-8.43	4.79		
Ceiling	177	72.33	11.28			-2.09	2.50	284.90	182.99			-2.99	6.14		
Ceiling	179	85.02	11.97			-2.09	2.50	403.30	185.37			2.45	7.25		
Ceiling	181	77.41	11.56			-2.09	2.50	632.70	189.89			-2.99	6.14		
Ceiling	196	79.95	11.70			0.90	3.90	654.90	190.33			-5.71	5.51		
Room 102															
NE Wall	7	46.95	9.75			-2.09	2.50	122.10	179.67			2.45	7.25		
North Wall	13	34.26	8.88			6.88	5.75	-144.30	174.10			18.77	9.84		
North Wall	19	29.19	8.51			0.90	3.90	33.30	177.63			7.89	8.21		
SE Wall	27	24.11	8.13			0.90	3.90	-114.70	174.72			2.45	7.25		
South Wall	47	27.92	8.42			-2.09	2.50	-314.50	170.44			7.89	8.21		
South Wall	52	25.38	8.22			0.90	3.90	-48.10	176.13			7.89	8.21		
South Wall	58	30.46	8.61			6.88	5.75	92.50	179.06			7.89	8.21		
West Wall	74	31.73	8.70			-2.09	2.50	-77.70	175.61			2.45	7.25		
West Wall	78	35.53	8.97			-2.09	2.50	40.70	177.98			-0.27	6.72		
West Wall	87	39.34	9.24			6.88	5.75	107.30	179.36			2.45	7.25		
Floor	102	20.30	7.82			-2.09	2.50	987.90	196.69			7.89	8.21	10.75	0.22
Floor	104	12.69	7.18			-2.09	2.50	891.70	194.87			-0.27	6.72	10.64	0.22
Floor	119	6.35	6.59			-2.09	2.50	995.30	196.83			-5.71	5.51	10.57	0.22
Floor	121	21.57	7.92			-2.09	2.50	1017.50	197.25			-2.99	6.14	10.39	0.22
Floor	124	12.69	7.18			3.89	4.91	1002.70	196.97			-0.27	6.72	11.05	0.23
Floor	138	24.11	8.13			0.90	3.90	1468.90	205.54			-0.27	6.72	10.70	0.22
Ceiling	157	74.87	11.42			6.88	5.75	536.50	188.01			-2.99	6.14		
Ceiling	159	90.10	12.24			0.90	3.90	654.90	190.33			-5.71	5.61		
Ceiling	174	78.68	11.63			-2.09	2.50	358.90	184.48			7.89	8.21		
Ceiling	176	86.29	12.04			3.89	4.91	484.70	186.99			-2.99	6.14		

T030, Lot 1 Survey Data, Affected 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
Ceiling	179	82.49	11.84			-2.09	2.50	662.30	190.47			-2.99	6.14		
Ceiling	195	77.41	11.56			3.89	4.91	366.30	184.63			-2.99	6.14		

T030, Lot 2 Survey Data, Unaffected Area

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
Office Hallway															
North Wall	13	44.42	9.58			-3.23	3.08	11.10	177.98			-0.82	6.83		
North Wall	22	45.68	9.66			5.59	5.95	159.10	181.04			1.90	7.35		
East Wall	32	39.34	9.24			-3.23	3.08	270.10	183.29			1.90	7.35		
South Wall	38	40.61	9.33			-0.29	4.26	536.50	188.59			-6.26	5.64		
South Wall	58	43.15	9.50			-0.29	4.26	203.50	181.94			18.22	9.92		
Floor	74	8.88	6.83			-3.23	3.08	832.50	194.31			1.90	7.35	10.83	0.22
Ceiling	95	74.87	11.42			-0.29	4.26	664.50	191.47			-8.98	4.94		
Room 103															
North Wall	8	35.53	8.97			2.65	5.18	-251.60	170.04			4.62	7.84		
East Wall	25	50.76	9.99			2.65	5.18	-74.00	173.86			7.34	8.29		
South Wall	39	48.22	9.83			-0.29	4.26	81.40	177.14			-0.82	6.83		
Floor	57	13.96	7.29			-3.23	3.08	1309.80	201.17			-0.82	6.83	10.70	0.22
Room 104															
North Wall	9	45.68	9.66			-0.29	4.26	18.50	178.14			7.34	8.29		
East Wall	21	46.95	9.75			-3.23	3.08	-3.70	177.68			15.50	9.54		
South Wall	39	49.49	9.91			-3.23	3.08	92.50	179.67			-0.82	6.83		
West Wall	47	48.22	9.83			-3.23	3.08	-11.10	177.52			-8.98	4.94		
Floor	53	21.57	7.92			-3.23	3.08	832.50	194.31			-3.54	6.26	10.80	0.22
Ceiling	75	79.95	11.70			-3.23	3.08	262.70	183.14			7.34	8.29		
Room 105															
North Wall	6	50.76	9.99			-0.29	4.26	-44.40	174.49			4.62	7.84		
East Wall	20	46.95	9.75			-3.23	3.08	74.00	176.98			-3.54	6.26		
South Wall	38	45.68	9.66			8.53	6.64	14.80	175.74			1.90	7.35		
West Wall	43	43.15	9.50			-0.29	4.26	-103.60	173.23			1.90	7.35		
Floor	55	26.65	8.32			-3.23	3.08	925.00	193.96			7.34	8.29	10.93	0.23
Ceiling	72	76.14	11.49			5.59	5.95	362.60	182.92			1.90	7.35		
Room 106															
North Wall	6	36.80	9.06			5.59	5.95	40.70	178.60			-3.54	6.26		
East Wall	19	38.07	9.15			-3.23	3.08	-11.10	177.52			-0.82	6.83		
South Wall	30	43.15	9.50			-0.29	4.26	-166.50	174.25			-6.26	5.64		
West Wall	45	40.61	9.33			2.65	5.18	18.50	178.14			-6.26	5.64		
Floor	61	20.30	7.82			-0.29	4.26	795.50	193.61			-6.26	5.64	10.65	0.22
Room 107															
East Wall	13	50.76	9.99			-3.23	3.08	-59.20	174.18			1.90	7.35		
West Wall	33	40.61	9.33			-3.23	3.08	-259.00	169.88			-0.82	6.83		
Room 108/110															

T030, Lot 2 Survey Data, Unaffected 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	9	35.53	8.97			-0.29	4.26	-314.50	171.08			1.90	7.35		
South Wall	33	39.34	9.24			2.65	5.18	-307.10	171.24			-0.82	6.83		
West Wall	50	48.22	9.83			-0.29	4.26	-129.50	175.04			-6.26	5.64		
Floor	57	27.92	8.42			-0.29	4.26	721.50	192.19			-3.54	6.26		
Ceiling	68	76.14	11.49			-3.23	3.08	307.10	184.04			-0.82	6.83		
Room 109															
East Wall	14	54.57	10.23			-3.23	3.08	-207.20	171.00			1.90	7.35		
West Wall	21	46.95	9.75			2.65	5.18	-170.20	171.80			1.90	7.35		
Floor	35	19.04	7.72			-3.23	3.08	1036.00	196.07			1.90	7.35	10.33	0.22
Ceiling	38	82.49	11.84			-0.29	4.26	495.80	185.59			4.62	7.84		
East Entrance															
Pad	1	20.30	7.82			-0.89	1.63	806.60	194.24			7.10	8.37	10.57	0.22

Lots 1 2 Tritium Data

Final Survey Tritium Data - T030
Lot 1 - Affected Area

No. of Samples: 60

SAMPLE NAME	GRID NAME	TRITIUM (dpm/100cm2) TOTAL	STD DEV
Walkway			
North Wall	3	-7.9	2.1
South Wall	22	-20.0	2.1
West Wall	33	-1.4	2.1
Floor	41	-4.2	2.1
N. Walkway Pad			
Womens RR Foyer			
South Wall	15	-25.0	2.1
Womens RR			
East Wall	10	-12.0	2.1
Floor	24	-24.0	2.1
Mens RR			
East Wall	8	-20.0	2.1
South Wall	15	-10.0	2.1
West Wall	21	-15.0	2.1
Floor	30	-18.0	2.1

Final Survey Tritium Data - T030
Lot 2 - Unaffected Area

No. of Samples: 40

SAMPLE NAME	GRID NAME	TRITIUM (dpm/100cm2) TOTAL	STD DEV
Office Hallway			
North Wall	13	-6.5	2.1
North Wall	22	-2.3	2.1
East Wall	32	-5.9	2.1
South Wall	38	-5.8	2.1
South Wall	58	0.9	2.1
Floor	74	2.0	2.1
Ceiling	95	0.0	2.1
Room 103			
North Wall	8	-6.7	2.1
East Wall	25	-4.8	2.1
South Wall	39	-6.0	2.1
Floor	57	4.0	2.1
Room 104			
North Wall	9	6.7	2.1
East Wall	21	-2.5	2.1
South Wall	39	-1.0	2.1
West Wall	47	-3.4	2.1
Floor	53	4.1	2.1
Ceiling	75	-5.1	2.1
Room 105			
North Wall	6	-4.2	2.1
East Wall	20	-9.0	2.1
South Wall	38	-9.1	2.1
West Wall	43	-19.0	2.1
Floor	55	-23.0	2.1

