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Certification Docket for the Remedial Action Performed at the University of Chicago, Chicago, Illinois, from December 1982 to October 1987

Department of Energy
Technical Services Division
Oak Ridge Operations Office

December 1989

0289-0440.1

LEGAL NOTICE

CERTIFICATION DOCKET FOR THE REMEDIAL ACTION PERFORMED AT THE UNIVERSITY OF CHICAGO, CHICAGO, ILLINOIS, FROM DECEMBER 1982 TO OCTOBER 1987

DECEMBER 1989

Prepared for

UNITED STATES DEPARTMENT OF ENERGY

OAK RIDGE OPERATIONS OFFICE

Under Contract No. DE-AC05-81OR20722

By

Bechtel National, Inc.

Oak Ridge, Tennessee

Bechtel Job No. 14501

TABLE OF CONTENTS

FIGURES

TABLES

ABBREVIATIONS

cm	centimeter
cm^2	square centimeter
dpm	disintegrations per minute
ft	foot
ft^2	square feet
ft^3	cubic feet
gal	gallon
ha	hectare
km	kilometer
L	liter
m	meter
m^2	square meter
m^3	cubic meter
mi	mile
µR/h	microroentgens per hour
µCi/ml	microcuries per milliliter
MeV	million electron volts
mrad/h	millirad per hour
mrem	millirem
mrem/yr	millirem per year
pCi/g	picocuries per gram

ACRONYMS

ADM	action description memorandum
AEC	Atomic Energy Commission
ANL	Argonne National Laboratory
BNI	Bechtel National, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
DOE	Department of Energy
EPA	Environmental Protection Agency
ERDA	Energy and Research Development Agency
FUSRAP	Formerly Utilized Sites Remedial Action Program
INEL	Idaho National Engineering Laboratory
IVC	independent verification contractor
MED	Manhattan Engineer District
NEPA	National Environmental Policy Act
NGA	National Guard Armory
ORAU	Oak Ridge Associated Universities
ORNL	Oak Ridge National Laboratory
OSRD	Office of Scientific Research and Development
PMC	project management contractor
PRAR	post-remedial action report
QAPmP	quality assurance program plan
SARA	Superfund Amendments and Reauthorization Act

Description of the Formerly Utilized Sites Remedial Action Program at the University of Chicago, Chicago, Illinois

The U.S. Department of Energy (DOE), Office of Nuclear Energy, Office of Remedial Action and Waste Technology, Division of Facility and Site Decommissioning Projects conducted a remedial action project at the University of Chicago in Chicago, Illinois. The work was administered by the Formerly Utilized Sites Remedial Action Program (FUSRAP), one of four remedial action programs under the direction of the DOE Division of Facility and Site Decommissioning Projects.

The United States Congress authorized DOE to initiate FUSRAP in 1974 to identify and clean up or otherwise control sites where residual radioactive material (exceeding current guidelines) remains from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has mandated DOE to remedy. The objectives of FUSRAP are to:

- Identify and assess sites formerly utilized to support early Manhattan Engineer District/Atomic Energy Commission (MED/AEC) nuclear work to determine whether further decontamination and/or control is needed
- Decontaminate and/or apply controls to these sites to permit conformance with currently applicable guidelines
- Dispose of and/or stabilize all generated residues in an environmentally acceptable manner
- Accomplish all work in accordance with appropriate landowner agreements and local and state environmental and land-use requirements to the extent specified by federal law and applicable DOE orders, regulations, standards, policies, and procedures
- Certify, at the completion of remedial action, that the radiological conditions at the site comply with guidelines and that the site is appropriate for future use

The identification and assessment of formerly utilized sites is accomplished by DOE. This process results in the designation of those sites into FUSRAP. Once a site has been designated as a FUSRAP site, the decontamination is managed and/or controls are

applied to this site by DOE, Oak Ridge Operations Office, Technical Services Division. The Oak Ridge Operations Office also manages the disposal and/or stabilization of residues generated during remedial action.

Upon completion of decontamination and disposal, DOE employs an independent verification contractor (IVC), which operates independently of the decontamination and disposal contractors. The IVC determines and verifies that the site has been successfully decontaminated such that the radiological conditions comply with guidelines and the site is appropriate for future use.

The current designation contractor is Oak Ridge National Laboratory (ORNL). Oak Ridge Associated Universities (ORAU) is presently under contract to DOE as the IVC to perform the verification surveys. As the project management contractor (PMC), Bechtel National, Inc. (BNI) is the DOE representative for planning, managing, and implementing decontamination activities and applying controls.

Environmental Regulations for FUSRAP

To assess the environmental impacts of federal actions, Executive Order 11991 empowered the Council on Environmental Quality (CEQ) to issue regulations to federal agencies for implementing those procedural provisions of the National Environmental Policy Act (NEPA) that are mandatory under the law. CEQ issued regulations containing guidance and specific requirements in June 1979. The DOE guidelines for implementing the NEPA process and satisfying the CEQ regulations were made effective on March 28, 1980.

The NEPA process required FUSRAP decision-makers to identify and assess the environmental consequences of proposed actions before beginning remedial action activities, developing disposal sites, or transporting and emplacing radioactive wastes. After the enactment of the Superfund Amendments and Reauthorization Act (SARA), which amended the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), DOE established a policy to integrate the

requirements of CERCLA and NEPA because both had similar requirements.

Documentation required by NEPA and CERCLA to support remedial action is prepared by Argonne National Laboratory (ANL). Supporting documentation is provided to ANL by the FUSRAP PMC through the preparation of a series of engineering studies of the remedial action under consideration for a site. The remedial action alternative selected by DOE based on the evaluation of NEPA and CERCLA processes is subsequently implemented with consideration for public safety and in compliance with applicable federal, state, and local requirements.

For the remedial action activities discussed in this certification docket, the NEPA and CERCLA requirements were satisfied by the preparation of an action description memorandum that led to the issuance of a memorandum to file documenting that the remedial action planned would have no significant impact on the environment.

Work performed under FUSRAP by the PMC, architect-engineers, and subcontractors is governed by the provisions of the DOE quality assurance program plan (QAPmP) developed for the project in compliance with DOE Order 5700.6. The effectiveness of implementation of the QAPmP is appraised regularly by the BNI quality assurance organization and by DOE-ORO.

Property Identification

The University of Chicago is a private university located in the Hyde Park-Kenwood area of the City of Chicago, Illinois. It is approximately 11 km (7 mi) south of the Chicago downtown business district. The existing campus buildings that were associated with MED work are Ryerson Physical Laboratory, Eckhart Hall, Kent Chemistry Laboratory, and George Herbert Jones Chemical Laboratory. These buildings are now in use as offices, laboratories, and classrooms. Other buildings associated with MED activities have

been torn down. Some laboratories are still used for nuclear research under license by the Illinois Department of Nuclear Safety.

Remedial action was completed at the University of Chicago in October 1987, and DOE certified that the property is in compliance with applicable DOE standards and criteria developed to protect health, safety, and the environment. A notice of certification was published in the Federal Register on _____, 1989.

Docket Contents

The purpose of this docket is to document the successful decontamination of the University of Chicago site. Material in this docket consists of documents supporting DOE certification that conditions at the subject property are in compliance with radiological guidelines and standards determined to apply to this property. Furthermore, the use of this property will not result in any measurable radiological hazard to the general public that is attributable to the activities of DOE or its predecessor agencies.

Exhibit I is a summary of remedial action activities conducted at the University of Chicago. The exhibit provides a brief history of the origin of the contamination, the radiological characterizations conducted, the remedial action performed, and post-remedial action/verification activities. Cost data covering all remedial action conducted at the site are also included in Exhibit I. Appendix A to Exhibit I contains the applicable remedial action guidelines.

Exhibit II consists of the letters, memos, reports, and other documents that were produced to encompass the entire remedial action process, from designation of the site under FUSRAP to the certification that no radiologically based restrictions limit the future use of the site. Documents that are brief are included in Exhibit II. Lengthy documents are incorporated by reference only; the actual documents are provided as an attachment to the certification docket at publication.

Exhibit III provides diagrams of the site that illustrate the areas that were decontaminated during the cleanup activities.

The certification docket will be archived by DOE through the Assistant Secretary for Management and Administration after certification of the site. Copies will be available for public review between 9:00 a.m. and 4:00 p.m., Monday through Friday (except federal holidays) at the DOE Public Reading Room located in Room 1E-190 of the Forrestal Building, 1000 Independence Avenue, S.W., Washington, D.C. Copies will also be available in the DOE Public Document Room at the Oak Ridge Operations Office in Oak Ridge, Tennessee, and in the DOE Public Reading Room at the Chicago Operations Office in Chicago, Illinois.

Exhibit I

Summary of Remedial Action Activities Performed at the University of Chicago, Chicago, Illinois, from December 1982 to October 1987

EXHIBIT I

SUMMARY OF REMEDIAL ACTION ACTIVITIES PERFORMED AT THE UNIVERSITY OF CHICAGO, CHICAGO, ILLINOIS, FROM DECEMBER 1982 TO OCTOBER 1987

1.0 INTRODUCTION

The site addressed in this certification docket is the University of Chicago, Chicago, Illinois (Figure I-1). This exhibit summarizes the activities culminating in the certification that radiological conditions at various University of Chicago buildings are in compliance with applicable guidelines and that use of the property will result in no radiological exposure above U.S. Department of Energy (DOE) standards and criteria established to protect members of the general public and occupants of the site. These activities were conducted under the Formerly Utilized Sites Remedial Action Program (FUSRAP) (Ref. 1). The remedial action process at the University of Chicago included characterizing its radiological status, designating the site as requiring remedial action, performing the remedial action, and verifying that the buildings have been decontaminated. Further detail on each activity can be found in the documents included or referenced in Exhibit II.

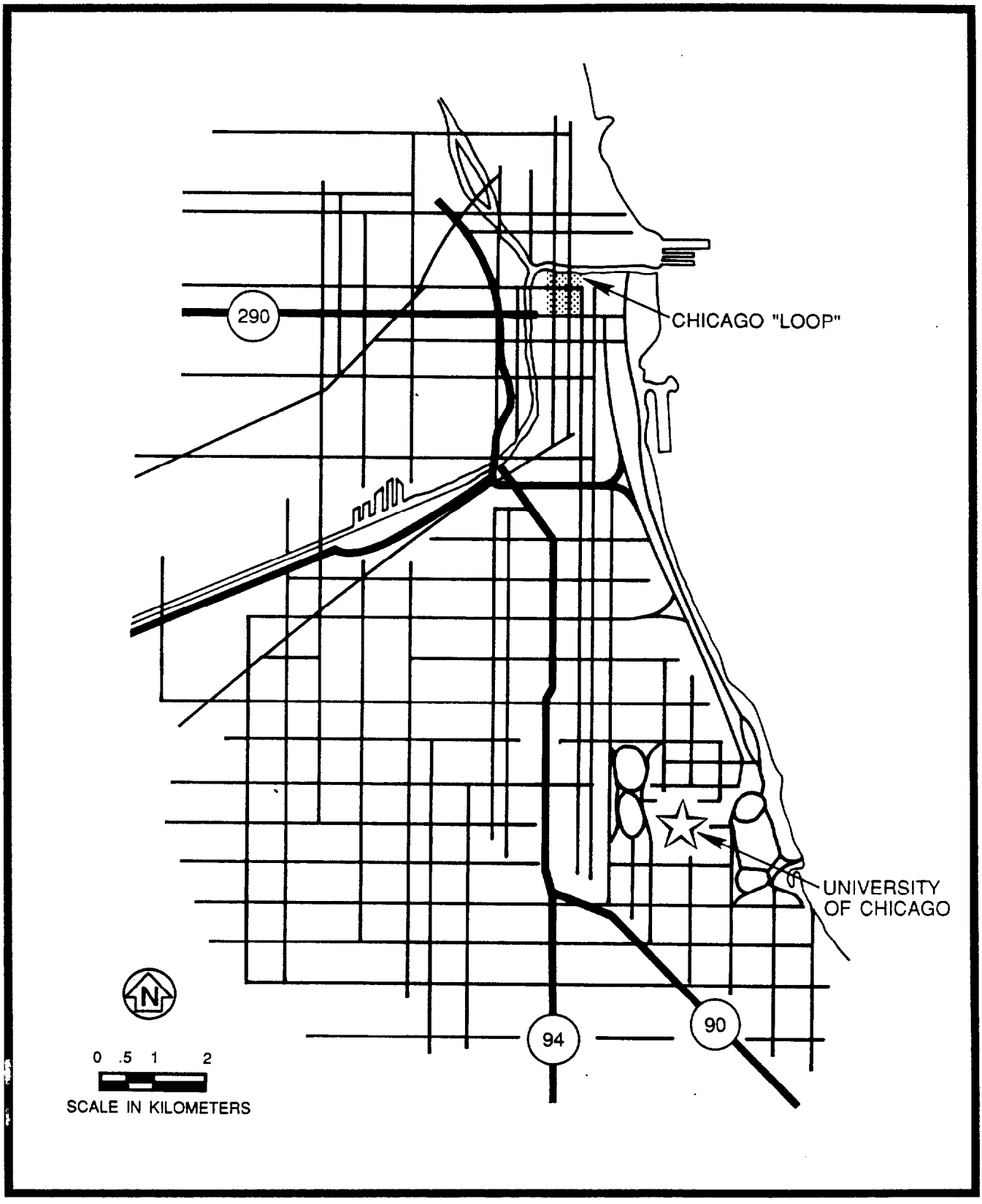

FIGURE I-1 LOCATION OF THE UNIVERSITY OF CHICAGO SITE

2.0 SITE HISTORY

The University of Chicago was one of the focal points for supporting activities conducted by predecessors of DOE, the Manhattan Engineer District (MED) and its successor, the Atomic Energy Commission (AEC). These activities included the handling of radioactive material associated with development of the atomic bomb during World War II (Refs. 1 and 2).

The primary focus of activities conducted at the University of Chicago under contract to MED was the production and purification of plutonium, which involved the handling and processing of uranium compounds (Refs. 3 and 4). Additional research and development operations were conducted throughout World War II to support the atomic bomb project at various laboratories and facilities.

The first contract with the University of Chicago was established through the Office of Scientific Research and Development (OSRD) in January 1942. By June of that year, the Army Corps of Engineers had assumed responsibility for developing the atomic bomb, forming MED for this purpose. The contract was transferred from OSRD to MED in May 1943. In 1947, AEC succeeded MED as the government agency in charge of nuclear programs. AEC-sponsored research continued at the University of Chicago until 1952. When MED/AEC operations at the university ceased, the facilities used by MED/AEC were decontaminated to meet health and safety criteria then in effect (Refs. 1 and 2).

3.0 SITE DESCRIPTION

The University of Chicago is a private university located on a 69.2-ha (171-acre) site in the Hyde Park-Kenwood National Historic District, Chicago, Illinois. It is approximately 11 km (7 mi) south of the downtown business district (Figure I-1).

The buildings on this campus that were associated with MED work were New Chemistry Laboratory and Annex, West Stands, Ryerson Physical Laboratory, Eckhart Hall, Kent Chemical Laboratory, George Herbert Jones Chemical Laboratory, and Ricketts Laboratory. New Chemistry Laboratory and Annex, West Stands, and Ricketts Laboratory have been torn down. The remaining buildings shown in the plan view (Figure I-2) are now in use as offices, laboratories, and classrooms.

Six university buildings (including Jones Laboratory) are listed in the National Register of Historic Places, as shown in Table I-1 (Ref. 5).

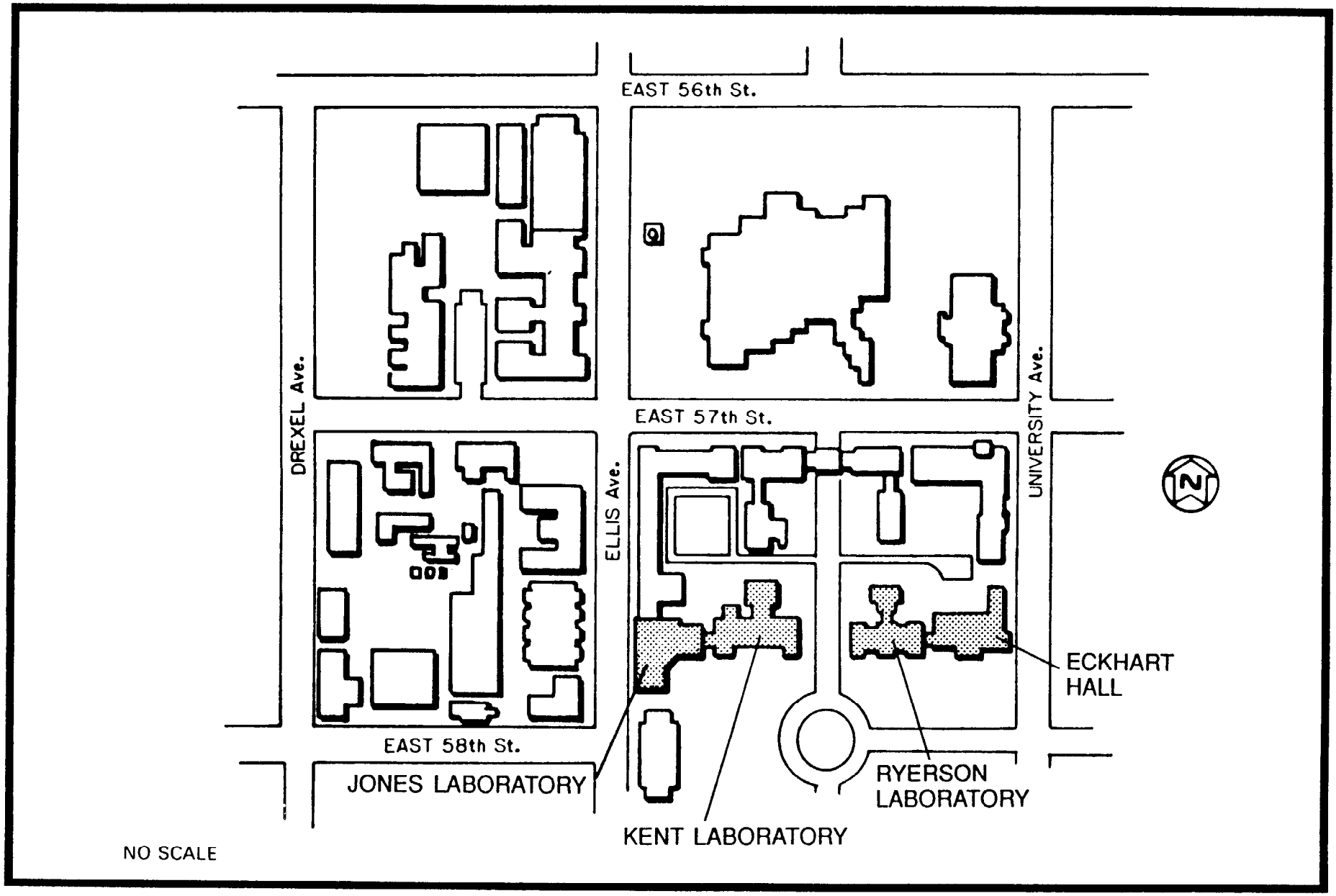

FIGURE I-2 PLAN VIEW OF THE UNIVERSITY OF CHICAGO SITE

TABLE I-1

PROPERTIES OF THE UNIVERSITY OF CHICAGO LISTED IN THE NATIONAL REGISTER OF HISTORIC PLACES

Property	Basis for Listing	Date Listed
Site of the first self-sustaining nuclear reaction, 5630 South Ellis Avenue	Site of the first controlled, self-sustaining nuclear chain reaction; now marked by Henry Moore sculpture, "Nuclear Energy."	10/15/66
Frederick C. Robie House, 5757 South Woodlawn Avenue	House designed by Frank Lloyd Wright, completed in 1909; the archetype for the prairie house design that revolutionized the architecture of the American home.	10/15/66
Lorado Taft Midway Studios, 6016 South Ingleside Avenue	Constructed in 1929 by Lorado Taft from sections of the first campus studio that was built in 1906. The original brick barn continued to be Taft's private sculpture studio until his death in 1936.	10/15/66
Room 405, George Herbert Jones Chemical Laboratory, 5747 South Ellis Avenue	Room where a group of scientists under the direction of Dr. Glenn T. Seaborg first isolated (Aug. 18, 1942) and weighed (Sept. 10, 1942) plutonium.	5/28/67
Frank R. Little House, 5801 South Kenwood Avenue	Designed by Irving and Allen Pond; regarded as an architectural landmark.	5/11/76
Charles Hitchcock Hall, 1009 East 57th Street	Designed by Dwight H. Perkins and constructed in 1902. This building combines the neo-Gothic architecture of nearby buildings with a prairie motif.	12/30/74

4.0 RADIOLOGICAL HISTORY AND STATUS

The University of Chicago was involved in theoretical, radiochemical, and physical research associated with the first successful nuclear pile (CP-1) that was constructed and operated in the West Stands (racquet courts) under Stagg Field. Research conducted under MED/AEC during the 1940s and 1950s included development of a process for producing high-purity uranium compounds, testing of uranium metal, research associated with operation of the pile, and plutonium separation.

4.1 RADIOLOGICAL SURVEYS

Radiological surveys of the University of Chicago facilities were performed between September 1976 and September 1977 (Refs. 6 through 9). These surveys indicated the presence of residual radioactive contamination in four buildings including Jones Laboratory, Kent Laboratory, Ryerson Laboratory, and Eckhart Hall. The surveys indicated contamination possibly resulting from MED/AEC activities in Jones Laboratory at 46 locations in 17 rooms or areas, in Kent Laboratory at 23 locations in 14 rooms or areas, in Ryerson Laboratory at 40 locations in 26 rooms or areas, and in Eckhart Hall at 13 locations in 9 rooms or areas. The contamination consisted mainly of small spots on the floors and walls (Refs. 10 and 11). Sixty-four exhaust ducts in Jones Laboratory were cleaned and radiologically surveyed in 1987 (Refs. 12 and 13).

The 1987 survey indicated that four ducts contained radioactive contamination in concentrations exceeding guidelines. Eleven air vents in the chimneys were also found to be contaminated in excess of recommended guidelines.

4.2 REMEDIAL ACTION GUIDELINES

The primary radionuclides of concern at the University of Chicago before remedial action were various isotopes of uranium, plutonium, thorium, and radium. Other radioactive isotopes (e.g., americium-241 and neptunium-237) are still handled in the laboratories; however, these isotopes are beyond the responsibility of DOE and not within the scope of this docket.

The remedial action performed in 1976 and 1977 was conducted according to the guidelines (which are consistent with DOE guidelines) provided in the report documenting decontamination activities at several university buildings (Ref. 10).

DOE residual contamination guidelines governing the release of the property for future use are presented in Table I-2. DOE implemented these guidelines on the basis of their compatibility with guidelines established by the Environmental Protection Agency (EPA) and adapted for DOE use (Ref. 14). The guidelines in Table I-2 were adapted from the Nuclear Regulatory Commission and applied primarily to surfaces such as walls, floors, ceilings, roofing tiles, and ductwork. On surfaces where contamination exceeded the applicable guidelines, remedial action was repeated until measurements were at or below DOE guidelines.

The remedial action guideline for uranium-238 in soil at the University of Chicago is the 150-pCi/g limit derived for the Illinois National Guard Armory, another FUSRAP site in Chicago (Ref. 15). Remedial action guidelines for surface contamination at the University of Chicago are 100 alpha dpm/100 cm^2, average, and 300 alpha dpm/100 cm^2, maximum; 0.2 mrad/h beta-gamma, average, and 1.0 mrad/h beta-gamma, maximum; and 20 alpha dpm/100 cm^2 for removable contamination (Ref. 15). Guidelines for radionuclide concentrations in water to be released to uncontrolled areas at the University of Chicago site are contained in a DOE memorandum issued in 1986 (Ref. 16).

TABLE I-2
SUMMARY OF RESIDUAL CONTAMINATION GUIDELINES FOR THE UNIVERSITY OF CHICAGO

BASIC DOSE LIMITS

The basic limit for the annual radiation dose received by an individual member of the general public is 100 mrem/yr.

SOIL (LAND) GUIDELINES

Radionuclide	Soil Concentration (pCi/g) above background[a,b,c]
Radium-226 Radium-228 Thorium-230 Thorium-232	5 pCi/g, averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over any 15-cm-thick soil layer below the surface layer.
Uranium-238	150 pCi/g*
Other radionuclides	Soil guidelines will be calculated on a site-specific basis using the DOE manual developed for this use.

STRUCTURE GUIDELINES

Airborne Radon Decay Products

Generic guidelines for concentrations of airborne radon decay products shall apply to existing occupied or habitable structures on private property that has no radiological restrictions on its use; structures that will be demolished or buried are excluded. The applicable generic guideline (40 CFR 192) is: In any occupied or habitable building, the objective of remedial action shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL.[d] In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL. Remedial actions are not required in order to comply with this guideline when there is reasonable assurance that residual radioactive materials are not the cause.

External Gamma Radiation

The average level of gamma radiation inside a building or habitable structure on a site that has no radiological restrictions on its use shall not exceed the background level by more than 20 μR/h.

Indoor/Outdoor Structure Surface Contamination

	Allowable Residual Surface Contamination[e] (dpm/100 cm^2)		
Radionuclide[f]	Average[g,h]	Maximum[h,i]	Removable[h,j]
Transuranics, Ra-226, Ra-228, Th-230, Th-228 Pa-231, Ac-227, I-125, I-129	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

*Argonne National Laboratory. Derivation of a Uranium Residual Radioactivity Guideline for the National Guard Armory in Chicago, Illinois, Chicago, IL, May 1987.

TABLE I-2

(continued)

Indoor/Outdoor Structure Surface Contamination (continued)

Radionuclide[f]	Allowable Residual Surface Contamination[e] (dpm/100 cm^2) Average[g,h]	Maximum[h,i]	Removable[h,j]
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) except Sr-90 and others noted above	5,000 β - γ	15,000 β - γ	1,000 β - γ

[a]These guidelines take into account ingrowth of radium-226 from thorium-230 and of radium-228 from thorium-232, and assume secular equilibrium. If either thorium-230 and radium-226 or thorium-232 and radium-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 the dose for the mixtures will not exceed the basic dose limit.

[b]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.

[c]Localized concentrations in excess of these limits are allowable provided that the average concentration over a 100-m^2 area does not exceed these limits.

[d]A working level (WL) is any combination of short-lived radon decay products in 1 liter of air that will result in the ultimate emission of 1.3×10^5 MeV of potential alpha energy.

[e]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 observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[f]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.

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

[h]The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h and 1.0 mrad/h, respectively, at 1 cm.

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

[j]The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area 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. The numbers in this column are maximum amounts.

4.3 POST-REMEDIAL ACTION STATUS

Post-remedial action surveys (Refs. 10, 11, and 13) of the University of Chicago buildings discussed in this docket do not indicate radioactive contamination exceeding applicable DOE guidelines (Refs. 15 and 16).

An independent review of the remedial action performed in 1987 was conducted by an independent verification contractor (IVC), the Radiological Site Assessment Group of Oak Ridge Associated Universities (ORAU) under contract to DOE. The purpose of the IVC assessment was to verify the data supporting the adequacy of the remedial action and to confirm that the ventilation system, upon completion of remedial action, was in compliance with existing guidelines.

The data collected showed that the remedial action activities performed at the University of Chicago were successful and that the radiological conditions of Jones Laboratory, Kent Laboratory, Ryerson Laboratory, and Eckhart Hall are in compliance with all applicable DOE radiological guidelines established for release for future use (Refs. 17 and 18).

5.0 SUMMARY OF REMEDIAL ACTION

The following subsections briefly describe the remedial action process and measures taken to protect the public and the environment.

5.1 PRE-REMEDIAL ACTION ACTIVITIES

5.1.1 Site Characterization and Scoping

To determine if any contamination remained as a result of MED/AEC activities, a comprehensive radiological assessment of areas of suspected contamination was conducted on the University of Chicago campus during 1976 and 1977. Direct instrument surveys and smear surveys indicated that some contamination and radioactive materials were still present in the following buildings:

- Ryerson Physical Laboratory
- George Herbert Jones Chemical Laboratory
- Eckhart Hall
- Kent Chemical Laboratory

Soil samples were taken from the ground around the buildings. Much of the ground had been disturbed by landscaping subsequent to the MED/AEC activities. The concentrations of radioactive material in these soil samples were essentially at background levels.

Survey procedures, results, and significant findings were reported in radiological surveys for each building (Refs. 6 through 9).

5.1.2 National Environmental Policy Act Compliance

An action description memorandum (ADM) for the decontamination of the Jones Laboratory, Eckhart Hall, and Ryerson Laboratory buildings was completed in 1983 (Ref. 3). A memorandum to file indicating that this action had no significant environmental impacts within the

meaning of the National Environmental Policy Act (NEPA) was issued in 1983 (Ref. 19). An ADM for remedial action of the ducts in Jones Laboratory was prepared in 1987 (Ref. 4). Since the cleanup of ducts in Jones Laboratory was within the scope of the NEPA determination given in the memorandum to file issued in 1983, a separate memorandum to file was not prepared for this activity.

5.2 DECONTAMINATION ACTIVITIES

Under the direction of DOE, decontamination activities at the University of Chicago were conducted by ANL in 1982 and 1983, by university personnel in 1982 and 1983, and by Bechtel National, Inc. (BNI) in 1987. ANL directed decontamination operations at Ryerson Laboratory, Jones Laboratory, and Eckhart Hall; the University of Chicago conducted decontamination efforts at the Kent Chemical Laboratory; and BNI cleaned and radiologically surveyed the 64 exhaust ducts in Jones Laboratory (Ref. 20). A total waste volume of 17 m^3 (600 ft^3) was generated during these activities.

The work was performed using standard procedures such as the application of solvents for metals and scabbling concrete. Items and materials that could not be readily decontaminated (e.g., cabinets) were removed and replaced wherever possible. This work resulted in 8.5 m^3 (300 ft^3) of radioactively contaminated solid waste and three 210-L (55-gal) drums of liquid waste. The solid waste was shipped to Idaho National Engineering Laboratory (INEL) for disposal, and the liquid waste was disposed of by ANL.

= 630 L ≅ 0.63 m^3

Work included removing contamination on concrete and wood floors and brick walls. Decontamination of small areas involved chipping the host material. For larger areas of contamination, remedial action involved removal of concrete and soil, removal of bricks from the wall, and removal of tile, wood, and insulation.

The contaminated sewers and some soil beneath Kent Laboratory were removed by the University of Chicago (Ref. 21); radiological conditions now comply with existing guidelines.

During remedial action activities at Jones Laboratory, measures were taken to prevent the spread of contamination and to keep exposure rates as low as possible for the building occupants, including remedial action workers. Measures were also taken to monitor airborne radioactivity resulting primarily from dust (Refs. 10, 11, and 12). Figures showing the areas in which remedial action was performed are provided in Exhibit III of this certification docket.

Remedial action was conducted on 64 ducts partially embedded in the walls of Jones Laboratory. The decontamination was complicated because picric and perchloric acid were suspected to have been used during the chemical separation process for MED. When dried, these two acid chemicals form crystals that are explosive and can be ignited either by heat or shock. The ducts were steam-cleaned to return the crystals to liquid form, and the liquid was removed from the ducts. Several ducts contained significant quantities of these crystals. A thorough water washing of the ducts followed the steam-cleaning operation. After drying, the ducts were radiologically surveyed. Two ducts found to exceed recommended guidelines were removed. The scabbled walls were restored and painted.

During the radiological survey, several unused ducts were found to be constructed of asbestos. Four of these ducts were removed and disposed of in compliance with regulations. Remaining asbestos ducts were identified to the university for removal during planned renovation. Several additional spots of contamination were located on the floor of the attic, and these were removed by scabbling. The scabbled areas were resurfaced. The roofs were not contaminated; however, several flues in the chimneys were identified as being contaminated and were removed.

The collected solid waste material [about 8.5 m^3 (300 ft^3)] was transported to INEL for disposal, and the liquids were shipped to ANL for processing. Approximately 8.5 m^3 (300 ft^3) of solid waste was accepted by ANL for subsequent disposal at INEL to support the duct remediation. Five drums of treatment water were tested and were either solidified and disposed of as solid waste or released to the municipal sewer system after complying with requirements.

A radiological survey was performed on all accessible drains in Jones Laboratory. Results from sample analysis show no radiological contamination to be present in concentrations that exceed DOE guidelines. The Chicago metropolitan sewers that received effluent from the university were also surveyed. Seven outlets and one upstream (background) location were sampled. Results indicated that no contamination was present in the municipal sewer system.

5.3 POST-REMEDIAL ACTION MEASUREMENTS

After the contaminated material was removed, additional radiological surveys were conducted on excavated areas and surfaces to ensure that they had been adequately decontaminated. Two techniques were used to conduct the surveys of excavated areas. First, the excavated areas were surveyed with various field instruments, including gas-flow proportional detectors, sodium iodide (NaI) crystal detectors, and Geiger-Mueller detectors. Soil samples were taken, and results showed that contamination was below guidelines. For surfaces that required remedial action, the survey was conducted using Geiger-Mueller detectors, alpha scintillation detectors, gas-flow proportional detectors, and NaI crystal detectors. No additional contamination in excess of DOE guidelines was found, and the surface was restored when necessary.

5.4 VERIFICATION ACTIVITIES

After remedial action activities were completed, ORAU conducted an IVC survey to verify that the properties were remediated to levels at or below DOE guidelines. The objective of the verification survey was to confirm that surveys, sampling, and analyses conducted during the remedial action process provided an accurate and complete description of the radiological status of the property.

The IVC activities included reviewing the published radiological survey reports and the post-remedial action reports, visiting the site for a visual inspection, and performing limited radiological survey and sampling activities. The surveys were conducted in accordance with a DOE-approved plan. Upon completion of the verification activities, the IVC prepared two verification reports, which were then submitted to DOE (Refs. 17 and 18).

5.5 PUBLIC AND OCCUPATIONAL EXPOSURES

5.5.1 Public Exposure

The total radiological dose to the occupants of the area following remedial action is less than 100 mrem/yr above the background radiation level.

5.5.2 Occupational Exposure

During the period January 1, 1987, through December 31, 1987, 31 employees working at the University of Chicago were monitored for exposure to beta-gamma radiation. Monitoring results measured by thermoluminescent dosimeters indicated that all 31 employees (100 percent) received no measurable exposure over their entire working period. These doses were well below the annual limit of

5,000 mrem/yr for occupational workers established by DOE (Ref. 22). The average dose received by the employees during the one-year working period was approximately 0 mrem.

5.6 COSTS

Costs associated with the remedial action performed at the University of Chicago are presented in Table I-3.

TABLE I-3

REMEDIAL ACTION COSTS

FOR THE UNIVERSITY OF CHICAGO

Activity	Cost ($1000s)
Site Characterization	1
Remedial Action	716
Final Report	14
Other Costs	288
TOTAL	1020

REFERENCES

1. U.S. Department of Energy. Description of the Formerly Utilized Sites Remedial Action Program, ORO-777, Oak Ridge, Tenn., September 1980.

2. U.S. Department of Energy. A Background Report for the Formerly Utilized Manhattan Engineer/Atomic Energy Commission Sites Program, DOE/EV-0097, Washington, D.C., 1980.

3. Argonne National Laboratory. Action Description Memorandum, Proposed Decontamination of Three Buildings at the University of Chicago Contaminated as a Result of Previous MED/AEC Activities, Argonne, Ill., December 1983.

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APPENDIX A

U.S. DEPARTMENT OF ENERGY GUIDELINES FOR RESIDUAL RADIOACTIVE MATERIAL AT FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM AND REMOTE SURPLUS FACILITIES MANAGEMENT PROGRAM SITES

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)

A. INTRODUCTION

This document presents U.S. Department of Energy (DOE) radiological protection guidelines for cleanup of residual radioactive materials and management of the resulting wastes and residues. It is applicable to sites identified by the Formerly Utilized Sites Remedial Action Program (FUSRAP) and remote sites identified by the Surplus Facilities Management Program (SFMP).* The topics covered are basic dose limits, guidelines and authorized limits for allowable levels of residual radioactive material, and requirements for control of the radioactive wastes and residues.

Protocols for identification, characterization, and designation of FUSRAP sites for remedial action; for implementation of the remedial action; and for certification of a FUSRAP site for release for unrestricted use are given in a separate document (U.S. Department of Energy 1986) and subsequent guidance. More detailed information on applications of the guidelines presented herein, including procedures

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* A remote SFMP site is one that is excess to DOE programmatic needs and is located outside a major operating DOE research and development or production area.

for deriving site-specific guidelines for allowable levels of residual radioactive material from basic dose limits, is contained in "A Manual for Implementing Residual Radioactive Material Guidelines" (U.S. Department of Energy 1987) referred to herein as the "supplement".

"Residual radioactive material" is used in these guidelines to describe radioactive materials derived from operations or sites over which the Department of Energy has authority. Guidelines or guidance to limit the levels of radioactive material to protect the public and environment are provided for: (1) residual concentrations of radionuclides in soil material, (2) concentrations of airborne radon decay products, (3) external gamma radiation level, (4) surface contamination levels, and (5) radionuclide concentrations in air or water resulting from or associated with any of the above.

A "basic dose limit" is a prescribed standard from which limits for quantities that can be monitored and controlled are derived; it is specified in terms of the effective dose equivalent as defined by the International Commission on Radiological Protection (ICRP 1977, 1978). The basic dose limits are used for deriving guidelines for residual concentrations of radionuclides in soil material. Guidelines for residual concentrations of thorium and radium in soil, concentrations of airborne radon decay products, allowable indoor external gamma radiation levels, and residual surface contamination concentrations are based on existing radiological protection standards or guidelines (U.S. Environmental Protection Agency 1983; U.S. Nuclear Regulatory Commission 1982; and Departmental Orders). Derived guidelines or limits based on the basic dose limits for those quantities are only used when the guidelines provided in the existing standards cited above are shown to be inappropriate.

A "guideline" for residual radioactive material is a level of radioactivity or of the radioactive material that is acceptable if the use of the site is to be unrestricted. Guidelines for residual radioactive material presented herein are of two kinds: (1) generic,

site-independent guidelines taken from existing radiation protection standards, and (2) site-specific guidelines derived from basic dose limits using site-specific models and data. Generic guideline values are presented in this document. Procedures and data for deriving site-specific guideline values are given in the supplement. The basis for the guidelines is generally a presumed worst case plausible scenario for a site.

An "Authorized Limit" is a level of residual radioactive material or radioactivity that must not be exceeded if the remedial action is to be considered completed and the site is to be released for unrestricted use. The Authorized Limit for a site will include limits for each radionuclide or group of radionuclides, as appropriate, associated with the residual radioactive material in the soil or in surface contamination of structures and equipment, and in the air or water, and, where appropriate, a limit on external gamma radiation resulting from the residual material. Under normal circumstances, expected to occur at most sites, Authorized Limits for residual radioactive material or radioactivity are set equal to guideline values. Exceptional conditions for which Authorized Limits might differ from guideline values are specified in Sections D and F. A site may be released for unrestricted use only if the conditions do not exceed the Authorized Limits or approved supplemental limits as defined in Section F.1 at the time remedial action is completed. Restrictions and controls on use of the site must be established and enforced if the site conditions exceed the approved limits, or if there is potential to exceed the dose limit if the site use was not restricted (Section F.2). The applicable controls and restrictions are specified in Section E.