Lots 1 2 Tritium Data

Final Survey Tritium Data - T030
Lot 1 - Affected Area

No. of Samples: 60

SAMPLE NAME	GRID NAME	TRITIUM (dpm/100cm2) TOTAL	STD DEV
Room 100			
North Wall	3	-15.0	2.1
South Wall	12	-11.0	2.1
Floor	19	-13.0	2.1
Room 101			
North Wall	13	-8.6	2.1
North Wall	16	-6.2	2.1
North Wall	18	-1.3	2.1
North Wall	28	-5.5	2.1
NE Wall	37	-5.8	2.1
NE Wall	43	-3.0	2.1
SE Wall	51	-18.0	2.1
South Wall	60	-3.6	2.1
West Wall	76	-7.6	2.1
West Wall	85	4.6	2.1
Floor	101	-5.8	2.1
Floor	105	-5.6	2.1
Floor	107	-5.1	2.1
Floor	122	6.3	2.1
Floor	124	2.2	2.1
Floor	126	-3.3	2.1
Floor	141	-7.0	2.1
Ceiling	156	-13.0	2.1
Ceiling	160	-4.7	2.1
Ceiling	162	-1.9	2.1
Ceiling	177	-5.7	2.1
Ceiling	179	-9.9	2.1
Ceiling	181	-11.0	2.1
Ceiling	196	1.4	2.1
Room 102			
NE Wall	7	1.5	2.1
North Wall	13	3.8	2.1
North Wall	19	-1.7	2.1

Final Survey Tritium Data - T030
Lot 2 - Unaffected Area

No. of Samples: 40

SAMPLE NAME	GRID NAME	TRITIUM (dpm/100cm2) TOTAL	STD DEV
Ceiling	72	-12.0	2.1
Room 106			
North Wall	6	-6.8	2.1
East Wall	19	-17.0	2.1
South Wall	30	-12.0	2.1
West Wall	45	-16.0	2.1
Floor	61	-18.0	2.1
Room 107			
East Wall	13	-21.0	2.1
West Wall	33	-16.0	2.1
Room 108/110			
North Wall	9	-23.0	2.1
South Wall	33	-9.9	2.1
West Wall	50	-14.0	2.1
Floor	57	-13.0	2.1
Ceiling	68	-14.0	2.1
Room 109			
East Wall	14	-19.0	2.1
West Wall	21	-14.0	2.1
Floor	35	-15.0	2.1
Ceiling	38	-19.0	2.1
East Entrance			
Pad	1	-0.3	2.1

Lots 1 2 Tritium Data

Final Survey Tritium Data - T030
Lot 1 - Affected Area

No. of Samples: 60

SAMPLE NAME	GRID NAME	TRITIUM (dpm/100cm2) TOTAL	STD DEV
SE Wall	27	-19.0	2.1
South Wall	47	-8.8	2.1
South Wall	52	-7.5	2.1
South Wall	58	-11.0	2.1
West Wall	74	-4.0	2.1
West Wall	78	-1.2	2.1
West Wall	87	-1.1	2.1
Floor	102	-1.2	2.1
Floor	104	-1.8	2.1
Floor	119	0.6	2.1
Floor	121	-23.0	2.1
Floor	124	-34.0	2.1
Floor	138	-13.0	2.1
Ceiling	157	-21.0	2.1
Ceiling	159	-18.0	2.1
Ceiling	174	-16.0	2.1
Ceiling	176	-21.0	2.1
Ceiling	179	-17.0	2.1
Ceiling	195	-18.0	2.1

Final Survey Tritium Data - T030
Lot 2 - Unaffected Area

No. of Samples: 40

SAMPLE NAME	GRID NAME	TRITIUM (dpm/100cm2) TOTAL	STD DEV

T030 FINAL SURVEY SSA's

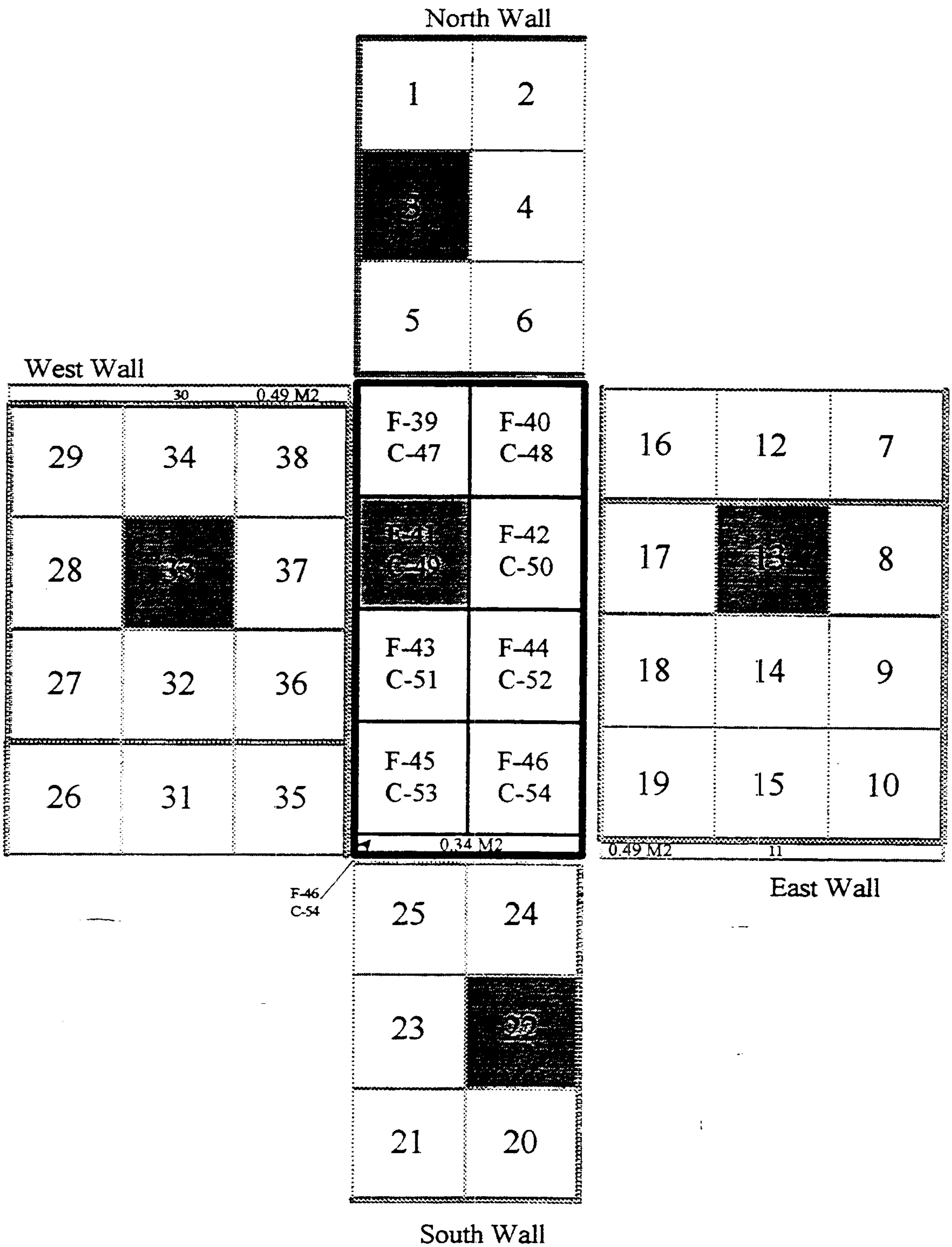
		Average SSA Values					
Lot No.	No. Samples*	Total Alpha	Total Beta	Rem. Alpha	Rem. Beta	Gamma	Tritium*
1	68	9.79	293	5.82	11.1	0.32	5.00
2	40	9.79	291	7.09	11.5	0.32	5.00
Maximum		9.79	293	7.17	11.7	0.32	5.00
Minimum		9.79	289	3.80	11.1	0.31	5.00
Wt. Mean		9.79	293	6.29	11.3	0.32	5.00

*Note: There were 60 tritium samples for the affected area.

Appendix C.