DOE policy requires that all exposures to radiation be limited to levels that are as low as reasonably achievable (ALARA). For sites to be released for unrestricted use, the intent is to reduce residual radioactive material to levels that are as far below Authorized Limits as reasonable considering technical, economic, and social factors. At sites where the residual material is not reduced to levels that permit release for unrestricted use, ALARA policy is implemented by establishing controls to reduce exposure to levels that are as low as reasonably achievable. Procedures for implementing ALARA policy are discussed in the supplement. ALARA policies,

procedures, and actions shall be documented and filed as a permanent record upon completion of remedial action at a site.

B. BASIC DOSE LIMITS

The basic dose limit for the annual radiation dose received by an individual member of the general public is 100 mrem/year. The internal committed effective dose equivalent, as defined in ICRP Publication 26 (ICRP 1977) and calculated by dosimetry models described in ICRP Publication 30 (ICRP 1978), plus dose from penetrating radiation sources external to the body shall be used for determining the dose. This dose shall be described as the "Effective Dose Equivalent". Every effort shall be made to ensure that actual doses to the public are as far below the dose limit as is reasonably achievable.

Under unusual circumstances it will be permissible to allow potential doses to exceed 100 mrem/year where such exposures are based upon scenarios which do not persist for long periods and where the annual life time exposure to an individual from the subject residual radioactive material would be expected to be less than 100 mrem/year. Examples of such situations include conditions that might exist at a site scheduled for remediation in the near future or a possible, but improbable, one-time scenario that might occur following remedial action. These levels should represent doses that are as low as reasonably achievable for the site. Further, no annual exposure should exceed 500 mrem.

C. GUIDELINES FOR RESIDUAL RADIOACTIVE MATERIAL

C.1 Residual Radionuclides in Soil

Residual concentrations of radionuclides in soil shall be specified as above-background concentrations averaged over an area of 100 sq meters. Generic guidelines for thorium and radium are specified below. Guidelines for residual concentrations of other radionuclides shall be derived from the basic dose limits by means of an environmental pathway analysis using

site-specific data where available. Procedures for these derivations are given in the supplement.

If the average concentration in any surface or below surface area less than or equal to 25 sq meters exceeds the Authorized Limit or guideline by a factor of $(100/A)^{1/2}$, where A is the area of the elevated region in square meters, limits for "Hot Spots" shall also be applicable. These Hot Spot Limits depend on the extent of the elevated local concentrations and are given in the supplement. In addition, every reasonable effort shall be made to remove any source of radionuclide that exceeds 30 times the appropriate soil limit irrespective of the average concentration in the soil.

Two types of guidelines are provided, generic and derived. The generic guidelines for residual concentrations of the Ra-226, Ra-228, Th-230, and Th-232 are:

- 5 pCi/g, averaged over the first 15 cm of soil below the surface
- 15 pCi/g, averaged over 15-cm-thick layers of soil more than 15 cm below the surface

These guidelines take into account ingrowth of Ra-226 from Th-230 and of Ra-228 from Th-232, 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 appropriate guideline is applied as a limit to the radionuclide with 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 the ratios of the soil concentration of each radionuclide to the allowable limit for that radionuclide will not exceed 1 ("unity"). Explicit formulas for calculating residual concentration guidelines for mixtures are given in the supplement.

C.2 Airborne Radon Decay Products

Generic guidelines for concentrations of airborne radon decay products shall apply to existing occupied or habitable structures on private property

that are intended for unrestricted use; structures that will be demolished or buried are excluded. The applicable generic guideline (40 CFR 192) is: In any occupied or habitable building, the objective of remedial action shall be, and a reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL.* In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL. Remedial actions by DOE are not required in order to comply with this guideline when there is reasonable assurance that residual radioactive materials are not the cause.

C.3 External Gamma Radiation

The average level of gamma radiation inside a building or habitable structure on a site to be released for unrestricted use shall not exceed the background level by more than 20 μR/h and shall comply with the basic dose limit when an appropriate use scenario is considered. This requirement shall not necessarily apply to structures scheduled for demolition or to buried foundations. External gamma radiation levels on open lands shall also comply with the basic dose limit considering an appropriate use scenario for the area.

C.4 Surface Contamination

The generic guidelines provided in the Table 1, Surface Contamination Guidelines are applicable to existing structures and equipment. These guidelines are adapted from standards of the U.S. Nuclear Regulatory

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* A working level (WL) is any combination of short-lived radon decay products in one liter of air that will result in the ultimate emission of 1.3×10^5 MeV of potential alpha energy.

TABLE 1 SURFACE CONTAMINATION GUIDELINES

Radionuclides [2]	Allowable Total Residual Surface Contamination (dpm/100 cm^2) [1] Average [3, 4]	Maximum [4, 5]	Removable [4, 6]
Transuranics, Ra-226, Ra-228, Th-230 Th-228, Pa-231, Ac-227, I-125, I-129	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	5,000 α	15,000 α	1,000 α
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5,000 β-γ	15,000 β-γ	1,000 β-γ

1 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.

2 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.

3 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.

4 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 1 cm.

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

6 The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area 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. The numbers in this column are maximum amounts.

Commission (1982)* and will be applied in a manner that provides a level of protection consistent with the Commission's guidance. These limits apply to both interior and exterior surfaces. They are not directly intended for use on structures to be demolished or buried, but, should be applied to equipment or building components that are potentially salvageable or recoverable scrap. If a building is demolished, the guidelines in Section C.1 are applicable to the resulting contamination in the ground.

C.5 Residual Radionuclides in Air and Water

Residual concentrations of radionuclides in air and water shall be controlled to levels required by DOE Environmental Protection Guidance and Orders, specifically DOE Order 5480.1A and subsequent guidance. Other Federal and/or state standards shall apply when they are determined to be appropriate.

D. AUTHORIZED LIMITS FOR RESIDUAL RADIOACTIVE MATERIAL

The Authorized Limits shall be established to: 1) ensure that, as a minimum, the Dose Limits specified in Section B will not be exceeded under the worst case plausible use scenario consistent with the procedures and guidance provided, or 2) where applicable generic guidelines are provided, be consistent with such guidelines. The Authorized Limits for each site and vicinity properties shall be set equal to the generic or derived guidelines except where it can be clearly established on the basis of site specific data, including health, safety and socioeconomic considerations, that the guidelines are not appropriate for use at the specific site. Consideration

* These guidelines are functionally equivalent to Section 4 - Decontamination for Release for Unrestricted Use of NRC Regulatory Guide 1.86, but are applicable to Non-Reactor facilities.

should also be given to ensure that the limits comply with or provide an equivalent level of protection as other appropriate limits and guidelines (i.e., state, or other Federal). Documentation supporting such a decision should be similar to that required for supplemental limits and exceptions (Section F), but should be generally more detailed because it covers an entire site.

Remedial actions shall not be considered complete unless the residual radioactive material levels comply with the Authorized Limits. The only exception to this requirement will be for those special situations where the supplemental limits or exceptions are applicable and approved as specified in Section F. However, the use of supplemental limits and exceptions should only be considered if it is clearly demonstrated that it is not reasonable to decontaminate the area to the Authorized Limit or guideline value. The Authorized Limits are developed through the project offices in the field (Oak Ridge Technical Services Division for FUSRAP) and approved by the headquarters program office (the Division of Facility and Site Decommissioning Projects).

E. CONTROL OF RESIDUAL RADIOACTIVE MATERIAL AT FUSRAP AND REMOTE SFMP SITES

Residual radioactive material above the guidelines at FUSRAP and remote SFMP sites must be managed in accordance with applicable DOE Orders. The DOE Order 5480.1A and subsequent guidance or superceding orders require compliance with applicable Federal, and state environmental protection standards.

The operational and control requirements specified in the following DOE Orders shall apply to interim storage, interim management, and long-term management.

a. 5440.1C, Implementation of the National Environmental Policy Act

b. 5480.1A, Environmental Protection, Safety, and Health Protection Program for DOE Operations as revised by DOE 5480.1 change orders and the 5 August 1985 memorandum from Vaughan to Distribution

c. 5480.2, Hazardous and Radioactive Mixed Waste Management

d. 5480.4, Environmental Protection, Safety, and Health Protection Standards

e. 5482.1A, Environmental Safety, and Health Appraisal Program

f. 5483.1A, Occupational Safety and Health Program for Government-Owned Contractor-Operated Facilities

g. 5484.1, Environmental Protection, Safety, and Health Protection Information Reporting Requirements

h. 5000.3, Unusual Occurrence Reporting System

i. 5820.2, Radioactive Waste Management

E.1 Interim Storage

a. Control and stabilization features shall be designed to ensure, to the extent reasonably achievable, an effective life of 50 years and, in any case, at least 25 years.

b. Above-background Rn-222 concentrations in the atmosphere above facility surfaces or openings shall not exceed: (1) 100 pCi/L at any given point, (2) an annual average concentration of 30 pCi/L over the facility site, and (3) an annual average concentration of 3 pCi/L at or above any location outside the facility site (DOE Order 5480.1A, Attachment XI-1).

c. Concentrations of radionuclides in the groundwater or quantities of residual radioactive materials shall not exceed existing Federal, or state standards.

d. Access to a site shall be controlled and misuse of onsite material contaminated by residual radioactive material shall be prevented through appropriate administrative controls and physical barriers--active and passive controls as described by the U.S. Environmental Protection Agency (1983--p. 595). These control features should be designed to ensure, to the extent reasonable, an effective life of at least 25 years. The Federal government shall have title to the property or shall have a long-term lease for exclusive use.

E.2 Interim Management

a. A site may be released under interim management when the resicual radioactive material exceeds guideline values if the residual radioactive material is in inaccessible locations and would be unreasonably costly to remove, provided that administrative controls are established to ensure that no member of the public shall receive a radiation dose exceeding the basic dose limit.

b. The administrative controls, as approved by DOE, shall include but not be limited to periodic monitoring as appropriate, appropriate shielding, physical barriers to prevent access, and appropriate radiological safety measures during maintenance, renovation, demolition, or other activities that might disturb the residual radioactivity or cause it to migrate.

c. The owner of the site or appropriate Federal, state, or local authorities shall be responsible for enforcing the administrative controls.

E.3 Long-Term Management

Uranium, Thorium, and Their Decay Products

a. Control and stabilization features shall be designed to ensure, to the extent reasonably achievable, an effective life of 1,000 years and, in any case, at least 200 years.

b. Control and stabilization features shall be designed to ensure that Rn-222 emanation to the atmosphere from the waste shall not: (1) exceed an annual average release rate of 20 $pCi/m^2/s$, and (2) increase the annual average Rn-222 concentration at or above any location outside the boundary of the contaminated area by more than 0.5 pCi/L. Field verification of emanation rates is not required.

c. Prior to placement of any potentially biodegradable contaminated wastes in a long-term management facility, such wastes shall be properly conditioned to ensure that (1) the generation and escape of biogenic gases will not cause the requirement in paragraph b. of this section (E.3) to be exceeded, and (2) biodegradation within the facility will not result in premature structural failure in violation of the requirements in paragraph a. of this section (E.3).

d. Groundwater shall be protected in accordance with Appropriate Departmental orders and Federal and state standards, as applicable to FUSRAP and remote SFMP sites.

e. Access to a site should be controlled and misuse of onsite material contaminated by residual radioactive material should be prevented through appropriate administrative controls and physical barriers--active and passive controls as described by the U.S. Environmental Protection Agency (1983--p. 595). These controls should be designed to be effective to the extent reasonable for at least 200 years. The Federal government shall have title to the property.

Other Radionuclides

f. Long-term management of other radionuclides shall be in accordance with Chapters 2, 3, and 5 of DOE Order 5820.2, as applicable.

F. SUPPLEMENTAL LIMITS AND EXCEPTIONS

If special site specific circumstances indicate that the guidelines or Authorized Limits established for a given site are not appropriate for a portion of that site or a vicinity property, then the field office may request that supplemental limits or an exception be applied. In either case, the field must justify that the subject guidelines or Authorized Limits are not appropriate and that the alternative action will provide adequate protection giving due consideration to health and safety,

environment and costs. The field office shall obtain approval for specific supplemental limits or exceptions from headquarters as specified in Section D of these guidelines and shall provide to headquarters those materials required for the justification as specified in this section and in the FUSRAP and SFMP protocols and subsequent guidance documents. The field office shall also be responsible for coordination with the state or local government of the limits or exceptions and associated restrictions as appropriate. In the case of exceptions, the field office shall also work with the state and/or local governments to insure that restrictions or conditions of release are adequate and mechanisms are in place for their enforcement.

F1. Supplemental Limits

The supplemental limits must achieve the basic dose limits set forth in this guideline document for both current and potential unrestricted uses of the site and/or vicinity property. Supplemental limits may be applied to a property or portion of a property or site if, on the basis of a site specific analysis, it is determined that certain aspects of the property or portion of the site were not considered in the development of the established Authorized Limits and associated guidelines for the site, and as a result of these unique characteristics, the established limits or guidelines either do not provide adequate protection or are unnecessarily restrictive and costly.

F2. Exceptions

Exceptions to the Authorized Limits defined for unrestricted use of the site may be applied to a portion of a site or a vicinity property when it is established that the Authorized Limits cannot be achieved and restrictions on use of the site or vicinity property are necessary to provide adequate protection of the public and environment. The field office must clearly demonstrate that the exception is necessary, and the restrictions will provide the necessary degree of protection and that they comply with the requirements for control of residual radioactive material as set forth in Part E of these guidelines.

F3. Justification for Supplemental Limits and Exceptions

Supplemental limits and exceptions must be justified by the field office on a case by case basis using site specific data. Every effort should be made to minimize the use of the supplemental limits and exceptions. Examples of specific situations that warrant the use of supplemental standards and exceptions are:

a. Where remedial actions would pose a clear and present risk of injury to workers or members of the general public, notwithstanding reasonable measures to avoid or reduce risk.

b. Where remedial actions--even after all reasonable mitigative measures have been taken--would produce environmental harm that is clearly excessive compared to the health benefits to persons living on or near affected sites, now or in the future. A clear excess of environmental harm is harm that is long-term, manifest, and grossly disproportionate to health benefits that can reasonably be anticipated.

c. Where it is clear that the scenarios or assumptions used to establish the Authorized Limits do not under plausible current or future conditions, apply to the property or portion of the site identified and where more appropriate scenarios or assumptions indicate that other limits are applicable or necessary for protection of the public and the environment.

d. Where the cost of remedial actions for contaminated soil is unreasonably high relative to long-term benefits and where the residual radioactive materials do not pose a clear present or future risk after taking necessary control measures. The likelihood that buildings will be erected or that people will spend long periods of time at such a site should be considered in evaluating this risk. Remedial actions will generally not be necessary where only minor quantities of residual radioactive

materials are involved or where residual radioactive materials occur in an inaccessible location at which site-specific factors limit their hazard and from which they are costly or difficult to remove. Examples are residual radioactive materials under hard-surface public roads and sidewalks, around public sewer lines, or in fence-post foundations. A site-specific analysis must be provided to establish that it would not cause an individual to receive a radiation dose in excess of the basic dose limits stated in Section B, and a statement specifying the residual radioactive material must be included in the appropriate state and local records.

e. Where there is no feasible remedial action.

G. SOURCES

Limit or Guideline	Source
Basic Dose Limits	
Dosimetry Model and Dose Limits	International Commission on Radiological Protection (1977, 1978)
Generic Guidelines for Residual Radioactivity	
Residual Concentrations of Radium and Thorium in Soil Material	40 CFR 192
Airborne Radon Decay Products	40 CFR 192
External Gamma Radiation	40 CFR 192
Surface Contamination	Adapted from U.S. Nuclear Regulatory Commission (1982)
Control of Radioactive Wastes and Residues	
Interim Storage	DOE Order 5480.1A and subsequent guidance
Long-Term Management	DOE Order 5480.1A and subsequent guidance; 40 CFR 192; DOE order 5820.2

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Exhibit II *Documents Supporting the Certification of the Remedial Action Performed at the University of Chicago, Chicago, Illinois, from December 1982 to October 1987*

EXHIBIT II

DOCUMENTS SUPPORTING THE CERTIFICATION OF THE

REMEDIAL ACTION PERFORMED AT THE

UNIVERSITY OF CHICAGO,

CHICAGO, ILLINOIS,

FROM DECEMBER 1982 TO OCTOBER 1987

1.0 CERTIFICATION PROCESS

The purpose of this certification docket is to provide a consolidated and permanent record of DOE activities at the University of Chicago and of the radiological conditions of this site at the time of certification. A summary of the remedial action activities conducted at this property was provided in Exhibit I. Exhibit II contains the letters, memos, reports, and other documents that were produced to encompass the entire remedial action process, from designation of the site under FUSRAP to certification that no radiologically based restrictions limit the future use of the subject property.

2.0 SUPPORTING DOCUMENTATION

For the convenience of the reader, Subsections 2.1 through 2.11 are paginated continuously. Each page number begins with the designator "II-" to distinguish the numbering systems used in the supporting documentation that constitutes Exhibit II. These page numbers are listed in the table of contents at the beginning of this docket and in Subsections 2.1 through 2.11. Lengthy documents are incorporated by reference only and are designated as such with the abbreviation "ref."; the actual documents have been provided as attachments to the certification docket at publication.

2.1 DECONTAMINATION OR STABILIZATION CRITERIA

The following documents contain the guidelines used to determine the need for remedial action. The subject property has been decontaminated to comply with these guidelines.

Page

U.S. Department of Energy. "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. App. I-A

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DERIVATION OF A URANIUM RESIDUAL RADIOACTIVITY GUIDELINE FOR THE NATIONAL GUARD ARMORY IN CHICAGO, ILLINOIS

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Energy and Environmental Systems Division

May 1987

work sponsored by

U.S. DEPARTMENT OF ENERGY
Oak Ridge Operations Office

CONTENTS

FIGURES

DERIVATION OF A URANIUM RESIDUAL RADIOACTIVITY GUIDELINE FOR THE NATIONAL GUARD ARMORY IN CHICAGO, ILLINOIS

by

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ABSTRACT

A uranium residual radioactivity guideline for the National Guard Armory in Chicago, Illinois, was derived using data from radiological surveys carried out in 1977 and 1978 by Argonne National Laboratory and in 1987 by Bechtel National, Inc. The derived guideline is based on the requirement that the 50-year committed effective dose equivalent to an individual who lives in the Armory should not exceed a dose of 100 mrem/yr following decontamination of the Armory. Procedures specified in the U.S. Department of Energy manual for implementing residual radioactivity guidelines were used in this evaluation. The results of the evaluation indicate that the basic dose limit of 100 mrem/yr will not be exceeded in the foreseeable future, provided that the concentration of uranium-238 within the Armory does not exceed 150 pCi/g following decontamination. This guideline applies to the activity concentration of uranium-238, with uranium-234 and uranium-235 present in the same activity ratio as in natural uranium (the activity ratio of uranium-238, uranium-234, and uranium-235 in natural uranium is 1:1:0.046).

1 HISTORY AND SUMMARY OF EXISTING CONDITIONS

The National Guard Armory is located in the northeast section of Washington Park at 52nd Street and Cottage Grove Avenue in Chicago, Illinois (Fig. 1). The Armory building, constructed in 1924, is a 71-m (230-ft) by 200-m (650-ft) concrete building with a facade of Indiana limestone. An arena occupies the center of the building, and offices are located on four floors at the north and south ends. The arena is 68 m (220 ft) by 100 m (350 ft) and has a ceiling over 30 m (100 ft) high of clear span (steel truss) construction. Stadium bleachers are located on the east and west sides of the arena. The arena was formerly used by a horse calvary and later for horse polo games played on a dirt floor (U.S. Dept. Energy 1983; Jones 1986).