Grid Locations for Building T030 Survey

T030 WALKWAY GRID LOCATION DIAGRAM



= (black and gray) 9 M2 locations

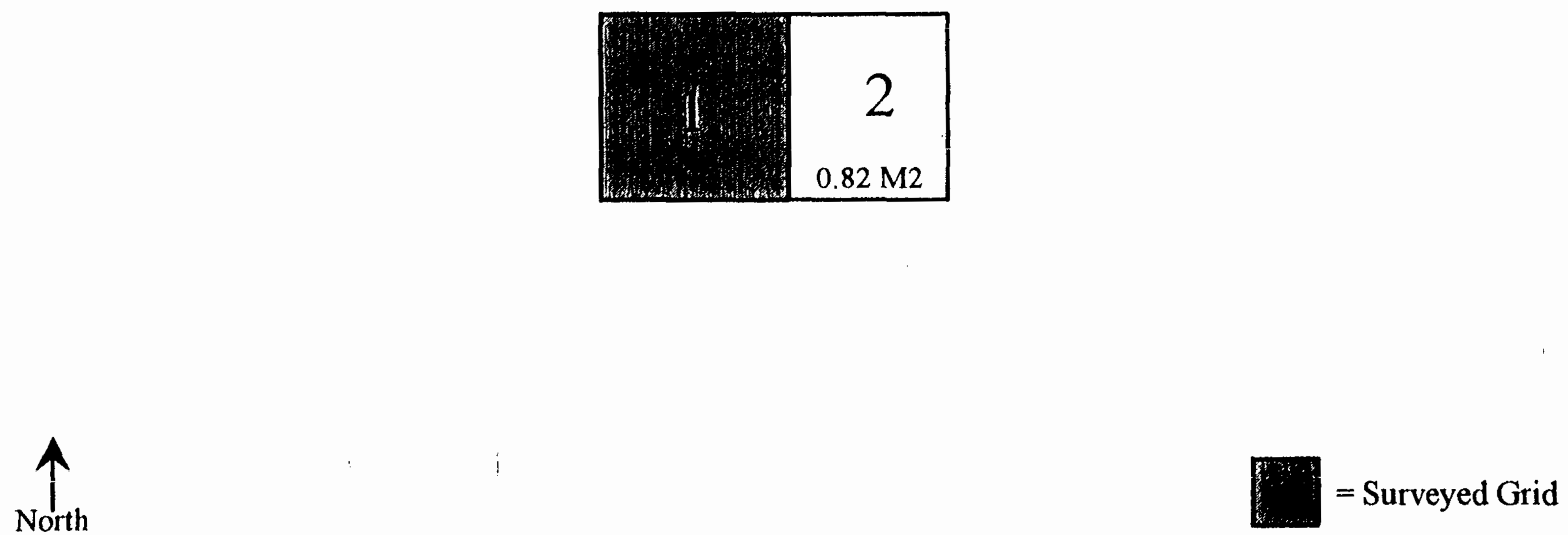
= Surveyed Grids

\# = Wall Grids

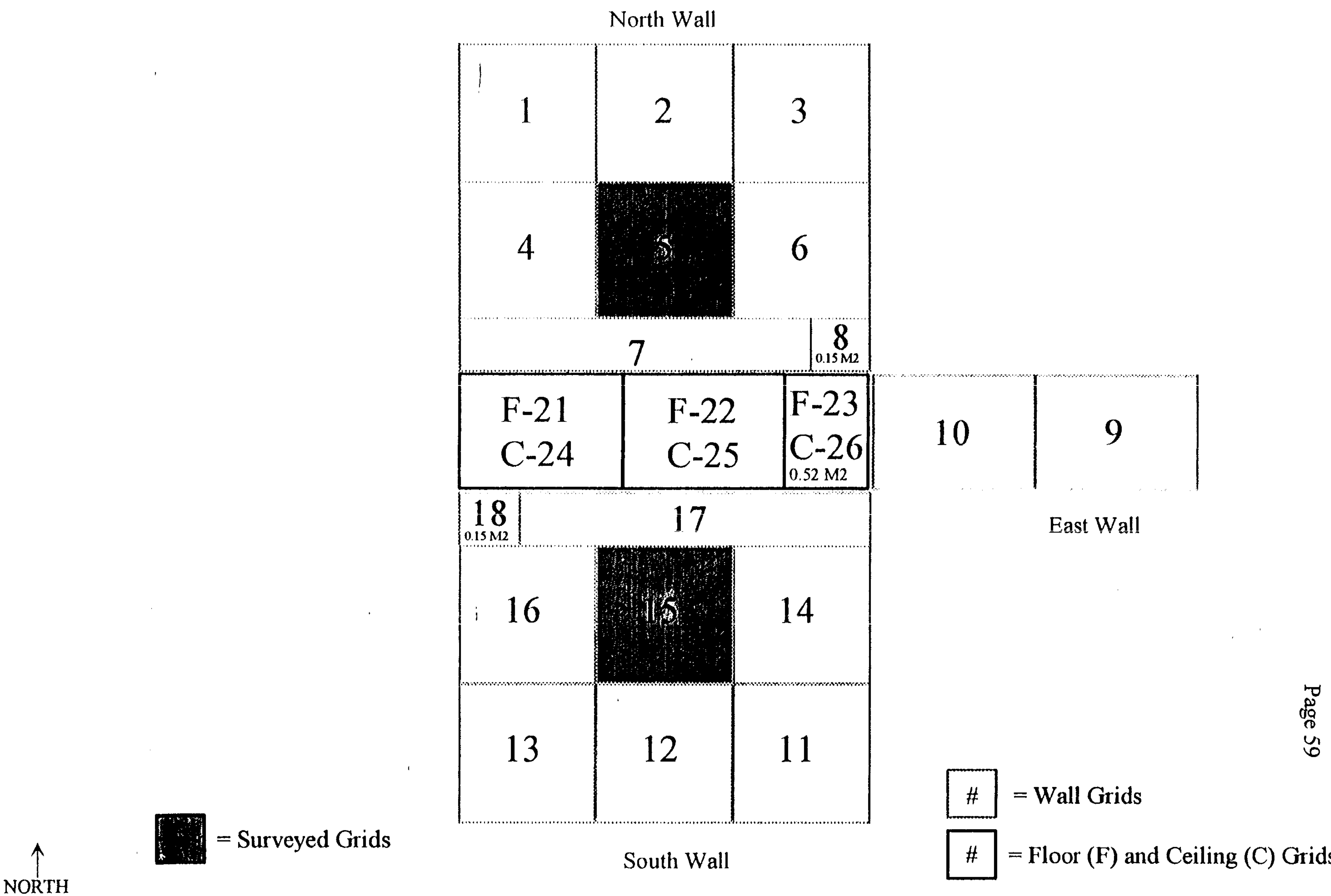