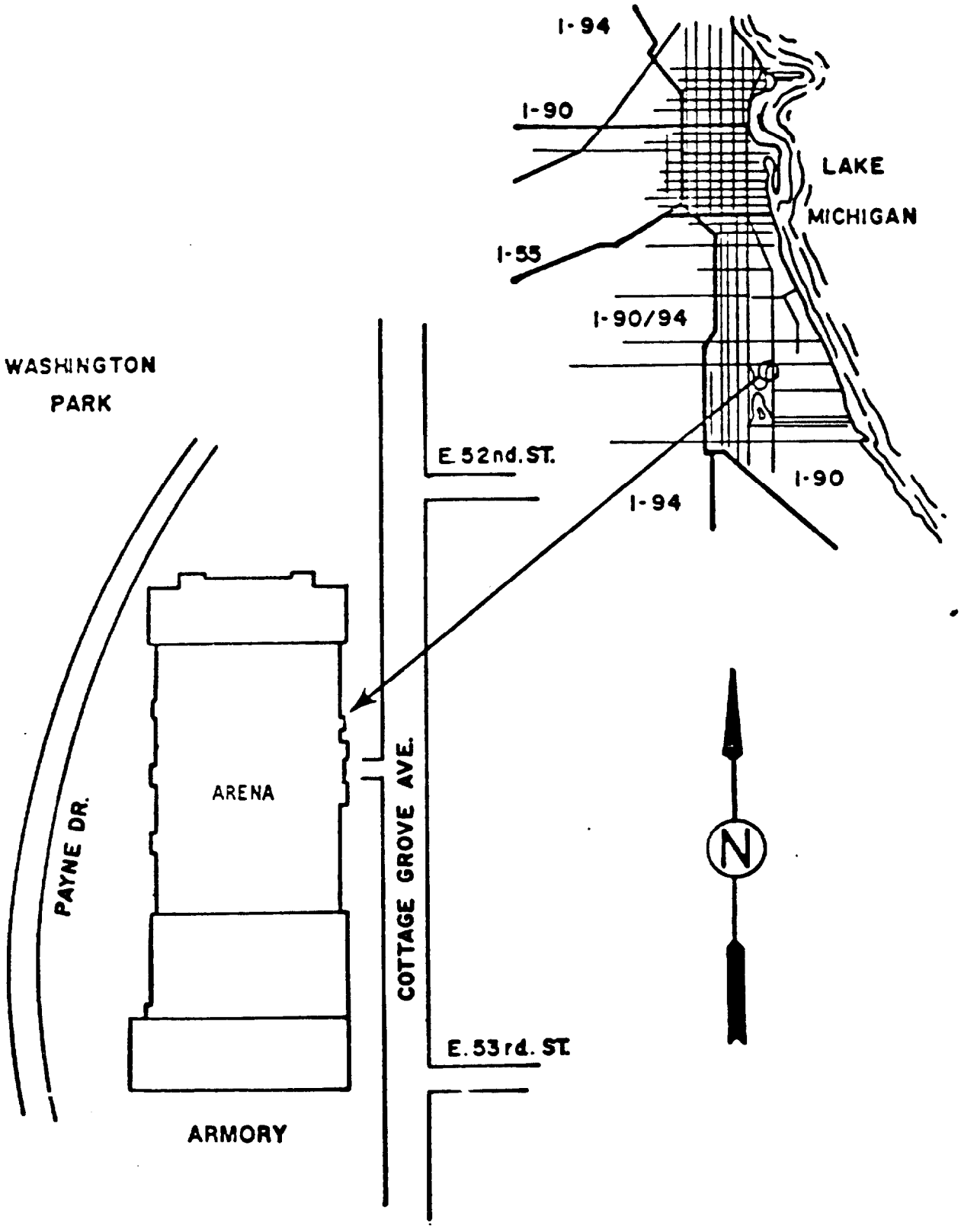

FIGURE 1 Location of the Illinois National Guard Armory, Chicago, Illinois (Source: Modified from U.S. Department of Energy 1983)

The Armory was leased from the state of Illinois 124th Field Artillery by the Manhattan Engineer District (MED) during World War II to support activities associated with development of the atomic bomb. Beginning in 1942, the building was used jointly by the MED Metallurgical Laboratory and the University of Chicago in support of federal programs involving nuclear materials. When use of this facility in support of nuclear programs was terminated in 1951, the property was returned to the state of Illinois for use by the National Guard (U.S. Dept. Energy 1980a, 1980b).

Various types of uranium processing activities were conducted in the Armory in support of nuclear activities. The arena was probably used for chemical processing and metal casting of uranium; the bleachers surrounding the arena were used for storage of radioactive materials. After MED stopped using the Armory, contaminated sediment from the arena dirt floor was removed and efforts were made to decontaminate some of the bleachers around the arena. A concrete slab was later poured over the dirt floor to facilitate use of the arena for maintenance of military vehicles (U.S. Dept. Energy 1983).

The principal radioactive contaminant in the Armory is processed natural uranium. The contamination is generally limited to relatively small areas (less than 300 cm^2), and the radiation level resulting from the contamination is quite low. In a radiological survey conducted in 1977 and 1978 (U.S. Dept. Energy 1983), no exposure rates in excess of background levels were detected at 1 m from the surface. The maximum contact exposure rate measured was 3 mR/h on a catch basin manhole cover in Room 1. The concentrations of radon-222 and its decay products in air in the building were within the range of values normally expected for background concentrations. The concentrations of long-lived radionuclides in air samples and the concentrations of radionuclides in soil samples collected around the facility were also essentially at background levels. These results indicate that the primary radioactive contaminant in the Armory is processed natural uranium, with minimal amounts of any decay products (i.e., thorium-230 and radium-226). A radiological survey was carried out by Bechtel National, Inc., in 1987 to more accurately delineate the extent of the contamination. TMA Eberline (1987) data from that survey are in general agreement with the results of the previous radiological survey conducted by Argonne National Laboratory in 1977 and 1978 (U.S. Dept. Energy 1983); the results from both surveys were used in this analysis.

A site-specific pathway analysis was carried out to establish the residual radioactivity guideline for the Armory, i.e., the residual radionuclide concentration that must not be exceeded if the Armory is to be released for unrestricted use. In this analysis, it was assumed that the three long-lived uranium isotopes -- uranium-238, uranium-234, and uranium-235 -- are in equilibrium, with an activity ratio of 1:1:0.046 (as in natural uranium). The derivation of the uranium guideline is based on procedures described in the U.S. Department of Energy (DOE) manual for implementing residual radioactivity guidelines (Gilbert et al. 1985 -- hereafter referred to as "the Manual"); the guidelines are presented in App. A. The derivation is limited to uranium-238, with uranium-234 and uranium-235 in equilibrium, because these are the only radionuclides that were detected in elevated concentrations in the areas surveyed.

2 SCENARIO DEFINITIONS

The potential exposure scenario considered in this evaluation assumes unrestricted use of the site at some time in the future. A hypothetical person is assumed to take up residence in the Armory building, drink water from a well adjacent to the Armory, and ingest plant foods grown in a garden adjacent to the Armory. The four pathways analyzed in this scenario are (1) external radiation from the contaminated materials, (2) internal radiation from inhalation of dust, (3) internal radiation from ingestion of plant foods grown in the uncontaminated soil outside the Armory but irrigated with potentially contaminated water, and (4) internal radiation from drinking water from a hypothetical shallow well adjacent to the Armory on the downgradient side. The livestock (meat and milk) and aquatic food (fish) pathways described in the Manual were eliminated from consideration based on the relatively small size of the Armory site.

The radiation dose to this potential future resident was calculated according to the method described in the Manual, based on the following specific assumptions:

- The individual lives in the most extensively contaminated room of the Armory building.
- Ten percent (10%) of the plant-food diet consumed by the individual is raised in the garden outside the Armory and is irrigated with potentially contaminated water.
- Wastewater collected in catch basins and sewer line eventually reaches the groundwater.
- The hydrogeologic and geochemical parameters for the Armory site are similar to those for the city of West Chicago, for which data are available. West Chicago is located about 40 km (25 mi) from the Armory site.

3 DOSE-TO-SOURCE RATIOS

The dose-to-source (D/S) ratios were calculated using the method described in the Manual. The summation of D_{ip}/S_i for each radionuclide i over the pathway p is the total D/S ratio that will be used to determine the allowable residual radioactivity for the Armory site, i.e.,

$$\text{Total } D/S = \sum_p \sum_i D_{ip}/S_i$$

The derivation of D_{ip}/S_i for uranium-238 for the four pathways applicable to the Armory site is presented in Sections 3.1-3.4. The various parameters used for this analysis are defined in App. B.

3.1 EXTERNAL GAMMA RADIATION PATHWAY

The formula for the D/S ratio for the external radiation pathway (p = 1) is:

$$D_{i1}/S_i = (D/E)_{i1} \times \rho_b \times FO_1 \times FA_1 \times FD_{i1}$$

Substituting the parameter values listed in Table B.1, App. B, one obtains:*

$$D_1/S = \sum_{i=1}^{2} D_{i1}/S_i = 0.087 \times 1.5 \times 1.0 \times 0.61 \times 0.45$$

$$+ 9.5 \times 10^{-4} \times 1.5 \times 1.0 \times 0.61 \times 0.63$$

$$= 3.6 \times 10^{-2} \text{ (mrem/yr)/(pCi/g)}$$

3.2 DUST INHALATION PATHWAY

The D/S ratio for internal exposure from inhalation of dust (p = 2) was calculated using the following equation:

$$D_{i2}/S_i = (D/E)_{i2} \times (E/A)_2 \times FO_2 \times FS_2 \times (A/S)_2$$

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*The summation is carried out for uranium-238 and uranium-234 (uranium-234 is assumed to be present in secular equilibrium with uranium-238). The dose contribution from uranium-235 is not included in this evaluation because it will be much lower than that for either uranium-238 or uranium-234, due to the much lower activity concentration of uranium-235.

The mass loading factor $(A/S)_2$, i.e., the mass of airborne dust per unit volume of air, was assumed to be 2.0×10^{-4} g/m^3. This value is conservative for normal indoor activities, i.e., it results in a higher inhalation dose (Gilbert et al. 1983). Because horse polo games were previously played in the arena of the Armory (Argonne Natl. Lab 1987), such an indoor mass loading factor at the Armory could occur in the future. Using the parameters listed in Table B.1, App. B, one obtains:

$$D_2/S = \sum_{i=1}^{2} D_{i2}/S_i = 0.12 \times 8400 \times 1.0 \times 1.0 \times 2.0 \times 10^{-4} + 0.13 \times 8400 \times 1.0 \times 1.0 \times 2.0 \times 10^{-4}$$

$$= 4.2 \times 10^{-1} \text{ (mrem/yr)/(pCi/g)}$$

3.3 PLANT-FOOD INGESTION PATHWAY

For the plant-food ingestion pathway (p = 3), the plant food was assumed to be raised in a garden adjacent to the Armory in an uncontaminated area. Thus, the root uptake and foliar deposition pathways were not considered in this analysis. However, the irrigation pathway, assuming use of potentially contaminated water, was evaluated. The D/S ratio for internal exposure from ingestion of the hypothetical plant-food diet was calculated using the following equation:

$$D_{i3}/S_i = (D/E)_{i3} \times (E_{i3}/S_i) \times FA_3 \times FD_3$$

The environmental transport factors in the above equation, E_{i3}/S_i, was calculated as

$$E_{i3}/S_i = (E_{i3}/W_i) \times (W_i/S_i)$$

using the conversion factors, E_{i3}/W_i, listed in Table 4.5 of the Manual. The water-to-source concentration ratios, W_i/S_i, were obtained from the drinking water pathway discussed in Section 3.4.

Using parameter values listed in Table B.1, App. B, and the W_i/S_i value calculated in Section 3.4, one obtains:

$$D_3/S = \sum_{i=1}^{2} (D_{i3}/S_i) = 2.6 \times 10^{-4} \times 7.7 \times 10^{2} \times 0.76 \times 0.10 \times 1.0 + 2.8 \times 10^{-4} \times 7.7 \times 10^{2} \times 0.76 \times 0.10 \times 1.0$$

$$= 3.2 \times 10^{-2} \text{ (mrem/yr)/(pCi/g)}$$

3.4 DRINKING WATER PATHWAY

The D/S ratio for internal exposure from drinking water (p = 4) was calculated using the equation:

$$D_{i4}/S_i = (D/E)_{i4} \times (E_{i4}/W_i) \times (W_i/S_i)$$

The water-to-source concentration factor, W_i/S_i, was calculated as

$$W_i/S_i = \left(1000/K_{d_i}^{cz}\right) \times F_{uz_i} \times F_{sz_i}$$

where $K_{d_i}^{cz}$ is the i^{th} radionuclide distribution coefficient in the contaminated (source) materials. The F_{uz_i} and F_{sz_i} factors were calculated using the method described in the Manual, except the retardation factor, R_d, was modified so that the radionuclide migration velocity is more conservatively estimated. The retardation factor defined in the Manual (p. 4-70) reads:

$$R_d = 1 + \rho_b K_d/\theta_e$$

where θ_e is the effective water content. It was modified to read:

$$R_d = 1 + \rho_b K_d/\theta_t$$

where θ_t is the total water content. The rationale for this modification can be found in reports of the U.S. Department of Energy (1987) and Yu (1987).

Using the parameters listed in Table B.1, App. B, it was calculated that:

$$F_{uz_i} = 1.0$$

and

$$F_{sz_i} = 3.8 \times 10^{-2}$$

Hence,

$$W_i/S_i = (1000/50) \times 1.0 \times 3.8 \times 10^{-2} = 0.76 \text{ (pCi/L)/(pCi/g)}$$

Therefore,

$$D_4/S = \sum_{i=1}^{2} D_{i4}/S_i = 2.6 \times 10^{-4} \times 410 \times 0.76 + 2.8 \times 10^{-4} \times 410 \times 0.76 = 1.7 \times 10^{-1} \text{ (mrem/yr)/(pCi/g)}$$

4 RESIDUAL RADIOACTIVITY GUIDELINE

Based on the dose-to-source ratios derived in the previous section for each pathway applicable to the Armory site, the total D/S ratio was calculated as follows:

$$\text{Total } D/S = \sum_{i=1}^{2} \sum_{p=1}^{4} D_{ip}/S_i$$

$$= \sum_{p=1}^{4} (D_p/S)$$

$$= 3.6 \times 10^{-2} + 4.2 \times 10^{-1} + 3.2 \times 10^{-2} + 1.7 \times 10^{-1}$$

$$= 6.6 \times 10^{-1} \text{ (mrem/yr)/(pCi/g)}$$

The residual radioactivity guideline is defined as the concentration of residual radioactivity that can remain in the Armory and still allow for unrestricted use of the site. Using the annual radiation dose limit of 100 mrem/yr (App. A), the residual radioactivity guideline for the Armory site is 150 pCi/g (i.e., 100 ÷ 0.66 = 150) for uranium-238, with uranium-234 and uranium-235 present in naturally occurring concentrations.

5 REFERENCES

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APPENDIX A. DOE GUIDELINES FOR RESIDUAL RADIOACTIVITY

U.S. DEPARTMENT OF ENERGY GUIDELINES FOR RESIDUAL RADIOACTIVITY AT FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM AND REMOTE SURPLUS FACILITIES MANAGEMENT PROGRAM SITES

(Rev. 1, July 1985)

A. INTRODUCTION

This document presents U.S. Department of Energy (DOE) radiological protection guidelines for cleanup of residual radioactive materials and management of the resulting wastes and residues. It is applicable to sites identified by the Formerly Utilized Sites Remedial Action Program (FUSRAP) and remote sites identified by the Surplus Facilities Management Program (SFMP).* The topics covered are basic dose limits, guidelines and authorized limits for allowable levels of residual radioactivity, and requirements for control of the radioactive wastes and residues.

Protocols for identification, characterization, and designation of FUSRAP sites for remedial action; for implementation of the remedial action; and for certification of a FUSRAP site for release for unrestricted use are given in a separate document (U.S. Dept. Energy 1984). More detailed information on applications of the guidelines presented herein, including procedures for deriving site-specific guidelines for allowable levels of residual radioactivity from basic dose limits, is contained in a supplementary document--referred to herein as the "supplement" (U.S. Dept. Energy 1985).

"Residual radioactivity" includes: (1) residual concentrations of radionuclides in soil material,** (2) concentrations of airborne radon decay products, (3) external gamma radiation level, and (4) surface contamination. A "basic dose limit" is a prescribed standard from which limits for quantities that can be monitored and controlled are derived; it is specified in terms of the effective dose equivalent as defined by the International Commission on Radiological Protection (ICRP 1977, 1978). Basic dose limits are used explicitly for deriving guidelines for residual concentrations of radionuclides in soil material, except for thorium and radium. Guidelines for

*A remote SFMP site is one that is excess to DOE programmatic needs and is located outside a major operating DOE research and development or production area.

**The term "soil material" refers to all material below grade level after remedial action is completed.

residual concentrations of thorium and radium and for the other three quantities (airborne radon decay products, external gamma radiation level, and surface contamination) are based on existing radiological protection standards (U.S. Environ. Prot. Agency 1983; U.S. Nucl. Reg. Comm. 1982). These standards are assumed to be consistent with basic dose limits within the uncertainty of derivations of levels of residual radioactivity from basic limits.

A "guideline" for residual radioactivity is a level of residual radioactivity that is acceptable if the use of the site is to be unrestricted. Guidelines for residual radioactivity presented herein are of two kinds: (1) generic, site-independent guidelines taken from existing radiation protection standards, and (2) site-specific guidelines derived from basic dose limits using site-specific models and data. Generic guideline values are presented in this document. Procedures and data for deriving site-specific guideline values are given in the supplement.

An "authorized limit" is a level of residual radioactivity that must not be exceeded if the remedial action is to be considered completed. Under normal circumstances, expected to occur at most sites, authorized limits for residual radioactivity are set equal to guideline values. Exceptional conditions for which authorized limits might differ from guideline values are specified in Sections D and F. A site may be released for unrestricted use only if the residual radioactivity does not exceed guideline values at the time remedial action is completed. Restrictions and controls on use of the site must be established and enforced if the residual radioactivity exceeds guideline values. The applicable controls and restrictions are specified in Section E.

DOE policy requires that all exposures to radiation be limited to levels that are as low as reasonably achievable (ALARA). Implementation of ALARA policy is specified as procedures to be applied after authorized limits have been set. For sites to be released for unrestricted use, the intent is to reduce residual radioactivity to levels that are as far below authorized limits as reasonable considering technical, economic, and social factors. At sites where the residual radioactivity is not reduced to levels that permit release for unrestricted use, ALARA policy is implemented by establishing controls to reduce exposure to levels that are as low as is reasonably achievable. Procedures for implementing ALARA policy are described in the supplement. ALARA policies, procedures, and actions must be documented and filed as a permanent record upon completion of remedial action at a site.

B. BASIC DOSE LIMITS

The basic limit for the annual radiation dose received by an individual member of the general public is 500 mrem/yr for a period of exposure not to exceed 5 years and an average of 100 mrem/yr over a lifetime. The committed effective dose equivalent, as defined in ICRP Publication 26 (ICRP 1977) and calculated by dosimetry models described in ICRP Publication 30 (ICRP 1978), shall be used for determining the dose.