\# = Floor (F) and Ceiling (C) Grids

NORTH

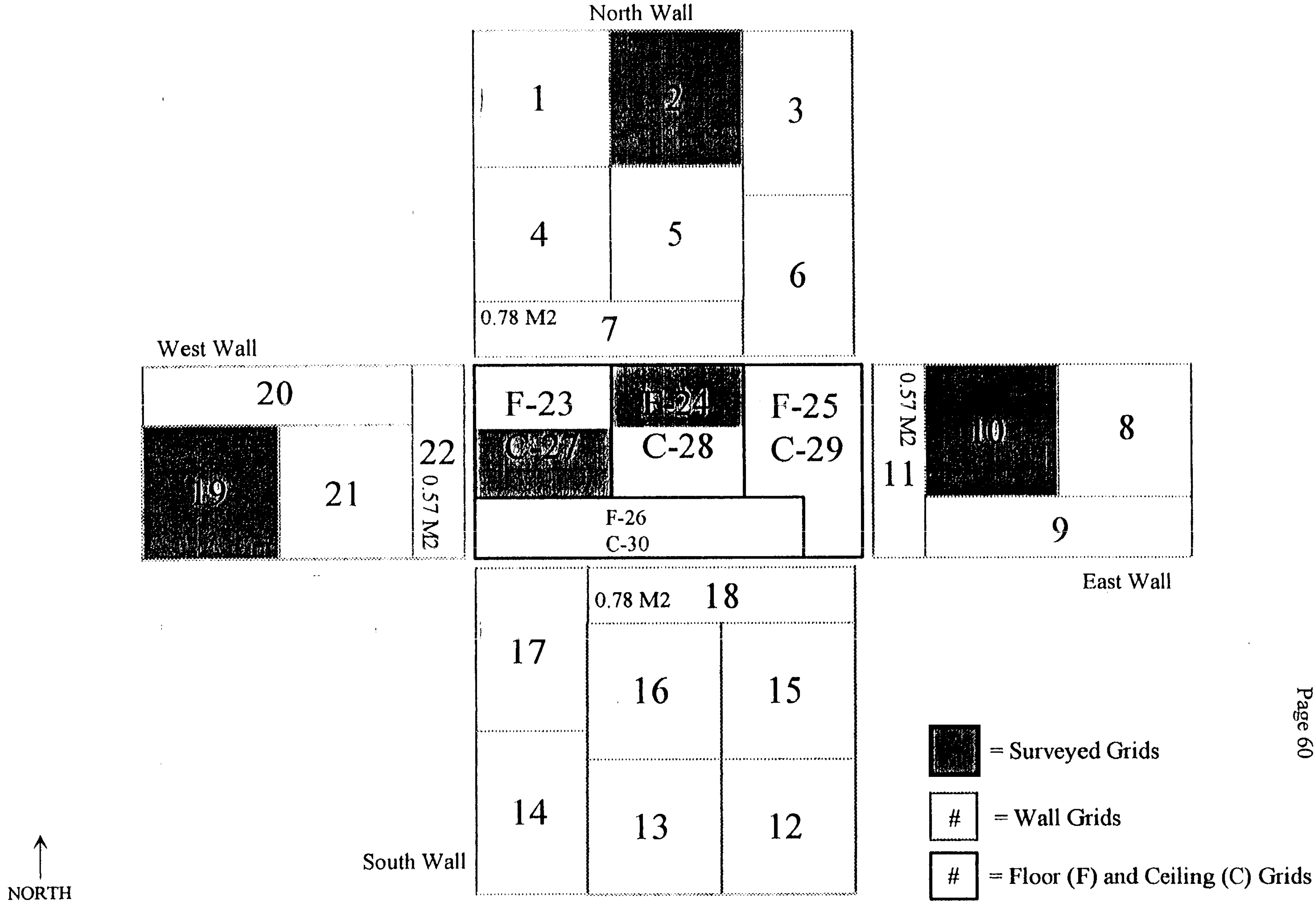
T030 NORTH WALKWAY CONCRETE PAD GRID LOCATOR DIAGRAM



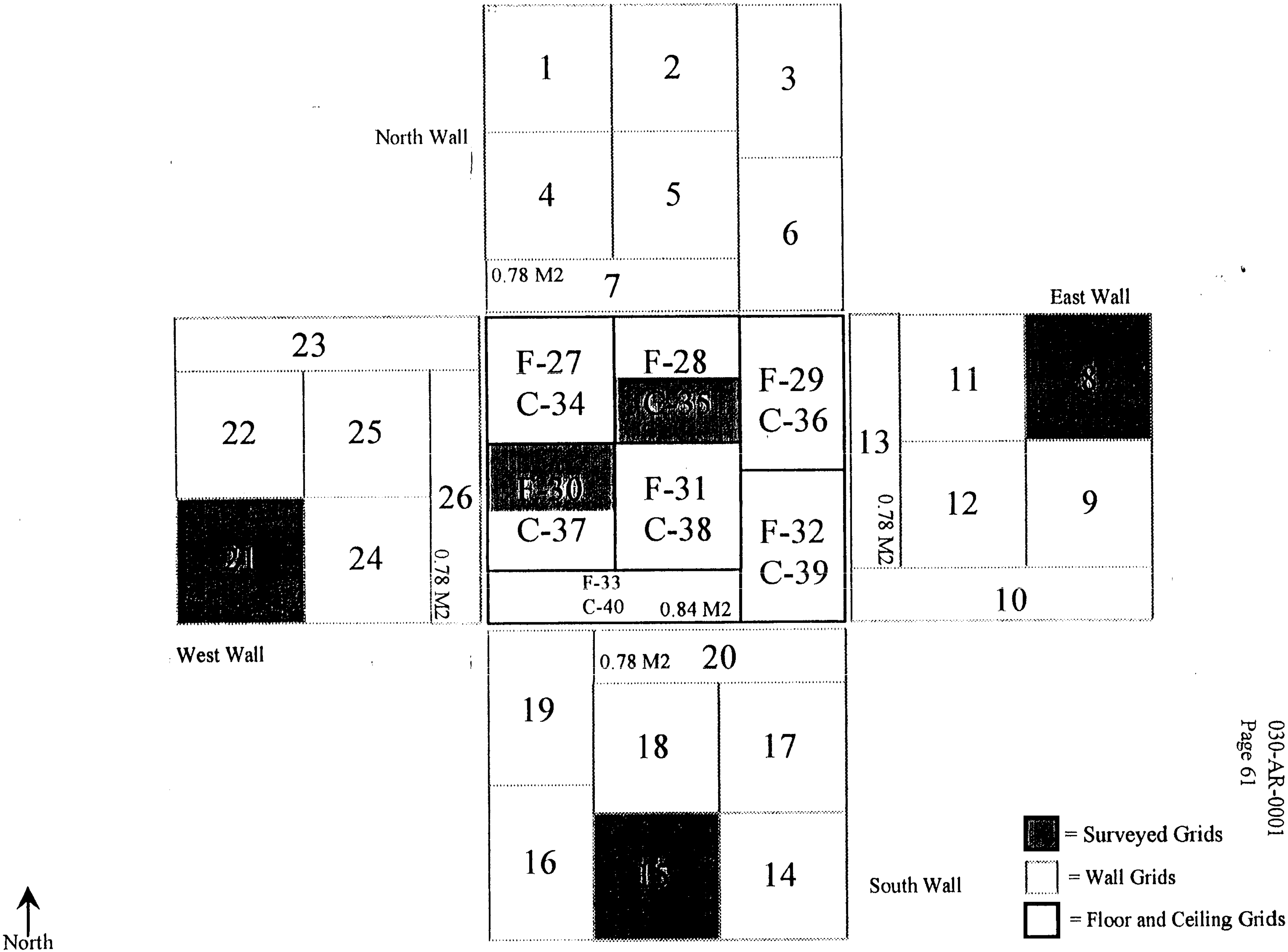
T030 WOMEN'S ROOM FOYER GRID LOCATION DIAGRAM