C. GUIDELINES FOR RESIDUAL RADIOACTIVITY

C.1 Residual Radionuclides in Soil Material

Residual concentrations of radionuclides in soil material shall be specified as above-background concentrations averaged over an area of 100 m^2. If the concentration in any area is found to exceed the average by a factor greater than 3, guidelines for local concentrations shall also be applicable. These "hot spot" guidelines depend on the extent of the elevated local concentrations and are given in the supplement.

The generic guidelines for residual concentrations of Th-232, Th-230, Ra-228, and Ra-226 are:

- 5 pCi/g, averaged over the first 15 cm of soil below the surface
- 15 pCi/g, averaged over 15-cm-thick layers of soil more than 15 cm below the surface

These guidelines take into account ingrowth of Ra-226 from Th-230 and of Ra-228 from Th-232, 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 the dose for the mixtures will not exceed the basic dose limit. Explicit formulas for calculating residual concentration guidelines for mixtures are given in the supplement.

The guidelines for residual concentrations in soil material of all other radionuclides shall be derived from basic dose limits by means of an environmental pathway analysis using site-specific data. Procedures for deriving these guidelines are given in the supplement.

C.2 Airborne Radon Decay Products

Generic guidelines for concentrations of airborne radon decay products shall apply to existing occupied or habitable structures on private property that are intended for unrestricted use; structures that will be demolished or buried are excluded. The applicable generic guideline (40 CFR 192) is: In any occupied or habitable building, the objective of remedial action shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL.* In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL. Remedial actions are not required in order to comply with this guideline when there is reasonable assurance that residual radioactive materials are not the cause.

C.3 External Gamma Radiation

The average level of gamma radiation inside a building or habitable structure on a site to be released for unrestricted use shall not exceed the background level by more than 20 μR/h.

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*A working level (WL) is any combination of short-lived radon decay products in one liter of air that will result in the ultimate emission of 1.3×10^5 MeV of potential alpha energy.

C.4 Surface Contamination

The following generic guidelines, adapted from standards of the U.S. Nuclear Regulatory Commission (1982), are applicable only to existing structures and equipment that will not be demolished and buried. They apply to both interior and exterior surfaces. If a building is demolished and buried, the guidelines in Section C.1 are applicable to the resulting contamination in the ground.

	Allowable Total Residual Surface Contamination (dpm/100 cm²)[a]		
Radionuclides[b]	Average[c,d]	Maximum[d,e]	Removable[d,f]
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	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	5,000β-γ	15,000β-γ	1,000β-γ

[a] 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.

[b] 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.

[c] Measurements of average contamination should not be averaged over an area of more than 1 m². 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 1 cm.

[e] The maximum contamination level applies to an area of not more than 100 cm².

[f] The amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area 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 cm² is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. The numbers in this column are maximum amounts.

D. AUTHORIZED LIMITS FOR RESIDUAL RADIOACTIVITY

The remedial action shall not be considered complete unless the residual radioactivity is below authorized limits. Authorized limits shall be set equal to guidelines for residual radioactivity unless: (1) exceptions specified in Section F of this document are applicable, in which case an authorized limit may be set above the guideline value for the specific location or condition to which the exception is applicable; or (2) on the basis of site-specific data not used in establishing the guidelines, it can be clearly established that limits below the guidelines are reasonable and can be achieved without appreciable increase in cost of the remedial action. Authorized limits that differ from guidelines must be justified and established on a site-specific basis, with documentation that must be filed as a permanent record upon completion of remedial action at a site. Authorized limits differing from the guidelines must be approved by the Director, Oak Ridge Technical Services Division, for FUSRAP and by the Director, Richland Surplus Facilities Management Program Office, for remote SFMP--with concurrence by the Director of Remedial Action Projects for both programs.

E. CONTROL OF RESIDUAL RADIOACTIVITY AT FUSRAP AND REMOTE SFMP SITES

Residual radioactivity above the guidelines at FUSRAP and remote SFMP sites must be managed in accordance with applicable DOE Orders. The DOE Order 5480.1A requires compliance with applicable federal, state, and local environmental protection standards.

The operational and control requirements specified in the following DOE Orders shall apply to interim storage, interim management, and long-term management.

a. 5440.1B, Implementation of the National Environmental Policy Act

b. 5480.1A, Environmental Protection, Safety, and Health Protection Program for DOE Operations

c. 5480.2, Hazardous and Radioactive Mixed Waste Management

d. 5480.4, Environmental Protection, Safety, and Health Protection Standards

e. 5482.1A, Environmental, Safety, and Health Appraisal Program

f. 5483.1, Occupational Safety and Health Program for Government-Owned Contractor-Operated Facilities

g. 5484.1, Environmental Protection, Safety, and Health Protection Information Reporting Requirements

h. 5484.2, Unusual Occurrence Reporting System

i. 5820.2, Radioactive Waste Management

E.1 Interim Storage

a. Control and stabilization features shall be designed to ensure, to the extent reasonably achievable, an effective life of 50 years and, in any case, at least 25 years.

b. Above-background Rn-222 concentrations in the atmosphere above facility surfaces or openings shall not exceed: (1) 100 pCi/L at any given point, (2) an annual average concentration of 30 pCi/L over the facility site, and (3) an annual average concentration of 3 pCi/L at or above any location outside the facility site (DOE Order 5480.1A, Attachment XI-1).

c. Concentrations of radionuclides in the groundwater or quantities of residual radioactive materials shall not exceed existing federal, state, or local standards.

d. Access to a site shall be controlled and misuse of onsite material contaminated by residual radioactivity shall be prevented through appropriate administrative controls and physical barriers--active and passive controls as described by the U.S. Environmental Protection Agency (1983--p. 595). These control features should be designed to ensure, to the extent reasonable, an effective life of at least 25 years. The federal government shall have title to the property.

E.2 Interim Management

a. A site may be released under interim management when the residual radioactivity exceeds guideline values if the residual radioactivity is in inaccessible locations and would be unreasonably costly to remove, provided that administrative controls are established to ensure that no member of the public shall receive a radiation dose exceeding the basic dose limit.

b. The administrative controls, as approved by DOE, shall include but not be limited to periodic monitoring, appropriate shielding, physical barriers to prevent access, and appropriate radiological safety measures during maintenance, renovation, demolition, or other activities that might disturb the residual radioactivity or cause it to migrate.

c. The owner of the site or appropriate federal, state, or local authorities shall be responsible for enforcing the administrative controls.

E.3 Long-Term Management

Uranium, Thorium, and Their Decay Products

a. Control and stabilization features shall be designed to ensure, to the extent reasonably achievable, an effective life of 1,000 years and, in any case, at least 200 years.

b. Control and stabilization features shall be designed to ensure that Rn-222 emanation to the atmosphere from the waste shall not: (1) exceed an annual average release rate of 20 pCi/m^2/s, and (2) increase the annual average Rn-222 concentration at or above any location outside the boundary of the contaminated area by more than 0.5 pCi/L. Field verification of emanation rates is not required.

c. Prior to placement of any potentially biodegradable contaminated wastes in a long-term management facility, such wastes shall be properly conditioned to ensure that (1) the generation and escape of biogenic gases will not cause the requirement in paragraph b of this section (E.3) to be exceeded, and (2) biodegradation within the facility will not result in premature structural failure in violation of the requirements in paragraph a of this section (E.3).

d. Groundwater shall be protected in accordance with 40 CFR 192.20(a)(2) and 192.20(a)(3), as applicable to FUSRAP and remote SFMP sites.

e. Access to a site should be controlled and misuse of onsite material contaminated by residual radioactivity should be prevented through appropriate administrative controls and physical barriers--active and passive controls as described by the U.S. Environmental Protection Agency (1983--p. 595). These controls should be designed to be effective to the extent reasonable for at least 200 years. The federal government shall have title to the property.

Other Radionuclides

f. Long-term management of other radionuclides shall be in accordance with Chapters 2, 3, and 5 of DOE Order 5820.2, as applicable.

F. EXCEPTIONS

Exceptions to the requirement that authorized limits be set equal to the guidelines may be made on the basis of an analysis of site-specific aspects of a designated site that were not taken into account in deriving the guidelines. Exceptions require approvals as stated in Section D. Specific situations that warrant exceptions are:

a. Where remedial actions would pose a clear and present risk of injury to workers or members of the general public, notwithstanding reasonable measures to avoid or reduce risk.

b. Where remedial actions--even after all reasonable mitigative measures have been taken--would produce environmental harm that is clearly excessive compared to the health benefits to persons living on or near affected sites, now or in the future. A clear excess of environmental harm is harm that is long-term, manifest, and grossly disproportionate to health benefits that may reasonably be anticipated.

c. Where the cost of remedial actions for contaminated soil is unreasonably high relative to long-term benefits and where the residual radioactive materials do not pose a clear present or future risk after taking necessary control measures. The likelihood that buildings will be erected or that people will spend long periods of time at such a site should be considered in evaluating this risk. Remedial actions will generally not be necessary where only minor quantities of residual radioactive materials are involved or where residual radioactive materials occur in an inaccessible location at

which site-specific factors limit their hazard and from which they are costly or difficult to remove. Examples are residual radioactive materials under hard-surface public roads and sidewalks, around public sewer lines, or in fence-post foundations. In order to invoke this exception, a site-specific analysis must be provided to establish that it would not cause an individual to receive a radiation dose in excess of the basic dose limits stated in Section B, and a statement specifying the residual radioactivity must be included in the appropriate state and local records.

d. Where the cost of cleanup of a contaminated building is clearly unreasonably high relative to the benefits. Factors that shall be included in this judgment are the anticipated period of occupancy, the incremental radiation level that would be effected by remedial action, the residual useful lifetime of the building, the potential for future construction at the site, and the applicability of remedial actions that would be less costly than removal of the residual radioactive materials. A statement specifying the residual radioactivity must be included in the appropriate state and local records.

e. Where there is no feasible remedial action.

C. SOURCES

Limit or Guideline	Source
Basic Dose Limits	
Dosimetry Model and Dose Limits	International Commission on Radiological Protection (1977, 1978)
Generic Guidelines for Residual Radioactivity	
Residual Concentrations of Radium and Thorium in Soil Material	40 CFR 192
Airborne Radon Decay Products	40 CFR 192
External Gamma Radiation	40 CFR 192
Surface Contamination	Adapted from U.S. Nuclear Regulatory Commission (1982)
Control of Radioactive Wastes and Residues	
Interim Storage	DOE Order 5480.1A
Long-Term Management	DOE Order 5480.1A; 40 CFR 192

H. REFERENCES

International Commission on Radiological Protection. 1977. Recommendations of the International Commission on Radiological Protection (Adopted January 17, 1977). ICRP Publication 26. Pergamon Press, Oxford. [As modified by "Statement from the 1978 Stockholm Meeting of the ICRP." Annals of the ICRP, Vol. 2, No. 1, 1978.]

International Commission on Radiological Protection. 1978. Limits for Intakes of Radionuclides by Workers. A Report of Committee 2 of the International Commission on Radiological Protection. Adopted by the Commission in July 1978. ICRP Publication 30. Part 1 (and Supplement), Part 2 (and Supplement), Part 3 (and Supplements A and B), and Index. Pergamon Press, Oxford.

U.S. Environmental Protection Agency. 1983. Standards for Remedial Actions at Inactive Uranium Processing Sites; Final Rule (40 CFR Part 192). Fed. Regist. 48(3):590-604 (January 5, 1983).

U.S. Department of Energy. 1984. Formerly Utilized Sites Remedial Action Program. Summary Protocol: Identification - Characterization - Designation - Remedial Action - Certification. Office of Nuclear Energy, Office of Terminal Waste Disposal and Remedial Action, Division of Remedial Action Projects. April 1984.

U.S. Department of Energy. 1985. Supplement to U.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites. A Manual for Implementing Residual Radioactivity Guidelines. Prepared by Argonne National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, and Pacific Northwest Laboratory for the U.S. Department of Energy. (In preparation.)

U.S. Nuclear Regulatory Commission. 1982. Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material. Division of Fuel Cycle and Material Safety, Washington, DC. July 1982.

APPENDIX B. PARAMETERS USED IN THE PATHWAY ANALYSIS

The parameter values used in the pathways analysis and their sources are listed in Table B.1. All parameter values are reported to two significant digits.

TABLE B.1 Parameters Used in the Pathway Analysis for the Armory Site

Parameter	Unit	Value	Reference
External Radiation Pathway (p = 1)			
$(D/E)_{U-238,1}$	$(mrem/yr)/(pCi/cm^3)$	0.087	Gilbert et al. (1985)
$(D/E)_{U-234,1}$	$(mrem/yr)/(pCi/cm^3)$	9.5×10^{-4}	Gilbert et al. (1985)
FA_1	-[a]	0.61	Gilbert et al. (1985)
FO_1	-[a]	1.0	-[b]
$FD_{U-238,1}$	-[a]	0.45	Gilbert et al. (1985)
$FD_{U-234,1}$	-[a]	0.63	Gilbert et al. (1985)
A	m^2	200	Argonne Natl. Lab (1987)
T	m	0.05	Argonne Natl. Lab (1987)
ρ_b	g/cm^3	1.5	-[b]
Dust Inhalation Pathway (p = 2)			
$(E/A)_2$	m^3/yr	8400	Gilbert et al. (1985)
FO_2	-[a]	1.0	-[b]
FS_2	-[a]	1.0	Gilbert et al. (1985)
$(A/S)_2$	g/m^3	2.0×10^{-4}	-[b]
$(D/E)_{U-238,2}$	mrem/pCi	0.12	Gilbert et al. (1985)
$(D/E)_{U-234,2}$	mrem/pCi	0.13	Gilbert et al. (1985)

TABLE B.1 Continued

Parameter	Unit	Value	Reference
Ingestion Pathway (p = 3 and 4)			
FA_3	-[a]	0.10	-[b]
FD_3	-[a]	1.0	Gilbert et al. (1985)
$(D/E)_{U\text{-}238,3\&4}$	mrem/pCi	2.6×10^{-4}	Gilbert et al. (1985)
$(D/E)_{U\text{-}234,3\&4}$	mrem/pCi	2.8×10^{-4}	Gilbert et al. (1985)
$(E/W)_3$	L/yr	770	Gilbert et al. (1985)
$(E/W)_4$	L/yr	410	Gilbert et al. (1985)
l	m	10	-[b]
d	m	5	Gilbert et al. (1985)
$K_{d_U}^{cz}$	mL/g	50	-[b]
$K_{d_U}^{uz}$	mL/g	50	U.S. Nucl. Reg. Comm. (1987)
$K_{d_U}^{sz}$	mL/g	4	U.S. Nucl. Reg. Comm. (1987)
θ_e^{uz}	-[a]	0.03	U.S. Nucl. Reg. Comm. (1987)
θ_t^{uz}	-[a]	0.21	U.S. Nucl. Reg. Comm. (1987)
θ_e^{sz}	-[a]	0.25	U.S. Nucl. Reg. Comm. (1987)
θ_t^{sz}	-[a]	0.40	U.S. Nucl. Reg. Comm. (1987)

TABLE B.1 Continued

Parameter	Unit	Value	Reference
K_h^{sz}	m/yr	2.1×10^4	U.S. Nucl. Reg. Comm. (1987)
ρ_b^{uz}	g/cm^3	1.8	U.S. Nucl. Reg. Comm. (1987)
ρ_b^{sz}	g/cm^3	1.5	U.S. Nucl. Reg. Comm. (1987)
J	-[a]	0.01	U.S. Nucl. Reg. Comm. (1987)
h	m	1.0	U.S. Nucl. Reg. Comm. (1987)
R	m/yr	1.0	-[b]

[a] A hyphen means the parameter is dimensionless.

[b] No data are available; conservative values are used in this analysis.

REFERENCES

Argonne National Laboratory, 1987, *Action Description Memorandum, Proposed Decontamination of the National Guard Armory in Chicago, Illinois*, prepared for U.S. Department of Energy, Oak Ridge Operations Office (March).

Gilbert, T.L., et al., 1985, *A Manual for Implementing Residual Radioactivity Guidelines: A Supplement to U.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites*, prepared by Argonne National Laboratory, Oak Ridge National Laboratory, Los Alamos National Laboratory, and Battelle Pacific Northwest Laboratory for U.S. Department of Energy (Sept.).

U.S. Nuclear Regulatory Commission, 1987, *Draft Supplemental Environmental Statement Related to the Decommissioning of the Rare Earths Facility, West Chicago, Illinois*, prepared by Energy and Environmental Systems Division, Argonne National Laboratory, Argonne, Ill.

2.2 DESIGNATION OR AUTHORIZATION DOCUMENTATION

The following document authorized or designated the subject site for remedial action.

Page

Letter, E.L. Keller, Director, Technical Services Division, Oak Ridge Operations Office, Department of Energy, to Robert Adams, Provost, University of Chicago. "Decontamination of University of Chicago Facilities: Eckhart Hall, Ryerson Physical Laboratory, and George Herbert Jones Laboratory," Oak Ridge, Tenn., August 22, 1983. II-27

AUG 22 1983

University of Chicago
ATTN: Mr. Robert Adams, Provost
Administration Building 502
5801 S. Ellis Avenue
Chicago, IL 60637

Gentlemen:

DECONTAMINATION OF UNIVERSITY OF CHICAGO FACILITIES: ECKHART HALL, RYERSON PHYSICAL LABORATORY, AND GEORGE HERBERT JONES CHEMICAL LABORATORY

The U. S. Department of Energy's Oak Ridge Operations Office recently received approval to proceed with remedial actions for the subject facilities at the University of Chicago under the Department's Formerly Utilized MED/AEC Sites Remedial Action Program (FUSRAP). The necessary work has been planned as part of our program for the year beginning October 1, 1983. The Department's Argonne National Laboratory will be utilized to accomplish the decontamination work under the contract to this office.

Enclosed is a draft scope-of-work statement which is being submitted for the University's review and comment. In order for the decontamination work to proceed, DOE will require confirmation that the scope and schedule of the work, and the criteria that have been adopted for the project, meet with the University's approval. The intended goal of the decontamination project is to permanently clean and restore all facilities for unqualified, unrestricted use to the extent practicable. It should be kept in mind that the current radiological conditions of the facilities are not such that any substantive use restrictions have been necessary in the past. However, with the completion of the decontamination project, all wall, floor, and ceiling surface contamination will be reduced below those levels proposed by the American National Standards Institute. These standards, and others that may also have some application to elements of the decontamination project, are outlined in the enclosed reports, ORO-831 and 832.

In order to facilitate your review of the scope-of-work, I have asked Jake Alexander of my staff, whom I have assigned to be the DOE project engineer for this work, to contact you to schedule a meeting where he, DOE Chicago

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Operations personnel, the Argonne staff that will be performing the work, and interested University of Chicago staff can discuss the project activities in more detail. Also, we would hope to have available at that time a draft two-party agreement covering the work.

As you are aware, there has recently been considerable publicity about the FUSRAP program in general, and DOE's tentative plans to decontaminate the University of Chicago in particular. Please be aware that these media activities were not the result of any DOE news release or other public information initiatives. On August 15, 1983, the Knoxville Journal (Knoxville, Tennessee) printed a news story that included some misleading statements about general FUSRAP project plans. The Associated Press subsequently produced a news service item that prompted many regional media request for more information, including the Chicago Tribune's inquiries about the University of Chicago.

Normally, DOE would expect to have discussed and reached agreement on any planned project activities with facility owners prior to any media news releases that may be determined to be necessary. In this case, it is doubtful any formal public information activities would have been warranted. DOE regrets any inconvenience the media coverage may have created for University staff or students.

Other University of Chicago facilities that were surveyed by Argonne in 1977 were the West Stands, the New Chemistry Laboratory and Annex, the Recketts Laboratory, and the Kent Chemical Laboratory. It has been determined that the West Stands, New Chemistry Laboratory and Annex, and the Recketts Laboratory have no residual radioactive contamination attributed to MED/AEC activities and, therefore, these facilities have not been designated for remedial action. The Kent Chemical Laboratory has been decontaminated by the University and, except for some possible additional investigation of sewer lines, requires no further remedial action effort.

Sincerely,

Original signed by
Lowell F. Campbell

E. L. Keller, Director
Technical Services Division

CE-53:JKA

Enclosures:
As Stated

bcc: G. W. Benedict, CE-50
F. Gorup, CH
W. Range, M-4

CE-53:JKAlexander:jm:6-4451:8-22-83
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DECONTAMINATION OF UNIVERSITY OF CHICAGO FACILITIES; DOE'S FORMERLY UTILIZED MED/AEC SITES REMEDIAL ACTION PROGRAM (FUSRAP)

Scope of Work

As part of the Department of Energy's Formerly Utilized MED/AEC Sites Remedial Action Program, the Argonne National Laboratory will perform all necessary decontamination tasks to decontaminate and restore the areas of the Ryerson Physical Laboratory, George Herbert Jones Chemical Laboratory, and Eckhart Hall determined to have been radiologically contaminated as a result of Manhattan Engineer District or early Atomic Energy Commission activities. The decontamination and restoration project will reduce residual radioactivity levels below criteria that have been determined to represent permanent and otherwise unqualified, unrestricted use conditions.

The areas of contamination of concern are specified in three DOE/Argonne radiological survey reports: Radiological Survey of Ryerson Physical Laboratory, DOE/EV-0005/23; Radiological Survey of Eckhart Hall, DOE/EV-0005/24; and Radiological Survey of the George Herbert Jones Chemical Laboratory, DOE/EV-0005/26. The criteria for these remedial actions are specified in the attached document, "Proposed Radiological Criteria for Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites", August 5, 1983. Particularly applicable to this specific remedial action are the indoor/outdoor building surface contamination criteria specified in Part 2.C. of the criteria document.

Standard decontamination techniques commonly utilized at Argonne and other DOE facilities will be applied. This will include the use of specialized cleaners and actual removal of surface material by brushing, scrubbing, sawing, etc., as necessary. Standard Argonne National Laboratory Health and Safety procedures will be followed.

To facilitate minimum disruption of ongoing University activities, a flexible work schedule, including weekends, holiday periods, and class breaks, will be utilized for certain work activities.

It is expected that decontamination activities would be initiated during the month of December 1983, starting with Eckhart Hall. This facility should be completed by February 1, 1984. Work on the Ryerson Physical Laboratory will be expected to begin in February 1984 with completion by April 1984. Jones Chemical Laboratory will be the final structure scheduled for decontamination. This structure will present the major challenge since there is a rather large area of cement floor in the attic which requires decontamination. A substantial amount of equipment will have to be moved during the progress of the decontamination effort. All decontamination effort is expected to be finished by the end of September 1984. A final decontamination activities report with radiological survey data will be provided. Prior to initiation of the onsite work effort, a brief decontamination plan will be made available.

It is expected that approximately 600 ft^3 of low-level radioactive waste will be generated during the decontamination effort. All radioactive waste will be placed in approved M-3 bins or 55-gallon containers for shipment and disposal. Non-radioactive waste will be disposed of through the normal landfill disposal process.

U. S. DEPARTMENT OF ENERGY

Proposed Radiological Criteria

for

Formerly Utilized Sites Remedial Action Program

and Remote

Surplus Facilities Management Program Sites

Presented here are the radiological cleanup and waste control criteria of general applicability to the FUSRAP project and remote SFMP sites.

With the exception of limits for radium-226, the soil cleanup criteria were developed on the basis of limiting maximum individual radiation exposure to DOE limits specified in DOE Order 5480.1A exclusive of exposure from natural background radiation or medical procedures. The aggregate of the contribution from all major pathways, based on scenarios for permanent intrusion, e.g., establishing residences on the site, has been assumed. In most circumstances, the probability is low that such an intrusion will occur. Also, conservative assumptions were used in deriving these criteria to ensure that a particular dose limit would not be exceeded. Use of these criteria is additionally conservative because the pathways considered in the derivation of the criteria assume all water intake and most food intake is from the site. Also, the sites often have limited agricultural capability and the contamination is generally not homogeneous. The combined effect of these factors is such that the probable radiation exposure to the average population on, or in the vicinity of, FUSRAP sites decontaminated to these criteria limits will not be appreciably different from that normally received from natural background radiation.

The cleanup criteria for surface contamination of structures were developed from a proposed ANSI standard modified as appropriate to be consistent with DOE Order 5480.1A and the specific needs of FUSRAP for cost-effective, workable guidelines which provide an adequate safety margin. The waste control criteria are based on applicable DOE Orders and EPA's regulations for inactive uranium milling sites, 40 CFR 192.

The reader should note that Sections A.1., A.2., and D. hereof have separate sets of footnotes.

August 5, 1983

PROJECT RADIOLOGICAL CRITERIA

A. Cleanup Criteria

1. Cleanup of Land

(Maximum limits for unrestricted use)

Radionuclide	Soil Remedial Action Criteria[1] Soil Criteria (pCi/g above background) Avg. over 100 m^2
Ra-226	5 pCi/g, averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over 15 cm thick soil layers more than 15 cm below the surface and less than 1.5 m below the surface.
U-Natural[2]	75
U-238[3]	75
U-234[4]	150
U-235[4]	150
Am-241[5]	20
Pu-241[5]	800
Pu-239, -240	100
Pu-238	100
Th-230[6]	300
Cs-137	80
Sr-90	100
H-3 (pCi/ml soil moisture)	5,200
Th-232[7]	15

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[1] Except for Ra-226, these criteria represent unrestricted-use residual concentrations above background averaged across any 15 cm thickness layer to any depth and over any contiguous 100 m^2 surface area. The same conditions prevail for Ra-226 except for soil layers beneath 1.5 m; beneath 1.5 m, the allowable Ra-226 concentration may be affected by site-specific conditions and must be evaluated accordingly.

[2] A curie of natural uranium means the sum of 3.7×10^{10} disintegrations per second from U-238 plus 3.7×10^{10} dis/sec from U-234 plus 1.7×10^{9} dis/sec from U-235. One curie of natural uranium is equivalent to 3,000 kilograms or 6,615 pounds of natural uranium.

[3/] This criterion is for the activity concentration of U-238 alone, but has been derived on the basis of the assumption that U-234 is also present in the soil at the same activity concentration and that the contribution from U-235 is small.

[4/] Assumes no other uranium isotopes are present.

[5/] The Pu-241 criterion was derived from the Am-241 concentration.

[6/] Applicable only for relatively short periods of unrestricted use (up to approximately 100 years if no Ra-226 is present initially). For most applications (permanently unrestricted use), the Th-230 concentration may not exceed the Ra-226 guideline.

[7/] Assumes all decay chain products are in equilibrium concentrations (e.g., Ra-228 criteria would be the same as that for Th-232).

2. Cleanup of Buildings

a. Indoor Radon Decay Products

A structure located on private property and intended for unrestricted use shall be subject to remedial action as necessary to ensure the annual average radon daughter concentration (RDC) is less than 0.03 WL within the structure.

b. Indoor Gamma Radiation

The indoor gamma radiation after cleanup shall not exceed 20 microroentgen per hour (20 microR/hr.) above background.

c. Indoor/Outdoor Building Surface Contamination

Building Surface Contamination Remedial Action Criteria:

Radionuclides	Allowable Surface Contamination ($dpm/100\ cm^2$) Total	Removable
Group 1: Radionuclides for which the area concentration guide in air above background[2/] is 2×10^{-13} Ci/m^3 or less or for which the uncontrolled area concentration guide in water above background[2/] is 2×10^{-7} Ci/m^3 or less; includes Pa-231, Th-228, Th-230, Ac-227, Ra-226, Ra-228, and Pb-210.	100	20

Group 2: Radionuclides not in Group 1 for which the uncontrolled area concentration guide in air above background[2/] is 1×10^{-12} Ci/m^3 or less or for which an uncontrolled area concentration guide in water above background[2/] is 1×10^{-6} Ci/m^3 or less; includes U-232, U-238, Th-232, Ra-223, and Po-210.	1,000	200
Group 3: Those radionuclides not in Group 1 or Group 2; includes U-234, U-235, and Ra-224.	5,000	1,000

[1/] The levels may be averaged over 1 m^2 provided the maximum activity in any area of 100 cm^2 is less than 3 times the limit value; dpm = disintegrations per minute.

[2/] Given in Attachment I to Chapter XI, Table II, DOE Order 5480.1A.

Source: Adapted from proposed ASNI N 13.12.

B. Control of Radioactive Wastes and Residues

1. Interim Storage

All operational and control requirements specified in the following DOE Orders shall apply:

a. 5480.1A, Environmental Protection, Safety, and Health Protection Program for DOE Operations.

b. 5480.2, Hazardous and Radioactive Mixed Waste Management.

c. 5481.1, Safety Analysis and Review System.

d. 5483.1, Occupational Safety and Health Program for Government-Owned Contractor-Operated Facilities.

e. 5484.1, Environmental Protection, Safety, and Health Protection Information Reporting Requirements.

f. 5484.2, Unusual Occurrence Reporting System.

g. Control and stabilization features will be designed to ensure, to the extent reasonably achievable, an effective life of 50 years, and in any case, at least 25 years.

h. Radon concentrations in the atmosphere above facility surfaces or openings shall not (1) exceed 100 pCi/l at any given point, or an average concentration of 30 pCi/l for the facility site, or (2) exceed an average radon concentration at or above any location outside the facility site of 3.0 pCi/l (above background).

i. For water protection, use existing State and Federal Standards; apply site-specific measures where needed.

2. Long-Term Management

a. All operational requirements specified for Interim Storage Facilities (B.1) will apply.

b. Control and stabilization features will be designed to ensure, to the extent reasonably achievable, an effective life of 1,000 years and, in any case, at least 200 years. Other disposal site design features shall conform with 40 CFR 192 performance guidelines/requirements.

c. Radon emanation to the atmosphere from facility surfaces or openings shall not (1) exceed an average release rate of 20 pCi/m^2 sec, or (2) increase the annual average radon concentration at or above any location outside the facility site by more than 0.5 pCi/l.

d. For water protection, use existing State and Federal Standards; apply site-specific measures where needed.

e. Prior to placement of any potentially biodegradable contaminated wastes in a Long-Term Management facility, such wastes will be properly conditioned to (1) insure the generation and escape of biogenic gases will not cause the criteria in paragraph 2.c. to be exceeded, and (2) insure biodegradation within the facility will not result in premature structural failure not in accordance with the criteria in paragraph 2.b. If biodegradable wastes are conditioned by incineration, incineration operations will be carried out in compliance with all applicable federal, state, and local air emission standards and requirements, including any standards for radionuclides established pursuant to 40 CFR 61, National Emission Standards for Hazardous Air Pollutants (NESHAPS).

C. Exceptions

1. Procedure -- Analysis of site-specific conditions.

2. Applicability -- Where health and safety would be endangered, or where cost clearly outweighs benefits.

D. Criteria Sources

Criteria	Source
1. Cleanup Criteria	
a. Cleanup of Land[1/]	DOE Order 5480.1A, 40 CFR 192[2/]
b. Cleanup of Buildings	40 CFR 192, proposed ANSI N13.12
2. Control of Radioactive Wastes and Residues	
a. Interim Storage	DOE Order 5480.1A
b. Disposal	40 CFR 192
3. Exceptions	
a. Procedure	40 CFR 192
b. Applicability	40 CFR 192

[1/] The bases of the cleanup criteria are developed in ORO-831 and ORO-832.

[2/] Based on limiting the radon daughter concentration to 0.03 WL within structures.

2.3 RADIOLOGICAL CHARACTERIZATION REPORTS

The documents listed below describe the radiological conditions of the subject properties before remedial action.

Page

Argonne National Laboratory. Radiological Survey of the George Herbert Jones Chemical Laboratory, the University of Chicago, Chicago, Illinois, June 13-17, 1977, DOE/EV-0005/26, ANL-OHS/HP-82-100, Argonne, Ill., May 1982. ref.

Argonne National Laboratory. Radiological Survey of the Kent Chemical Laboratory, the University of Chicago, Chicago, Illinois, September 7-13, 1977, DOE/EV-0005/25, ANL-OHS/HP-82-101, Argonne, Ill., May 1982. ref.

Argonne National Laboratory. Radiological Survey of the Ryerson Physical Laboratory, the University of Chicago, Chicago, Illinois, September 11-25, 1976, DOE/EV-0005/23, ANL-OHS/HP-82-103, Argonne, Ill., May 1982. ref.

Argonne National Laboratory. Radiological Survey of the Eckhart Hall, the University of Chicago, Chicago, Illinois, September 14, 1976 - March 22, 1977, DOE/EV-0005/24, ANL-OHS/HP-82-102, Argonne, Ill., May 1982. ref.

Letter, R.R. Harbert, Project Manager, Bechtel National, Inc. to P.J. Gross, Director, Technical Services Division, Oak Ridge Operations Office, Department of Energy. "Revised Letter Characterization Report for the George Herbert Jones Chemical Laboratory at the University of Chicago Site, Chicago, Illinois," DOE/OR/20722-131 (BNI CCN 057117), Oak Ridge, Tenn., November 15, 1988. ref.

2.4 NATIONAL ENVIRONMENTAL POLICY ACT DOCUMENTS

The documents listed below fulfill National Environmental Policy Act requirements for the subject site.

ACTION DESCRIPTION MEMORANDUM

PROPOSED DECONTAMINATION OF THREE BUILDINGS AT THE UNIVERSITY OF CHICAGO CONTAMINATED AS A RESULT OF PREVIOUS MED/AEC ACTIVITIES

Prepared by

Environmental Research Division
Argonne National Laboratory
Argonne, Illinois

December 1983

Prepared for

U.S. Department of Energy
Oak Ridge Operations
Technical Services Division
Oak Ridge, Tennessee

CONTENTS

SUBJECT: Proposed Decontamination of Three Buildings at the University of Chicago Contaminated as a Result of Previous MED/AEC Activities

Summary of Proposed Action

As part of its Formerly Utilized Sites Remedial Action Program (FUSRAP), the U.S. Department of Energy (DOE), Oak Ridge Operations, proposes to decontaminate those areas of three buildings at the University of Chicago that are radioactively contaminated as a result of programs conducted by the Manhattan Engineer District (MED) and the Atomic Energy Commission (AEC). The three buildings to be decontaminated are Eckhart Hall, Ryerson Physical Laboratory, and Jones Chemical Laboratory. The contamination in these buildings is located in several laboratories and adjoining areas, but the concentrations of radioactivity are fairly low except for isolated small areas. The purpose of decontamination and restoration is to reduce the amount of residual radioactivity to levels below the established cleanup criteria, thereby permitting unrestricted use.

Specific project actions will include:

- Identification of all areas requiring decontamination.
- Decontamination of identified areas.
- Packaging of all radioactive waste generated by decontamination in approved containers.
- Disposal of all waste generated; the radioactive waste will be transported to and disposed in an approved facility, and all nonradioactive waste will be transported to and disposed in a nearby sanitary landfill.
- Restoration of the facilities as appropriate for intended future uses.
- Certification that the radioactivity levels meet criteria for unrestricted use.
- Radiological assessment of the underground sewers connected to these three buildings that may be radioactively contaminated.

Setting

The University of Chicago is a private university located in the Hyde Park-Kenwood area of the city of Chicago. The Hyde Park-Kenwood neighborhood covers an area of about 400 ha (1000 acres) and is a residential community of more than 45,000 people, 11 km (7 mi) south of the Chicago downtown business district. The university covers an area of about 70 ha (172 acres) and has an

enrollment of about 8000 students. The university was founded in 1891 and contains buildings with architectural styles representing the past nine decades. Six properties on campus are listed in the National Register of Historic Places (see Table 1).

As part of FUSRAP, the U.S. Department of Energy, Oak Ridge Operations, is proposing to decontaminate those portions of three buildings at the University of Chicago that are radioactively contaminated as a result of programs conducted by MED and AEC. The three buildings to be decontaminated--i.e., Eckhart Hall, Ryerson Physical Laboratory, and Jones Chemical Laboratory--are Gothic style and are located near the center of the campus (Figure 1). Eckhart Hall and Ryerson Physical Laboratory are connected to each other, and Jones Chemical Laboratory is connected to Searle Chemistry Laboratory and Kent Chemical Laboratory. Many of the buildings in this portion of the campus are currently being renovated.

The radiation intensity in these buildings is quite low; the highest exposure rate measured in radiological surveys conducted in 1976 and 1977 was 16 mR/h in contact with a building surface (in Ryerson Physical Laboratory). At only one location in the three buildings was an elevated exposure rate found at a distance of one meter from the surface. This location, in the basement corridor of Ryerson Physical Laboratory, had a reading of 0.1 mR/h at one meter above the floor (U.S. Dep. Energy 1982a). Although the amount of contamination is quite low and does not present an immediate hazard, remodeling or demolition activities could allow contamination that is now fixed to be released to the environment, resulting in a potential health hazard.

Background and Need for Action

The University of Chicago was one of the focal points for activities conducted in support of development of the atomic bomb during World War II. The first contract with the university was initiated by the Office of Scientific Research and Development (OSRD) in January 1942. In June 1942, the MED was established within the U.S. Army Corps of Engineers; the contract with the University of Chicago was transferred from OSRD to MED on May 15, 1943.

The primary goal of the work performed at the university was to develop methods for the production and purification of plutonium. Because plutonium is produced when uranium absorbs neutrons, this work necessitated the construction of a facility that would maintain a self-sustaining nuclear chain reaction and, in turn, provide an intense source of neutrons. The first chain-reacting "pile" was constructed of uranium and graphite beneath the west stands of Stagg Field under the direction of Dr. Enrico Fermi. A self-sustaining condition was achieved on December 2, 1942, thereby demonstrating the feasibility of this technology for producing plutonium.

Additional research and development programs were conducted for MED throughout World War II to support the atomic bomb project. Various laboratories and facilities at the university were used for these activities. On January 1, 1947, the AEC, a civilian organization, succeeded the military MED as the governmental organization in charge of nuclear programs. Research activities continued at the University of Chicago under AEC. Research conducted under MED/AEC during the 1940s and 1950s included development of a

process for producing high-purity uranium compounds, testing of uranium metal, research associated with operation of the pile, and plutonium separation (U.S. Dep. Energy 1980a).

At the completion of these MED/AEC research activities, the facilities were decontaminated so that they met health and safety criteria then in use. However, radiological criteria, guidelines, and proposed guidelines for returning sites to unrestricted use have become more stringent as concern about the effects of low-level radiation has increased and instrumentation for detecting and measuring low levels of radiation has become more sensitive. Accordingly, Eckhart Hall, Ryerson Physical Laboratory, and Jones Chemical Laboratory were resurveyed in 1976 and 1977 to determine the extent of existing contamination (U.S. Dep. Energy 1982a, 1982b, 1982c). These surveys indicated that residual contamination in these three buildings exceeds currently accepted criteria.

Proposed Remedial Action

The U.S. Department of Energy is proposing to decontaminate those portions of Eckhart Hall, Ryerson Physical Laboratory, and Jones Chemical Laboratory at the University of Chicago that are radioactively contaminated as a result of previous MED/AEC activities. The contamination is widespread throughout several laboratories and adjoining areas; however, the concentrations of radioactivity are fairly low except for isolated small areas (U.S. Dep. Energy 1980b).