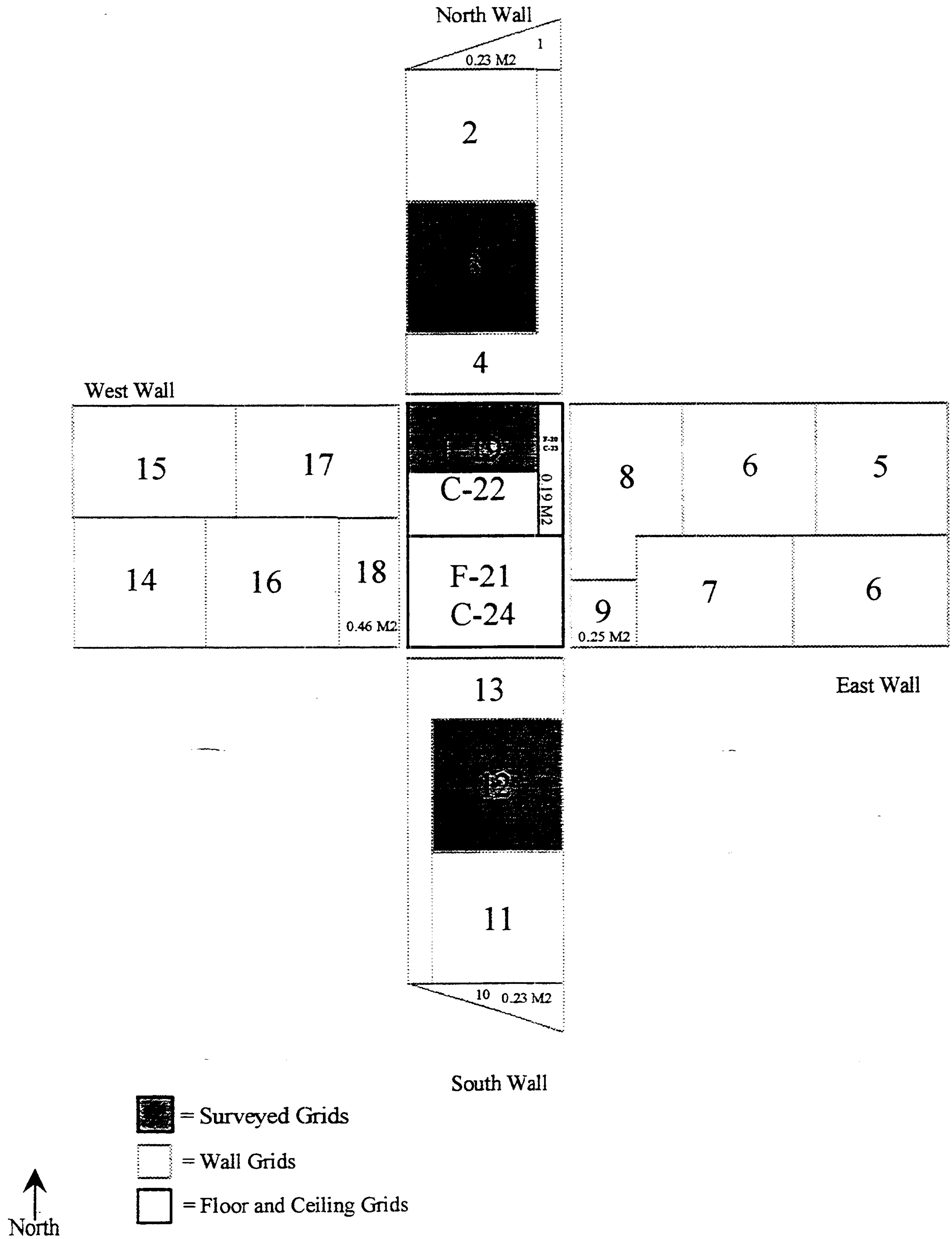
T030 WOMEN'S ROOMGRID LOCATION DIAGRAM



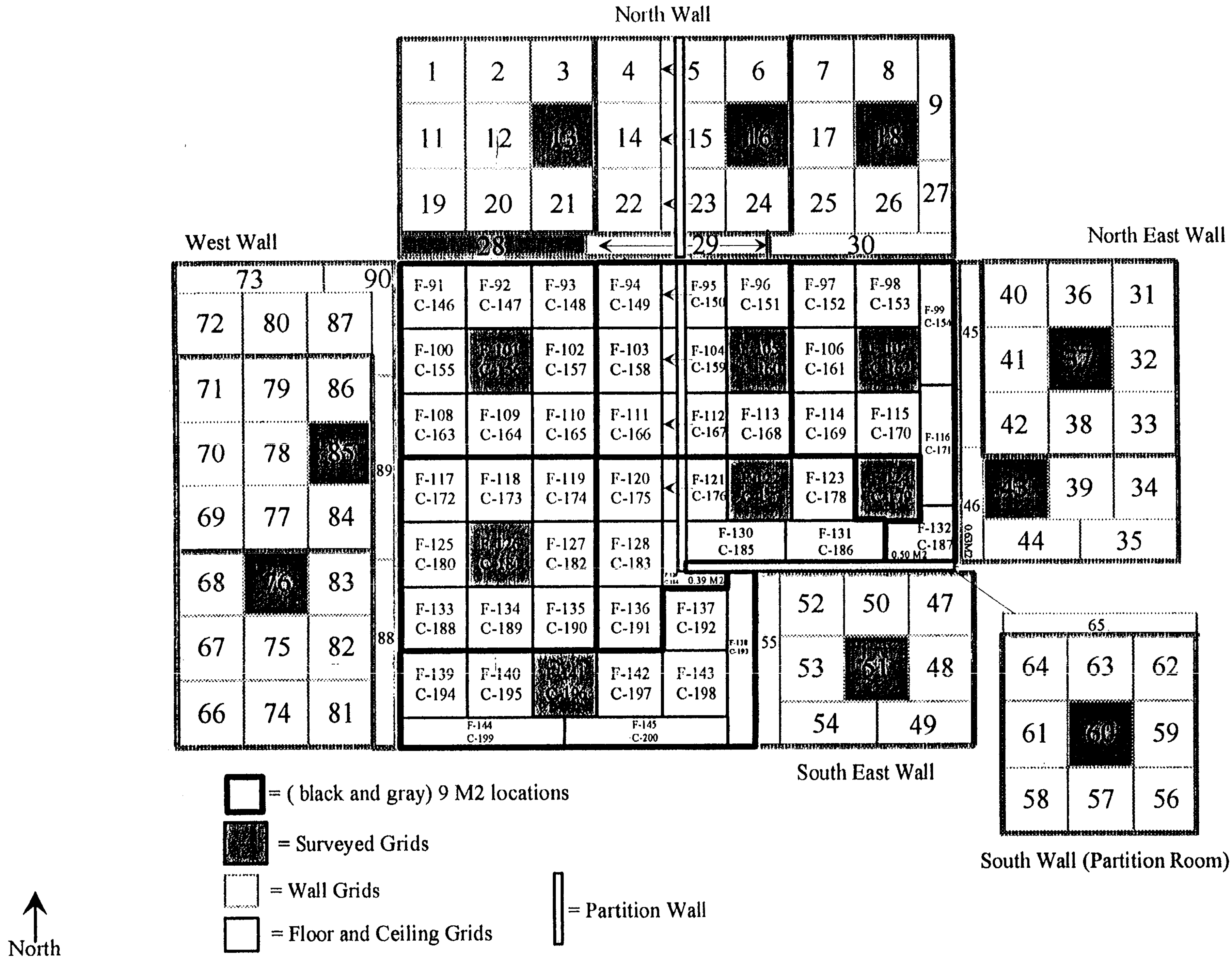
T030 MEN'S ROOM GRID LOCATOR DIAGRAM



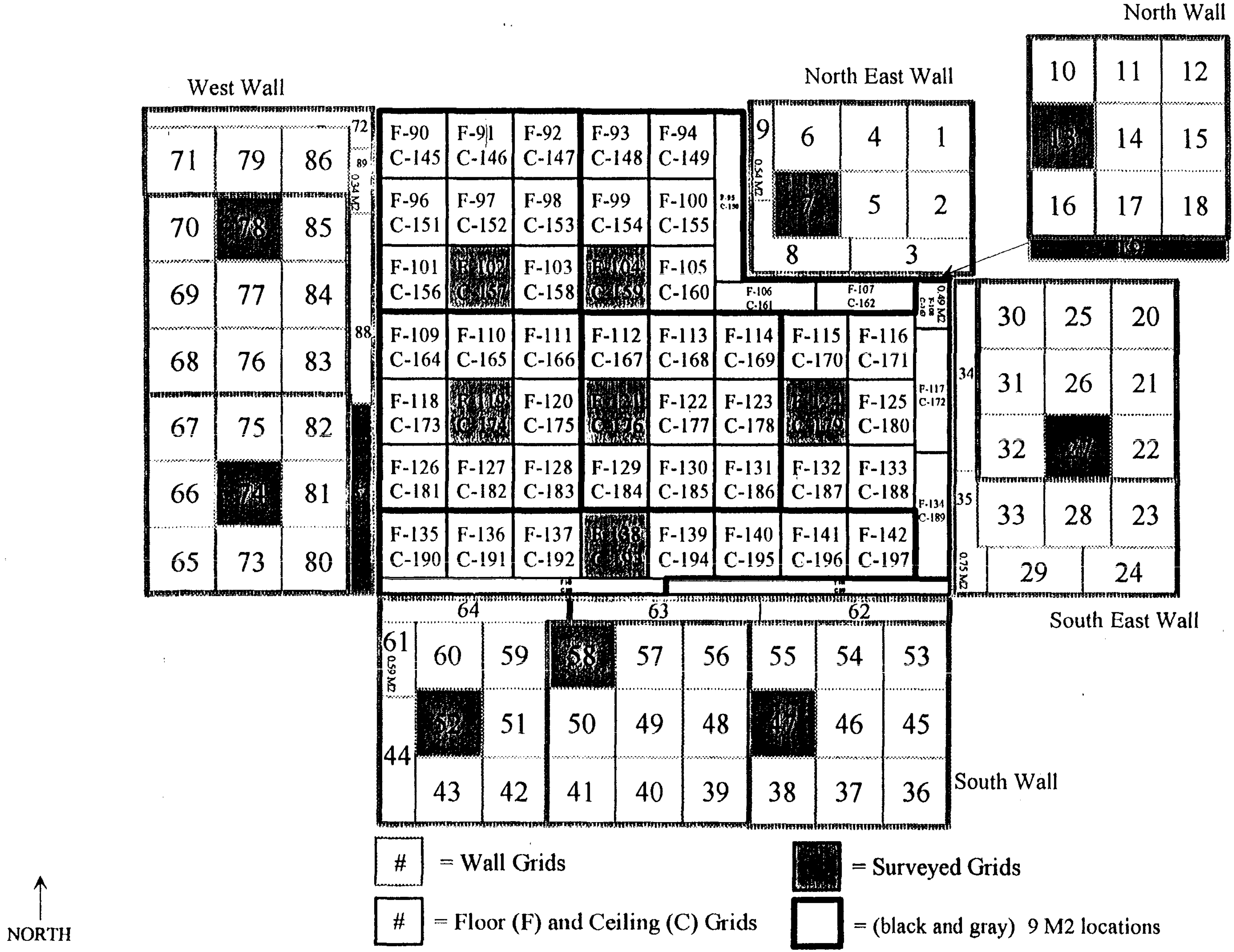
T030 ROOM 100 GRID LOCATOR DIAGRAM



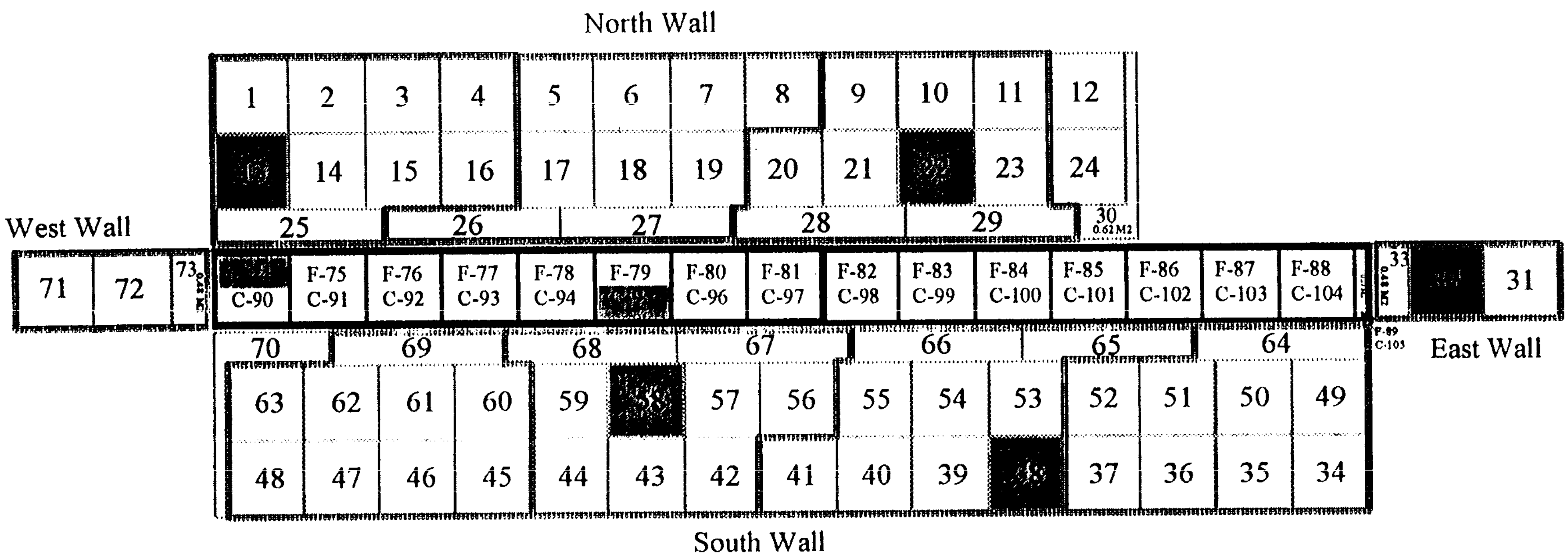
T030 ROOM 101 GRID LOCATOR DIAGRAM