The results of the three radiological surveys conducted in 1976 and 1977 will be used as guides to locate contaminated areas. In addition, all areas suspected of being radioactively contaminated as a result of MED/AEC activities will be surveyed as part of this action to ensure that all suspect areas are identified. Standard techniques will be utilized to decontaminate the areas identified. For example, special cleaners will be used to remove the contamination while leaving the surface material intact; in situations where this is not possible, the surface material will be removed by brushing, grinding, spalling, sawing, etc., as appropriate. If necessary, entire components may be removed as radioactive waste. Decontamination will continue until residual radioactivity levels are as low as reasonably achievable (ALARA) and meet criteria developed for FUSRAP. The criteria to be utilized are based on levels proposed by the American National Standards Institute and are summarized in a report of the U.S. Department of Energy (1983).*

All radioactive waste resulting from decontamination will be packaged in DOE-approved containers for shipment offsite to an approved disposal site. Use of the Hanford site near Richland, Washington, is currently planned.

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*The state of Illinois also has surface contamination limits for releasing facilities for uncontrolled use (Ill. Dep. Public Health 1974). These limits are similar to those developed for FUSRAP but are not radionuclide-specific. The state of Illinois criteria are less stringent than the strictest criteria for FUSRAP--i.e., those for "Group 1 radionuclides" (see U.S. Dep. Energy 1983). Because the three University of Chicago buildings are contaminated with Group 1 radionuclides, it will be necessary to decontaminate to levels more stringent than the state limits to meet the FUSRAP cleanup criteria.

Decontamination of these three buildings is expected to generate approximately 17 m^3 (600 ft^3) of low-activity radioactive waste. This volume of waste can be accommodated in a single shipment to the disposal site. All nonsalvageable or otherwise unusable nonradioactive waste will be disposed along with other University of Chicago waste in a local sanitary landfill.

After the affected areas have been decontaminated, the areas will be restored in a manner consistent with their intended future uses. Technicians and tradespeople employed by the University of Chicago will be used for this purpose to the extent practicable. If necessary, additional specialized workers will be employed to perform selected tasks. All restoration will be subject to concurrence by the university prior to implementation.

It is expected that decontamination will be initiated during the month of December 1983, starting with Eckhart Hall. This facility should be completed by February 1984. Work on the Ryerson Physical Laboratory will begin in February 1984, with completion by April 1984. Jones Chemical Laboratory will be the final building to be decontaminated and is expected to be finished by August 1984.

Following completion of decontamination and restoration, the affected areas of the three buildings will be surveyed to ensure compliance with FUSRAP cleanup criteria. If necessary, additional decontamination and restoration of selected areas will be performed.

A radiological assessment of the underground sewers connected to these three buildings will be performed as a part of this action to ascertain the extent of sewer contamination and associated radiological risks. There are no plans at present to decontaminate any of these underground sewers.

Potential Issues

Potential issues associated with the proposed action are the following:

1. Disruption of ongoing research programs and classes at the University of Chicago.

2. Increased radiological risks associated with decontamination and transport of radioactive waste to an approved disposal site.

3. Public concerns about the adequacy of the decontamination criteria and the techniques used to achieve these levels.

4. Radiological risks associated with contaminated sewers that will not be cleaned as part of this action.

5. Possible damage to Room 405 of Jones Chemical Laboratory, which has been designated by the U.S. Department of the Interior as a Registered National Historic Landmark. This room is the laboratory where plutonium was first isolated (August 18, 1942) and weighed (September 10, 1942).

The U.S. Department of Energy believes that none of these potential issues involve significant environmental impacts for the following reasons:

1. In order to avoid or at least minimize disruption of scheduled classes and other ongoing university activities, decontamination and restoration will be conducted on a flexible work schedule utilizing evenings, weekends, and holiday periods to the extent that is necessary. This work schedule will be prepared in consultation with administrative officers of the University of Chicago.

2. Decontamination of the three buildings will be conducted in compliance with DOE guidelines and will utilize standard health-physics practices. All radioactive waste-handling and transportation activities will be in compliance with DOE guidelines and applicable state requirements. The small volume of radioactive waste (17 m^3) can be transported in one shipment. Compliance with these guidelines will ensure that no workers or members of the general are exposed to unacceptable levels of risk.

3. Recent public awareness of the existing contamination in these three buildings has resulted in a significant amount of local interest, e.g., newspaper articles and local and national television coverage. The local news media and public officials will be informed of the purpose of all intended activities and the results of these activities. The proposed action should tend to lower public concerns because it is a demonstration that DOE and the University of Chicago are taking action to further safeguard public health and safety even though the existing situation presents no immediate hazard. The cleanup criteria will ensure the future safety of the general public since these criteria were developed using conservative assumptions and include an appropriate margin of safety. The decontamination procedures to be utilized are proven techniques that have been shown to be effective in cleaning up radioactively contaminated facilities to the levels required.

4. It is not possible at this time to estimate the radiological risks associated with the contaminated sewers. An assessment of this risk will be performed using data that will be gathered as a part of this action. Future actions will be taken to decontaminate the sewers if the risk assessment indicates that such actions are required.

5. All reasonable efforts will be made during decontamination and restoration to minimize disturbance of university facilities. Extreme care will be taken during work in the vicinity of Room 405 of Jones Chemical Laboratory to ensure that this historical landmark is not damaged or degraded in any manner.

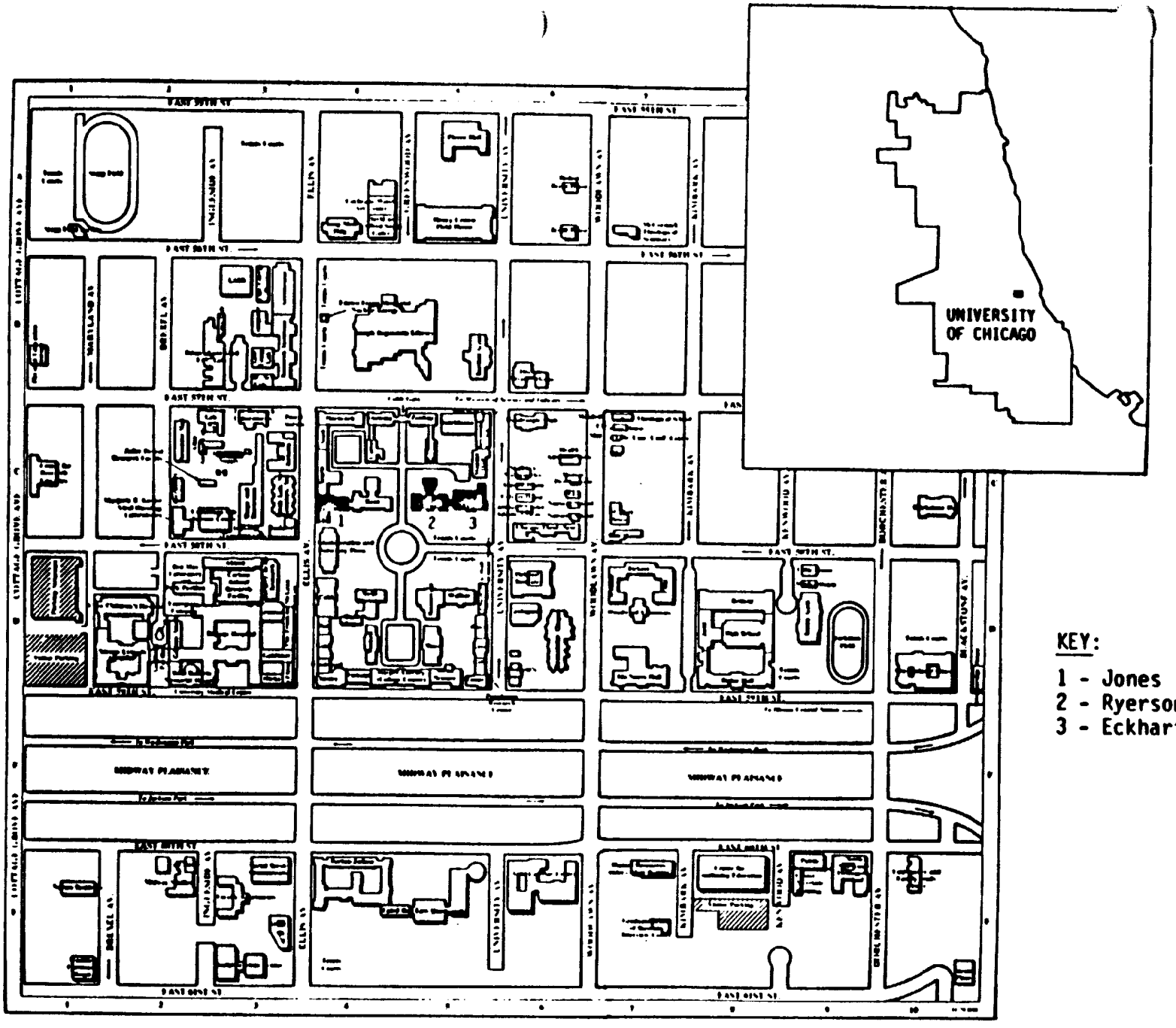

Figure 1. Location of Eckhart Hall, Ryerson Physical Laboratory, and Jones Chemical Laboratory at the University of Chicago.

Table 1. Properties at the University of Chicago Listed in the National Register of Historic Places

Property	Notoriety	Date Listed
SITE OPPOSITE THE ENRICO FERMI INSTITUTE, 5630 South Ellis Avenue	Site of the first controlled, self-sustaining nuclear chain reaction. Now marked by Henry Moore's sculpture "Nuclear Energy".	10/15/66
FREDERICK C. ROBIE HOUSE, 5757 South Woodlawn Avenue	House designed by Frank Lloyd Wright, completed in 1909. The archetype for the prairie house design which revolutionized the architecture of the American home.	10/15/66
LORADO TAFT MIDWAY STUDIOS, 6016 South Ingleside Avenue	Constructed in 1929 by Lorado Taft from sections of the first campus studio that was built in 1906. The original brick barn continued to be Taft's private sculpture studio until his death in 1936.	10/15/66
ROOM 405, GEORGE HERBERT JONES CHEMICAL LABORATORY, 5747 South Ellis Avenue	Room where a group of scientists under the direction of Dr. Glenn T. Seaborg first isolated (August 18, 1942) and weighed (September 10, 1942) plutonium.	5/28/67
FRANK R. LILLIE HOUSE, 5801 South Kenwood Avenue	Designed by Irving and Allen Pond; regarded as an architectural landmark.	5/11/76
CHARLES HITCHCOCK HALL, 1009 East 57th Street	Designed by Dwight H. Perkins and constructed in 1902. This building combines the neo-Gothic architecture of nearby buildings with a "prairie" motif.	12/30/74

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ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue, Argonne, Illinois 60439

ACTION DESCRIPTION MEMORANDUM

PROPOSED REMEDIAL ACTION ACTIVITIES AT THE UNIVERSITY OF CHICAGO

by

Energy and Environmental Systems Division

July 1987

work supported by

U.S. DEPARTMENT OF ENERGY
Oak Ridge Operations
Technical Services Division
Oak Ridge, Tennessee

CONTENTS

FIGURES

TABLE

ACTION DESCRIPTION MEMORANDUM

PROPOSED REMEDIAL ACTION ACTIVITIES AT THE UNIVERSITY OF CHICAGO

by

Energy and Environmental Systems Division

1 SUMMARY OF PROPOSED ACTION

As part of its Formerly Utilized Sites Remedial Action Program (FUSRAP), the U.S. Department of Energy (DOE), Oak Ridge Operations, proposes to perform remedial action activities in Jones Chemical Laboratory at the University of Chicago and to obtain additional data on the radiological condition of various nearby facilities. Portions of Jones Chemical Laboratory are radioactively contaminated as a result of programs previously conducted by the Manhattan Engineer District (MED) and the U.S. Atomic Energy Commission (AEC). The proposed action is a follow-on activity to previous remedial action conducted in 1984 and involves decontamination of ductwork, much of which is inside interior walls, in Jones Chemical Laboratory. In addition to this decontamination effort, the proposed action will also involve radiological characterization of sediment and water within drain lines of Jones Chemical Laboratory, Ryerson Physical Laboratory, and Eckhart Hall of the University of Chicago and within municipal sewer lines in the vicinity of the university. Radiological characterization of the sewer lines on the university campus was performed in 1984. DOE is also proposing to perform a limited radiological characterization of suspect areas on the roof and in the gutters of Jones Chemical Laboratory to determine if these areas are contaminated in excess of FUSRAP cleanup criteria.

Although the ductwork does not represent an immediate health hazard, it may be contaminated in excess of current cleanup criteria. The purpose of decontaminating the ductwork is to reduce the amount of residual radioactivity to levels below the established DOE cleanup criteria. The drain lines, roof, and gutters will be characterized to determine if additional decontamination activities should be performed in the future. Proposed project actions include:

- Identification of ductwork within Jones Chemical Laboratory that requires decontamination.
- Decontamination of contaminated ductwork, either by cleaning the ductwork to below allowable levels of residual radioactivity or by removal as radioactive waste.
- Packaging, in approved containers, of all radioactive wastes generated during decontamination activities.

- Transport to and disposal of the radioactive wastes at the Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho; and transport to and disposal of the nonradioactive wastes at a nearby sanitary landfill.

- Certification that the radioactivity levels meet criteria for unrestricted use.

- Restoration (or monetary compensation) of the facilities as appropriate for intended future uses.

- Collection and analysis of samples from (1) drain lines within Jones Chemical Laboratory, Ryerson Physical Laboratory, and Eckhart Hall; (2) suspect areas on the roof and in the gutters of Jones Chemical Laboratory; and (3) municipal sewer lines in the vicinity of the university.

A more detailed description of the proposed action is given in Sec. 3.

2 HISTORY AND NEED FOR ACTION

2.1 GENERAL SETTING

The University of Chicago is a private university located in the Hyde Park-Kenwood area of the city of Chicago. The Hyde Park-Kenwood neighborhood covers an area of about 400 ha (1,000 acres) and is a residential community of more than 45,000 people; it is about 11 km (7 mi) south of the Chicago downtown business district (Fig. 1). The university covers an area of about 70 ha (172 acres) and has an enrollment of about 8,000 students. The university was founded in 1891 and contains buildings with architectural styles representing the past nine decades. A major portion of the University of Chicago is located within the Hyde Park-Kenwood National Historic District; in addition, six properties on campus are listed in the *National Register of Historic Places* (Table 1).

As part of FUSRAP, DOE is proposing to decontaminate ductwork in Jones Chemical Laboratory at the University of Chicago. This ductwork, much of which is inside interior walls, is radioactively contaminated above current guidelines as a result of programs previously conducted for the MED and AEC. In addition, DOE is proposing to radiologically characterize drain lines within Jones Chemical Laboratory, Ryerson Physical Laboratory, and Eckhart Hall; suspect areas on the roof and in the gutters of Jones Chemical Laboratory; and municipal sewer lines in the vicinity of the university.

2.2 HISTORY OF SITE ACTIVITIES

The University of Chicago was one of the focal points for activities conducted in support of atomic bomb development during World War II. The first contract with the university was initiated by the Office of Scientific Research and Development (OSRD) in January 1942. In June 1942, the MED was established within the U.S. Army Corps of Engineers; the contract with the University of Chicago was transferred from OSRD to MED on May 15, 1943.

The primary goal of the work performed at the university was to develop methods for the production and purification of plutonium. Because plutonium is produced when uranium absorbs neutrons, this work necessitated the construction of a facility that would maintain a self-sustaining nuclear chain reaction and, in turn, provide an intense source of neutrons. The first chain-reacting "pile" was constructed of uranium and graphite beneath the west stands of Stagg Field under the direction of Dr. Enrico Fermi. A self-sustaining condition was achieved on December 2, 1942, thereby demonstrating the feasibility of this technology for producing plutonium.

Additional research and development programs were conducted for the MED throughout World War II to support the atomic bomb project. Various laboratories and facilities at the university were used for these activities. On January 1, 1947, the AEC, a civilian organization, succeeded the military MED as the governmental organization in charge of nuclear programs. Research activities continued at the University of Chicago under the AEC. Research conducted under the MED/AEC during the 1940s and 1950s

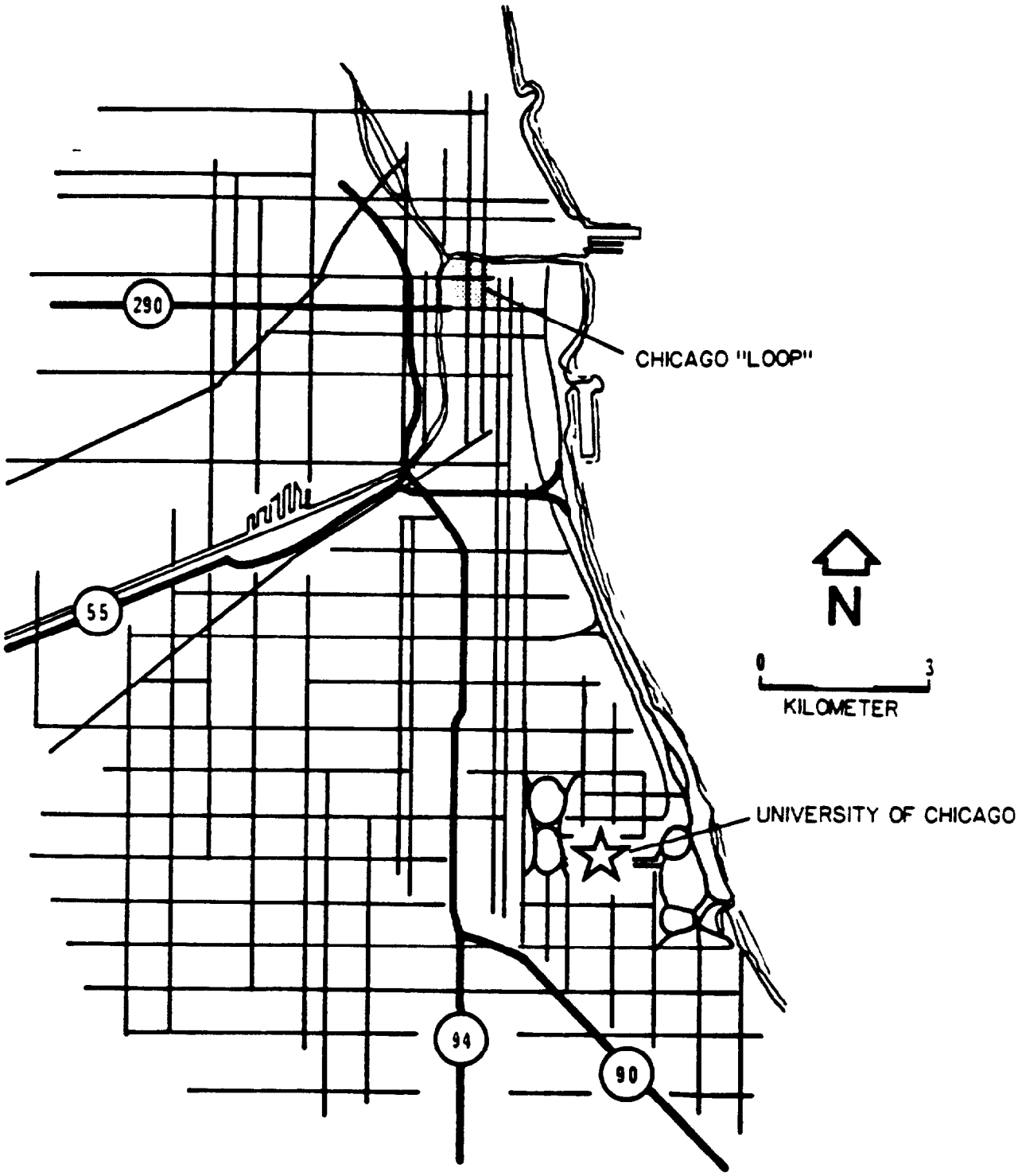

FIGURE 1 Location of the University of Chicago, Chicago, Illinois (Source: Argonne National Laboratory 1984)

TABLE 1 Properties of the University of Chicago Listed in the *National Register of Historic Places*

Property	Notoriety	Date Listed
SITE OF THE FIRST SELF-SUSTAINING NUCLEAR REACTION, 5630 South Ellis Avenue	Site of the first controlled, self-sustaining nuclear chain reaction; now marked by Henry Moore's sculpture, "Nuclear Energy."	10/15/66
FREDERICK C. ROBIE HOUSE, 5757 South Woodlawn Avenue	House designed by Frank Lloyd Wright, completed in 1909; the archetype for the prairie house design that revolutionized the architecture of the American home.	10/15/66
LORADO TAFT MIDWAY STUDIOS, 6016 South Ingleside Avenue	Constructed in 1929 by Lorado Taft from sections of the first campus studio that was built in 1906. The original brick barn continued to be Taft's private sculpture studio until his death in 1936.	10/15/66
ROOM 405, GEORGE HERBERT JONES CHEMICAL LABORATORY, 5747 South Ellis Avenue	Room where a group of scientists under the direction of Dr. Glenn T. Seaborg first isolated (Aug. 18, 1942) and weighed (Sept. 10, 1942) plutonium.	5/28/67
FRANK R. LILLIE HOUSE, 5801 South Kenwood Avenue	Designed by Irving and Allen Pond; regarded as an architectural landmark.	5/11/76
CHARLES HITCHCOCK HALL, 1009 East 57th Street	Designed by Dwight H. Perkins and constructed in 1902. This building combines the neo-Gothic architecture of nearby buildings with a "prairie" motif.	12/30/74

Source: U.S. Department of the Interior (1980).

included development of a process for producing high-purity uranium compounds, testing of uranium metal, research associated with operation of the pile, and plutonium separation (U.S. Dept. Energy 1980a, 1980b).