T030 ROOM 102 GRID LOCATION DIAGRAM



T030 OFFICE HALLWAY GRID LOCATION DIAGRAM



NORTH

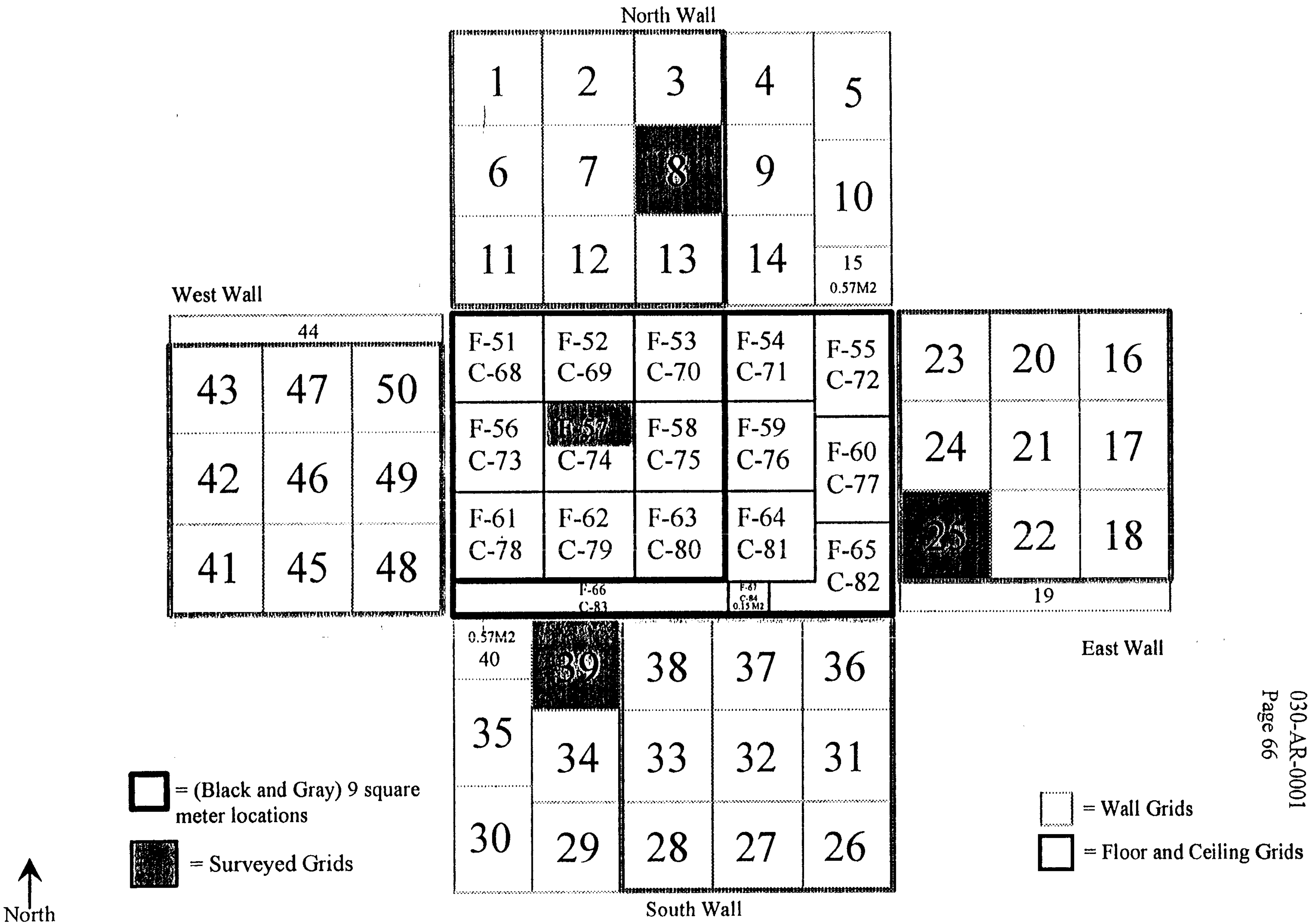
= Wall Grids

= Floor (F) and Ceiling (C) Grids

= (black and gray) 9 M2 locations

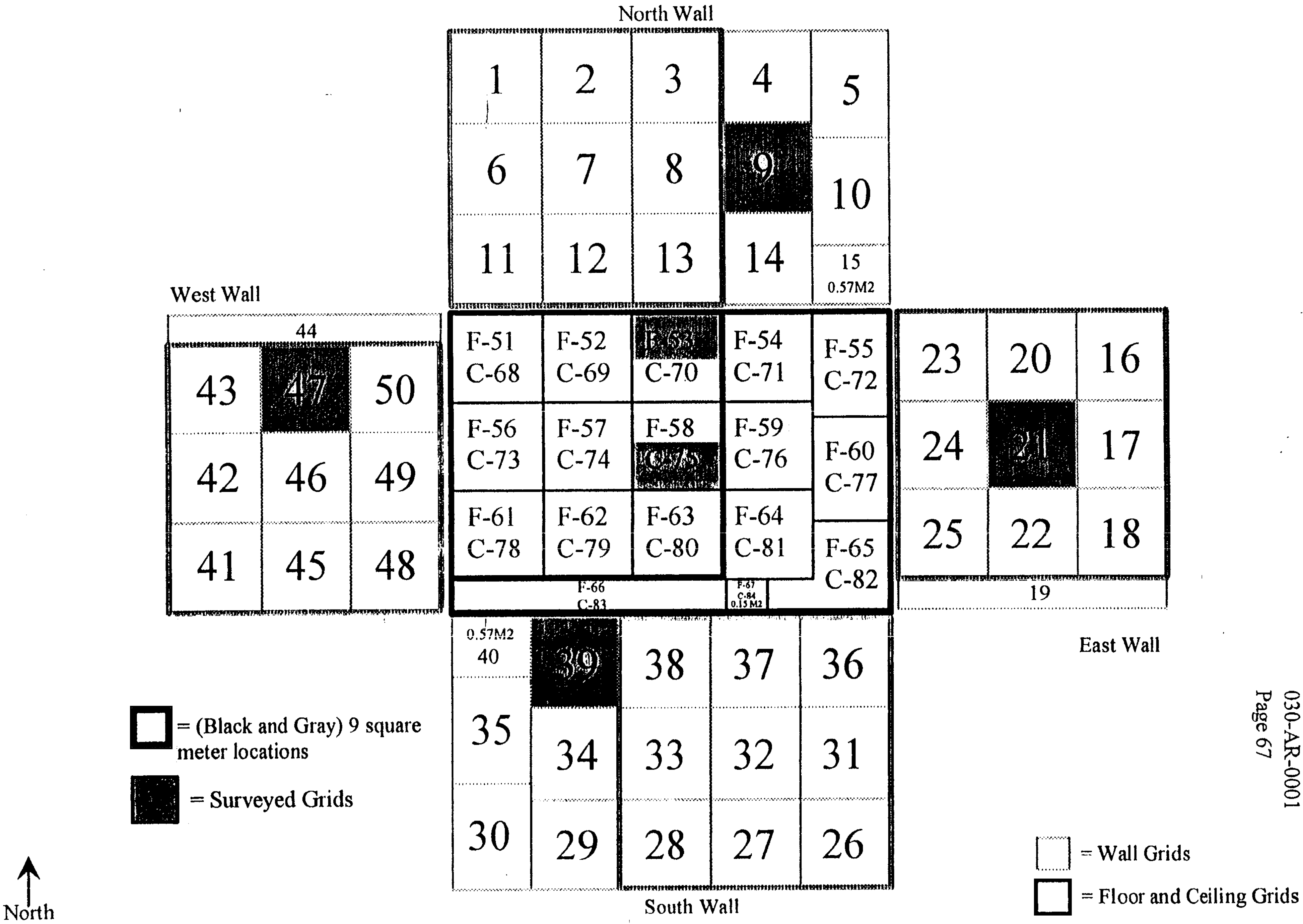
= Surveyed Grids

T030 ROOM 103 GRID LOCATOR DIAGRAM

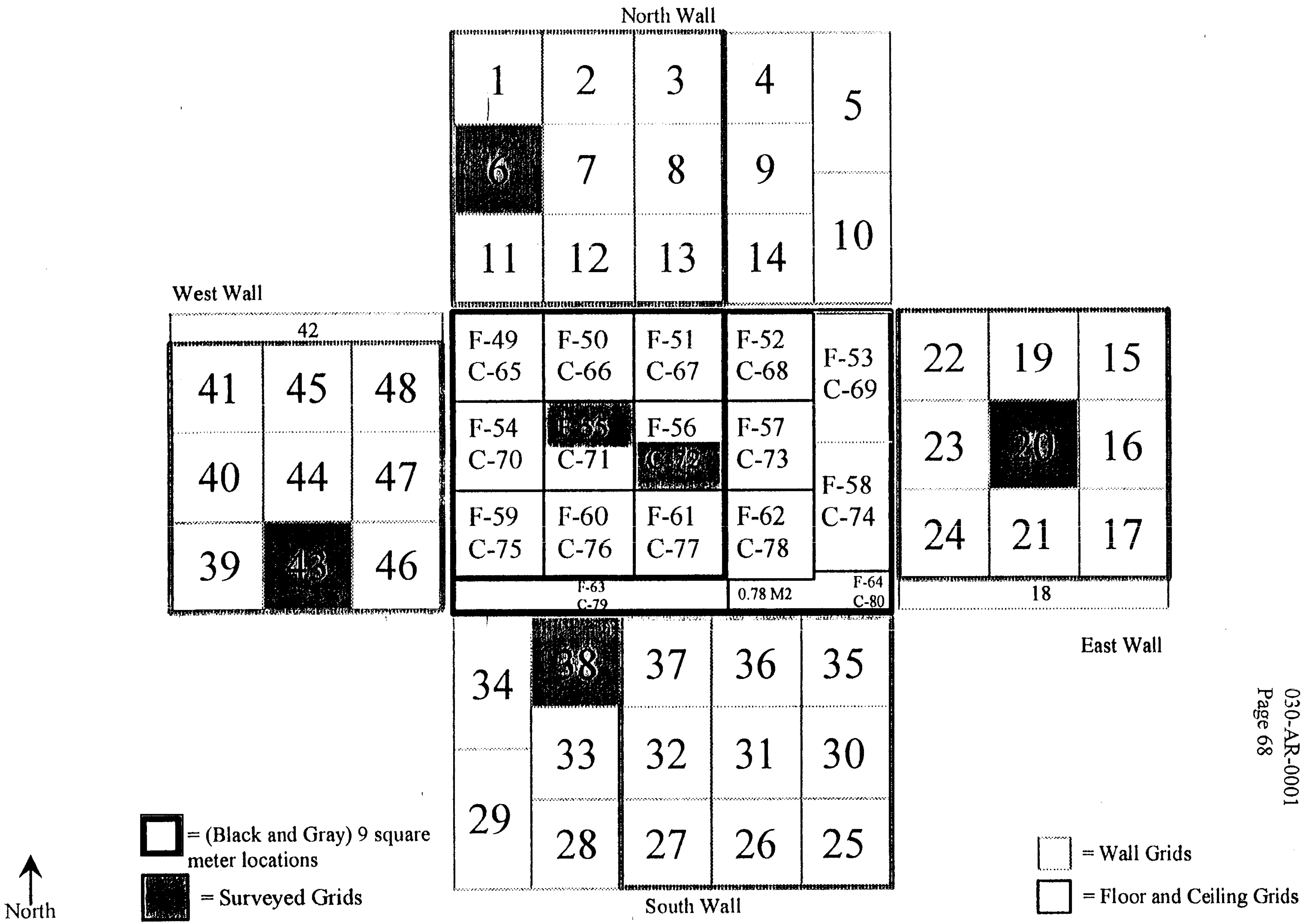


030-AR-0001
Page 66

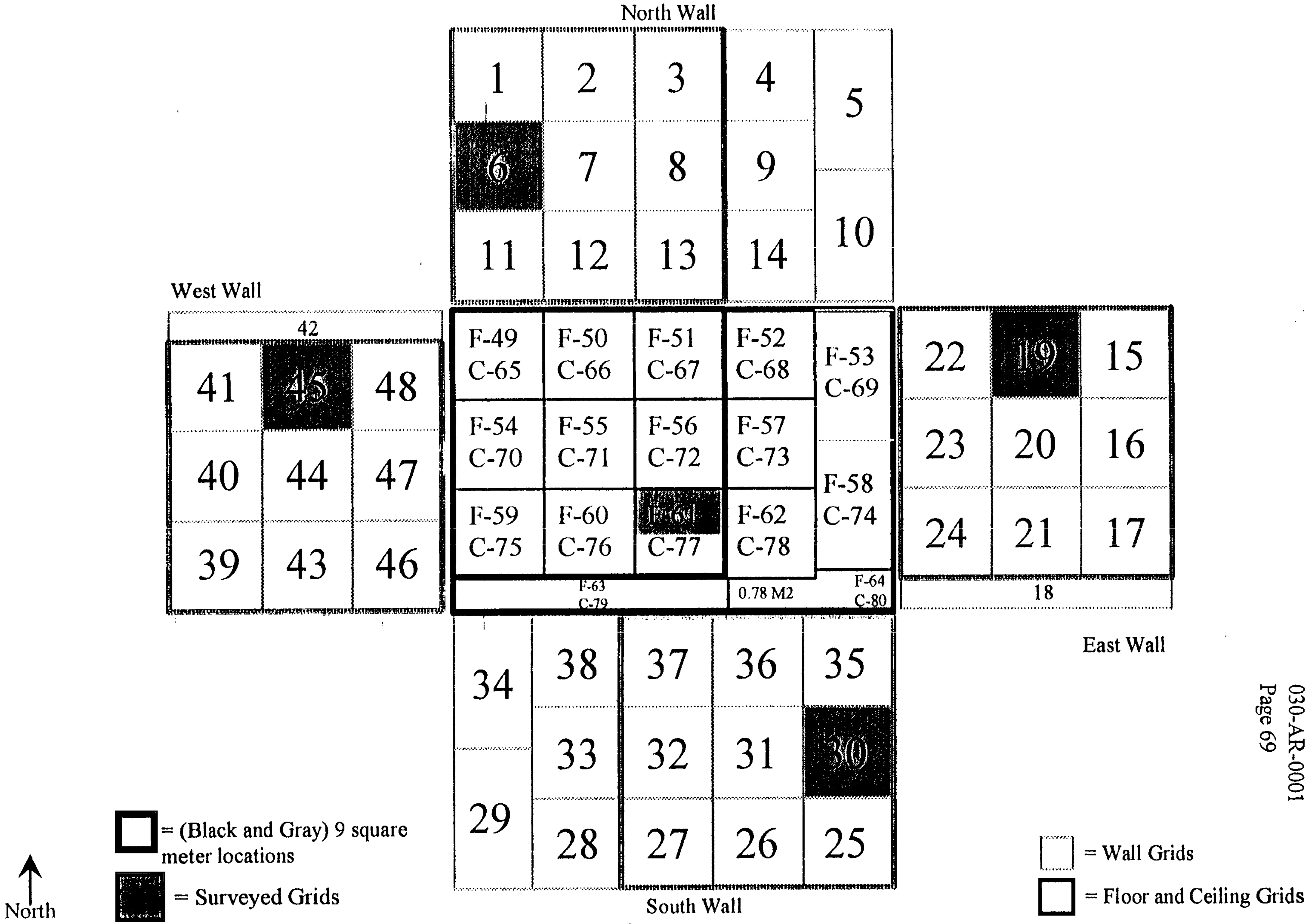
T030 ROOM 104 GRID LOCATOR DIAGRAM



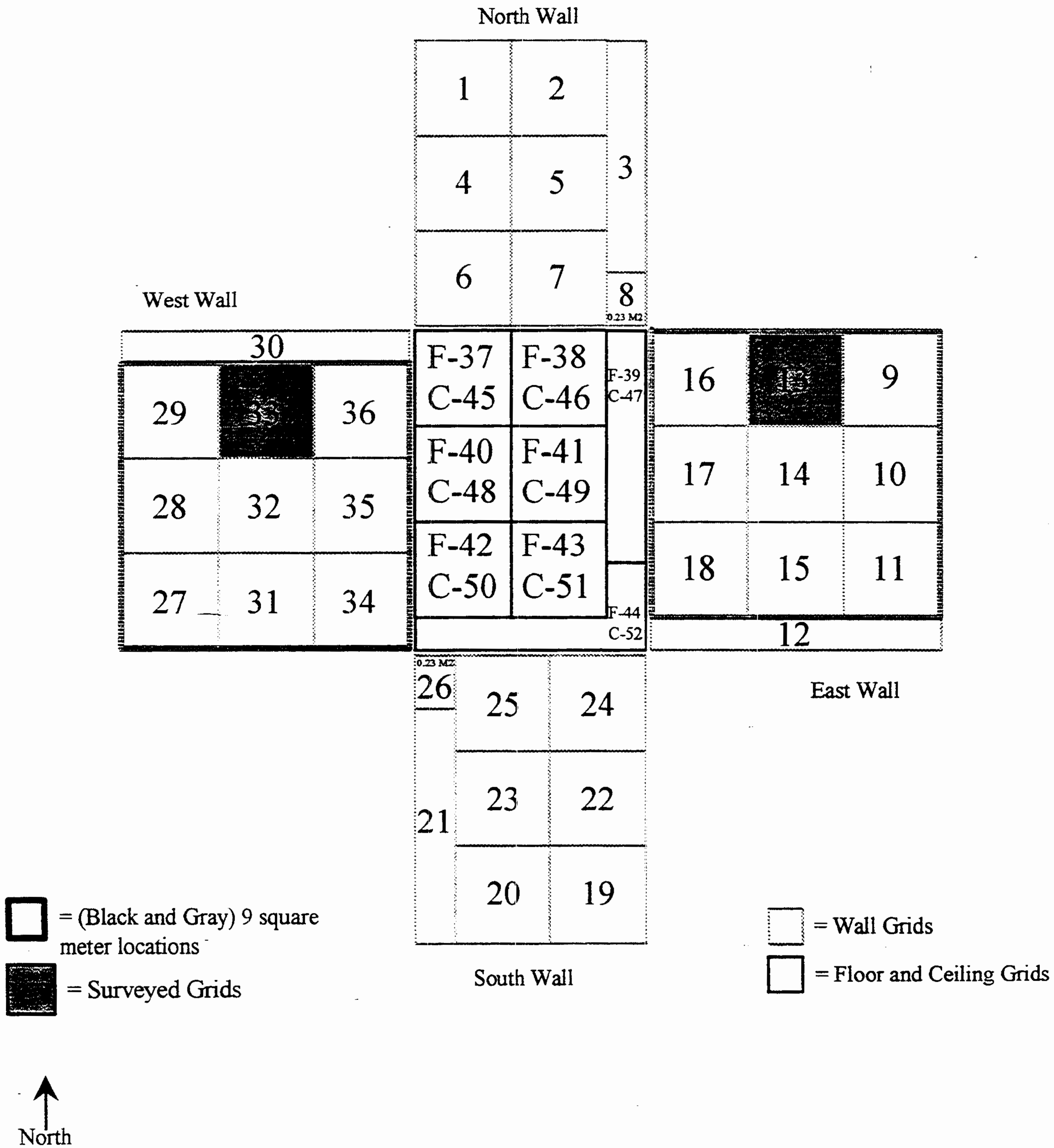
T030 ROOM 105 GRID LOCATOR DIAGRAM



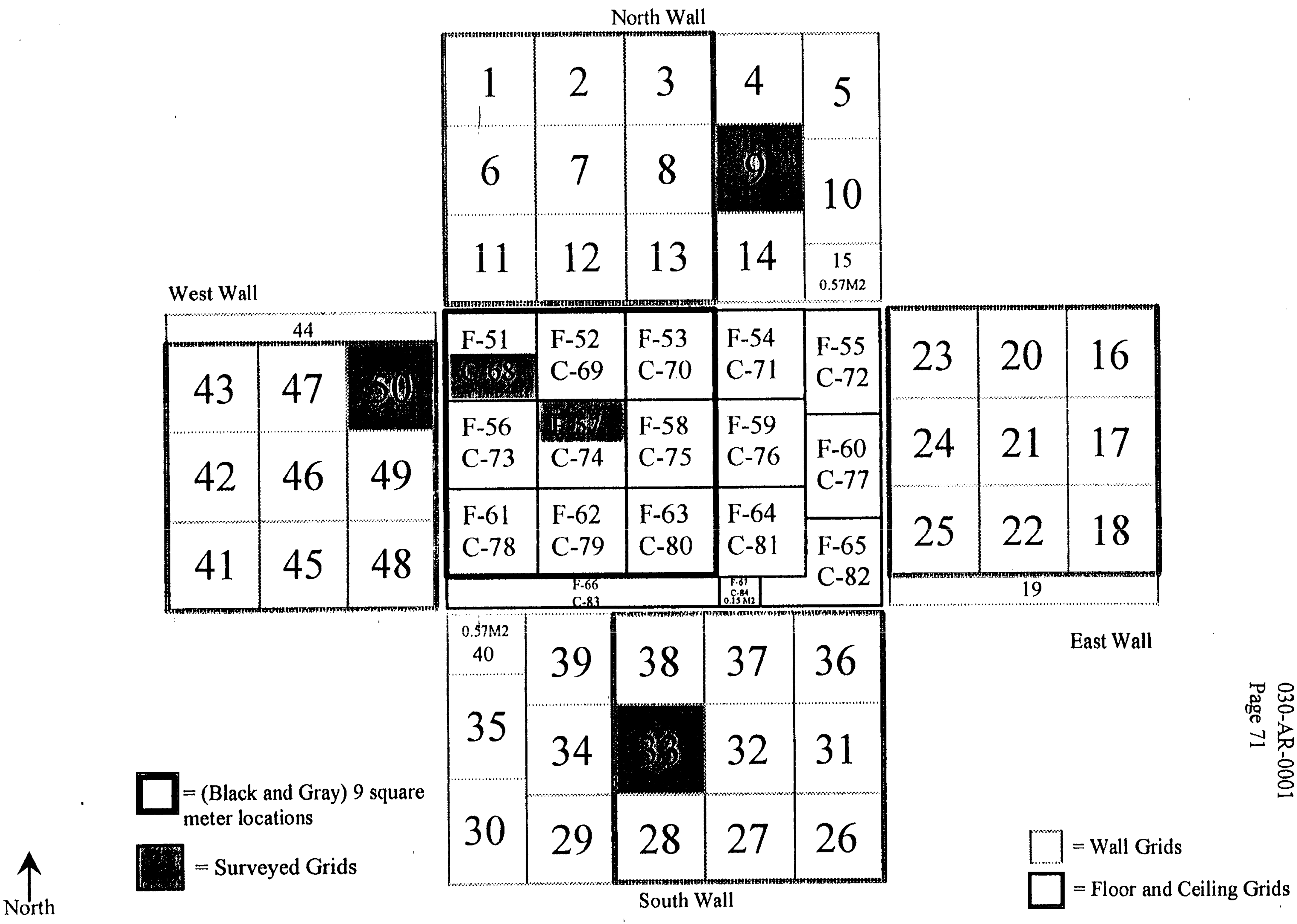
T030 ROOM 106 GRID LOCATOR DIAGRAM



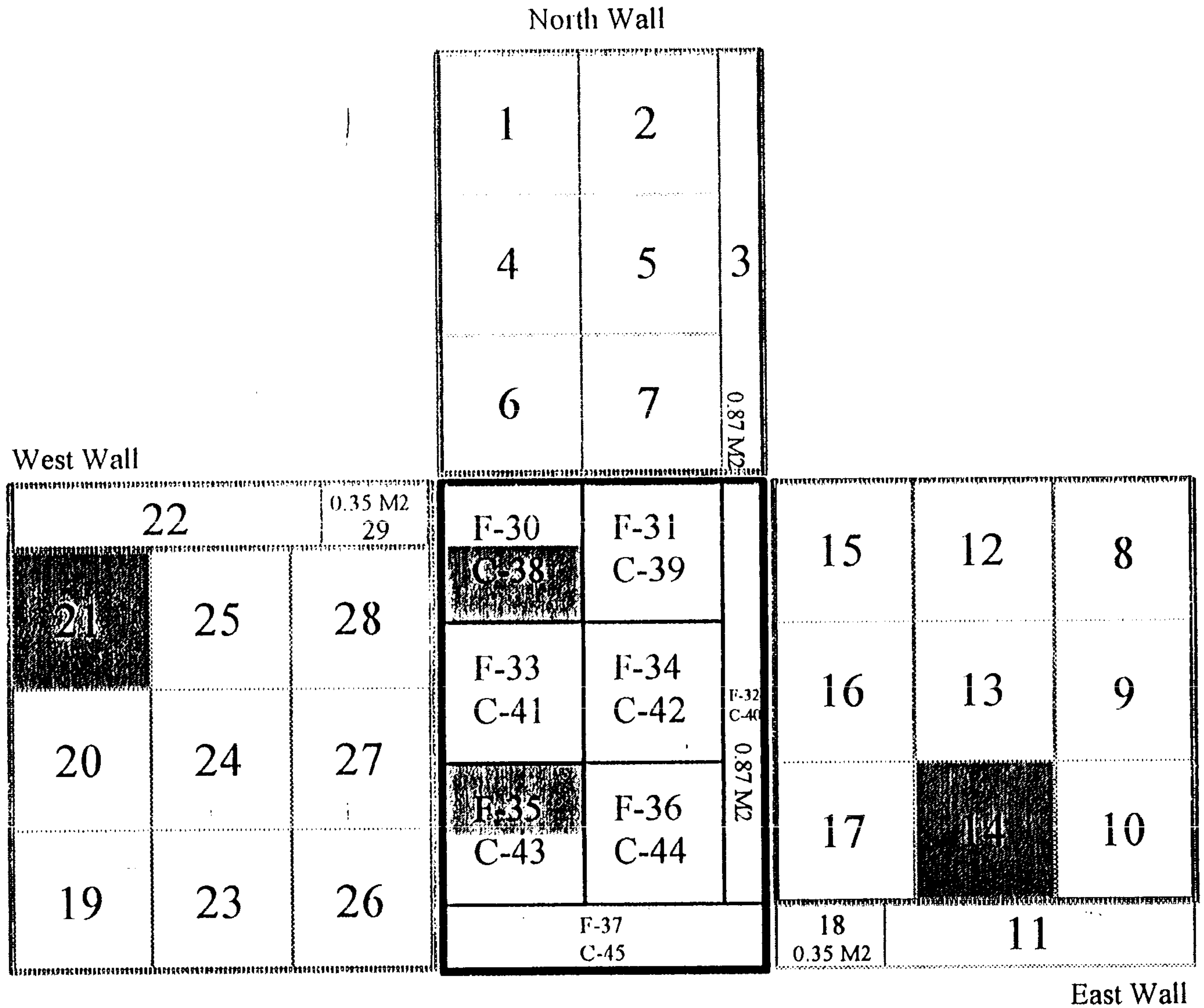
T030 ROOM 107 GRID LOCATOR DIAGRAM



T030 ROOM 108/110 GRID LOCATOR DIAGRAM



T030 ROOM 109 GRID LOCATION DIAGRAM



= Wall Grids

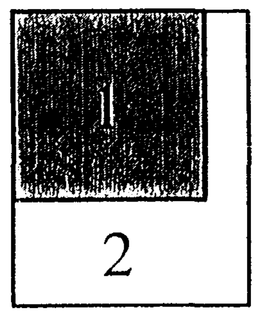
= Floor (F) and Ceiling (C) Grids

= (black and gray) 9 M2 locations

= Surveyed Grids

↑ NORTH

T030 EAST ENTRANCE CONCRETE PAD GRID LOCATOR DIAGRAM



North

= Surveyed Grid