At the completion of these MED/AEC research activities, the facilities were decontaminated so that they met health and safety criteria then in use. However, radiological surveys were conducted in 1976 and 1977, and these surveys indicated that residual contamination in areas of four buildings -- Jones Chemical Laboratory, Kent Chemical Laboratory, Ryerson Physical Laboratory, and Eckhart Hall -- exceeded currently accepted criteria (see Fig. 2 for the location of these buildings). Decontamination of Kent Chemical Laboratory was completed by the University of Chicago, and Argonne National Laboratory (ANL) performed a post-remedial action survey of this decontamination effort in 1983.

Decontamination of the residual radioactivity in Jones Chemical Laboratory, Ryerson Physical Laboratory, and Eckhart Hall was accomplished by ANL in 1984, using standard procedures such as applying solvents on metals and scabbling concrete (an Action Description Memorandum describing this activity was prepared in 1983 [Argonne Natl. Lab. 1983]). Items and materials that could not be readily decontaminated, e.g., ductwork, were removed and replaced wherever possible. Hoods and ductwork suspected or known to be contaminated as a result of previous activities were removed wherever possible and disposed of as radioactive waste. Ductwork inside the walls of Jones Chemical Laboratory that was inaccessible without extensive demolition within the building and the connecting ductwork in the attic sections of the building are the ductwork that DOE is proposing to remove as part of this action. Items and areas affected by decontamination operations were restored or replaced (as determined on a case-by-case basis) subject to agreement between DOE, ANL, and the University of Chicago.

Radiological characterization of on-campus sewer lines associated with Jones Chemical Laboratory, Kent Chemical Laboratory, Ryerson Physical Laboratory, and Eckhart Hall was also performed in 1984. Sewers were surveyed with portable survey instruments at all available access points. In addition, water and/or sludge samples were taken at the access points, and these samples were radiochemically analyzed to ascertain the type and concentration of any radioactive contaminants. Although measurable levels of radioactive material were found in samples taken from the available access points, the need for any immediate remedial action for the sewer lines was determined to be unnecessary as long as the integrity of the system remains intact. In Jones Chemical Laboratory, Ryerson Physical Laboratory, and Eckhart Hall, DOE is proposing to do additional radiochemical surveys in the drain lines that lead to the on-campus sewer lines and in the nearby municipal sewer lines. DOE is also proposing to radiologically characterize suspect areas on the roof and in the gutters of Jones Chemical Laboratory to more thoroughly ascertain any potential contamination resulting from previous MED/AEC activities conducted at the university.

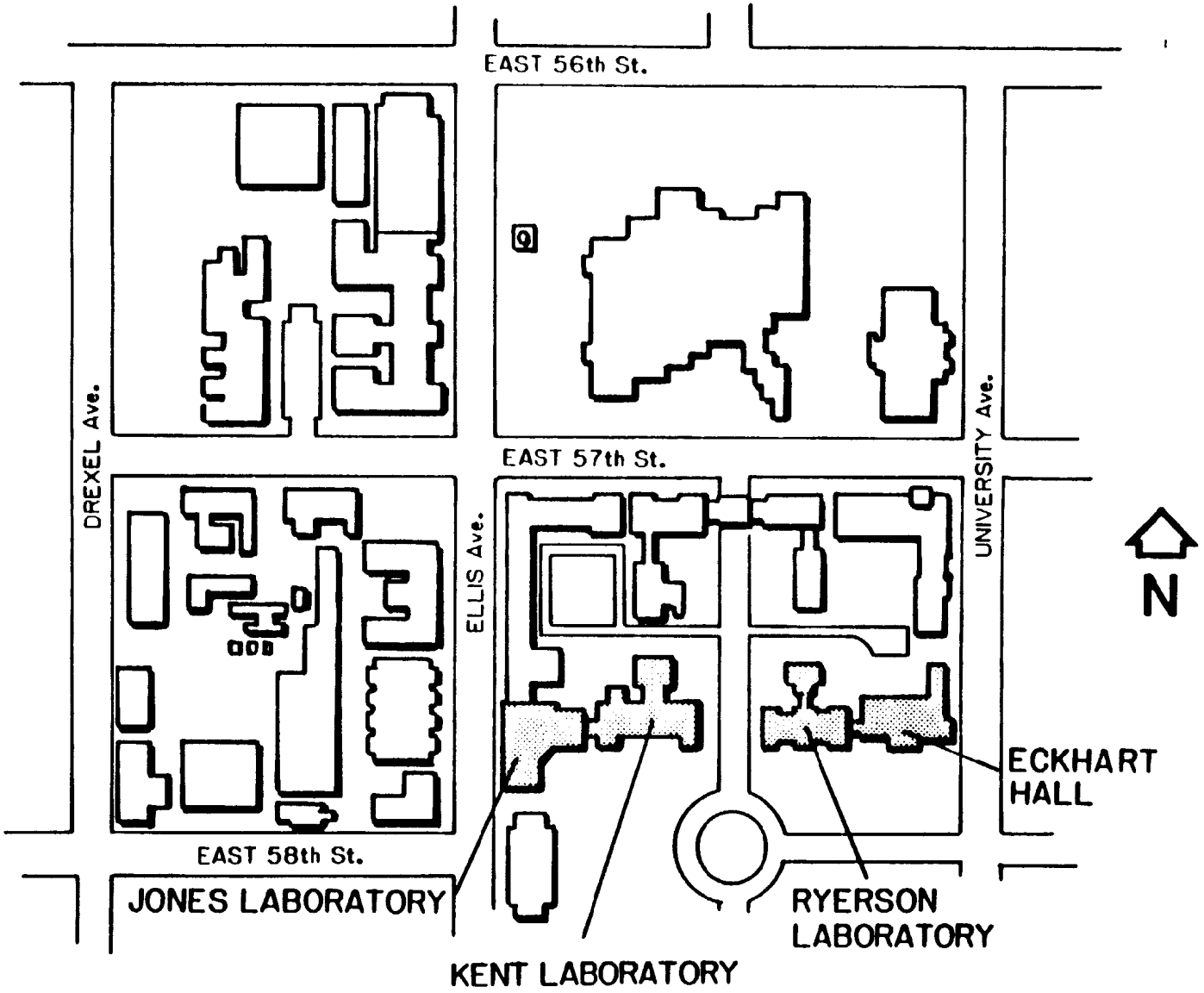

FIGURE 2 The University of Chicago Campus (Source: Argonne National Laboratory 1984)

3 DESCRIPTION OF PROPOSED ACTION

The potentially contaminated ductwork in Jones Chemical Laboratory will either be decontaminated in place or removed as radioactive waste. If decontamination of the ductwork is determined to be appropriate, the ductwork will be cleaned by vacuuming and/or by use of water or special cleaners. These solutions will remove the contamination but leave the surface material essentially intact. If it is necessary to remove portions of the ductwork contained within interior walls, the ductwork will be accessed by partial demolition of the walls as needed. Attic and wall ductwork will be removed in sections where possible. Additional areas in the vicinity of the ductwork will be decontaminated, as necessary. Appropriate precautions will be taken to protect against radiological and chemical hazards, e.g., asbestos. All wastes will be collected, placed in appropriate containers, and labeled. Decontamination will continue until residual radioactivity levels are as low as reasonably achievable (ALARA) and meet criteria developed for FUSRAP (App. A).*

All radioactive waste resulting from the decontamination effort will be transported off-site to an approved disposal site. The waste will be packaged in DOE-approved containers that meet or exceed U.S. Department of Transportation (DOT) requirements for shipment. Current plans call for shipment of the radioactive waste in ANL M-3 bins to Idaho National Engineering Laboratory (INEL) near Idaho Falls, Idaho; these bins have a nominal capacity of 3.4 m^3 (120 ft^3). Assuming that all ductwork in Jones Chemical Laboratory is removed as radioactive waste — a worst-case situation -- decontamination of the ductwork is expected to generate approximately 82 m^3 (2,900 ft^3) of low-level radioactive waste. Any radioactive waste that contains chemically hazardous constituents will be packaged, transported, and disposed of in compliance with all applicable regulations. All nonsalvageable or otherwise unusable nonradioactive waste will be disposed of in a local sanitary landfill.

After decontamination, the affected areas will be restored in a manner consistent with their intended future uses. All decontamination activities will be performed by Bechtel National, Inc. (BNI), DOE's project management contractor. Because the areas to be decontaminated are currently being used, it will be necessary to schedule activities with the University of Chicago to minimize disruption of ongoing activities. Restoration requirements will be subject to concurrence by the university and will either be performed by BNI or the university will be monetarily compensated such that it can perform its own restoration activities.

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*The state of Illinois also has surface contamination limits for releasing facilities for uncontrolled use (Ill. Dept. Nucl. Saf. 1981; see App. B). These limits are similar to those developed for FUSRAP but are not radionuclide-specific. The state of Illinois criteria are less stringent than the strictest criteria for FUSRAP -- i.e., those for transuranic radionuclides (see Sec. C.4 of App. A). Because the ductwork is probably contaminated with transuranic radionuclides, it will be necessary to decontaminate to levels more stringent than the state limits to meet the FUSRAP cleanup criteria.

It is expected that decontamination will be initiated by the end of July 1987 and completed in September 1987. Following completion of decontamination, the affected areas of Jones Chemical Laboratory will be radiologically surveyed by an Independent Verification Contractor to ensure compliance with applicable cleanup criteria. If necessary, additional selected areas will be decontaminated.

Biased samples of sediment and water from drain lines in Jones Chemical Laboratory, Ryerson Physical Laboratory, and Eckhart Hall that lead to on-campus sewer lines will be collected and analyzed for radioactive contamination. In addition, samples of sediment and water from Chicago municipal sewer lines will be collected upstream and downstream of the university. These samples will be analyzed for radioactive species utilized at the university to determine if increased levels of radioactive materials are present in the municipal sewer lines as a result of university activities. Finally, a limited radiological characterization of suspect areas on the roof and in the gutters of Jones Chemical Laboratory will be performed to assess the need for any future decontamination activities.

4 ENVIRONMENTAL CONSEQUENCES

4.1 RADIOLOGICAL

The incremental radiation doses to the general public from decontamination of the contaminated ductwork in Jones Chemical Laboratory and from transport of the radioactive waste to INEL, as well as from the additional radiological characterization activities, will be immeasurably small compared with doses received from background sources of radiation. The amount of contamination in the ductwork should be very small given the use of chemical laboratories at the university for small-scale experimentation and the use of the ductwork as a conveyance medium for ventilation air moving at a rather fast velocity. No data are currently available on the amount of contamination remaining within the ductwork.

The work environment will be monitored for airborne radioactivity during remedial action activities and, if measurable concentrations of radioactivity are detected, corrective actions will be implemented to confine the radioactivity (i.e., use of localized ventilation). This will ensure that radiation doses to the general public will be kept immeasurably small.

The potential radiation doses to workers performing the remedial action will be kept as low as reasonably achievable (ALARA) by standard health-physics practices and strict compliance with DOE environmental protection, safety, and health protection guidelines given in DOE Order 5480.1A.* Because the measured exposure rates at 1 m from the surface are all at essentially background levels, no external radiation hazard exists. The only pathway by which workers could incur radiation doses in excess of background exposure is by inhalation of airborne radioactive contaminants generated during the decontamination and waste-packaging activities. Radioactive waste-handling and transportation activities will comply with all applicable DOE, DOT, and state of Illinois requirements.

The potential doses to workers will be kept low by minimizing the amount of airborne contamination through standard practices such as wetting surfaces to minimize dust generation and using localized ventilation. In addition, workers will wear respiratory protection equipment, as necessary, to reduce the likelihood of inhaling radioactively contaminated particulates. To ensure a safe environment, air samples will be collected during the entire remedial action period. Procedures to minimize radiation doses will also serve to minimize exposure to any hazardous chemicals that may be present, e.g., asbestos.

The occupational dose commitment was estimated by assuming that a total of 1 μCi of alpha-emitting radioactivity is present in the ductwork. The ductwork is assumed to be removed, resulting in a greater airborne release of radioactivity than if the ductwork was flushed with water or industrial cleaners and left intact. The

*Chapter XI of Order 5480.1A has been amended -- see Vaughan (1985) and U.S. Department of Energy (1986).

contamination is assumed to be plutonium-239 having a deposition velocity of 1 cm/s and a particulate resuspension rate of 1×10^{-6}/s (i.e., 1×10^{-6} of the total amount of contamination in the ductwork is released per second). This deposition velocity and resuspension rate are assumed to be representative of those associated with mechanical disturbances such as are required to section and remove the ductwork. The airborne concentration of plutonium-239 is estimated to be about 0.1 pCi/m^3.

The total length of time associated with decontamination activities is estimated to be 400 hours. During all activities that have the potential for generating airborne radioactivity, it is assumed that workers will wear respiratory protection equipment providing a protection factor of 10 (the same factor that is provided by half-masks — see 10 CFR Part 20). A worker is estimated to incur a dose of about 1.6 mrem during the 400-hour period, assuming a breathing rate of 1.2 m^3/h and a lung clearance class of Y. This dose estimate is based on the dose conversion factors recommended by the International Commission on Radiological Protection (1979). The entire occupational dose commitment to a crew of 10 workers is estimated to be 16 person-mrem. The same work force would incur a dose of about 400 person-mrem from background sources of radioactivity over the same time period. The occupational dose commitment associated with transportation of the wastes to INEL and with radiological characterization activities will be much lower than that associated with removal of the contaminated ductwork.

4.2 NONRADIOLOGICAL

The nonradiological impacts of the proposed action are expected to be minimal. There will be no impacts on surface water or groundwater because current plans do not include any discharges to water bodies and the only below-grade activities involve collection of sediment and water samples from drain lines and municipal sewer lines. There may be small nonradioactive atmospheric releases related to ductwork removal activities, but such releases will be low and further mitigated by using such procedures as localized ventilation during removal activities. Impacts on local biota at the university will be negligible because activities will occur largely within Jones Chemical Laboratory. Transportation of the wastes to INEL will not have a significant impact along the transportation route because only four or five truckloads will be required according to current projections.

The proposed action will have a negligible effect on the local economy due to the relatively small size of the work force and the short duration of the proposed decontamination activities. Because Jones Chemical Laboratory is located at the University of Chicago, there will be limited impact on local traffic patterns, residences, and businesses. The small increase in noise during decontamination activities may cause a short-term nuisance to students and faculty at the university, but such nuisance is expected to be minimal.

It is possible that portions of the ductwork may contain deposits of perchloric acid, perchlorates, picric acid, and picrates as a result of the ductwork's previous use for ventilating laboratories in which perchloric acid and picric acid were used. Perchloric acid and perchlorates are explosive hazards, especially in contact with organic materials

that are likely to be present in the ducts; picric acid and picrates are also explosive. To eliminate these potential hazards, the ductwork will be thoroughly examined for deposits of perchloric acid, perchlorates, picric acid, and picrates. If any such deposits are found, they will be removed or neutralized prior to decontamination or removal of the ductwork.

Because the proposed action would affect structures located within a National Historic Preservation District (and one of the rooms in Jones Chemical Laboratory is also listed separately in the *National Register of Historic Places*), the Illinois State Historic Preservation Agency was asked to determine if there might be any potential adverse impacts on these structures. On July 29, 1987, the agency concluded that the proposed action would have "no effect" on the historic structures (Hild 1987; see Appendix C).

5 REFERENCES

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Vaughan, W.A., 1985, memorandum on Radiation Standards for Protection of the Public in the Vicinity of DOE Facilities, from W.A. Vaughan (U.S. Department of Energy, Assistant Secretary for Environment, Safety and Health) to Distribution, Aug. 5.

6 LIST OF CONTRIBUTORS

Name	Education/Expertise	Contribution
John F. Hoffecker	Ph.D. Anthropology 14 yr experience in archeological research 4 yr experience in environmental assessment	General setting and non-radiological impacts
John M. Peterson	M.S., P.E. Nuclear Engineering 12 yr experience in nuclear programs, including 9 yr in environmental assessment	History, radiological environment, description of proposed action
John H.C. Wang	Ph.D. Health Physics 6 yr experience in health physics	Radiological impacts
Dimis J. Wyman	M.S. Botany; M.A. Library Science 12 yr experience in technical editing	Overall editorial responsibility

APPENDIX A

DOE GUIDELINES FOR RESIDUAL RADIOACTIVE MATERIAL

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)

A. INTRODUCTION

This document presents U.S. Department of Energy (DOE) radiological protection guidelines for cleanup of residual radioactive material and management of the resulting wastes and residues. It is applicable to sites identified by the Formerly Utilized Sites Remedial Action Program (FUSRAP) and remote sites identified by the Surplus Facilities Management Program (SFMP).* The topics covered are basic dose limits, guidelines and authorized limits for allowable levels of residual radioactive material, and requirements for control of the radioactive wastes and residues.

Protocols for identification, characterization, and designation of FUSRAP sites for remedial action; for implementation of the remedial action; and for certification of a FUSRAP site for release for unrestricted use are given in a separate document (U.S. Department of Energy 1986) and subsequent guidance. More detailed information on applications of the guidelines presented herein, including procedures for deriving site-specific guidelines for allowable levels of residual radioactive material from basic dose limits, is contained in "A Manual for Implementing Residual Radioactive Material Guidelines" (U.S. Department of Energy 1987), referred to herein as the "supplement".

"Residual radioactive material" is used in these guidelines to describe radioactive material derived from operations or sites over which DOE has authority. Guidelines or guidance to limit the levels of radioactive material and to protect the public and the environment are provided for (1) residual concentrations of radionuclides in soil,** (2) concentrations of airborne

*A remote SFMP site is one that is excess to DOE programmatic needs and is located outside a major operating DOE research and development or production area.

**"Soil" is defined herein as unconsolidated earth material, including rubble and debris that may be present in earth material.

radon decay products, (3) external gamma radiation levels, (4) surface contamination levels, and (5) radionuclide concentrations in air or water resulting from or associated with any of the above.

A "basic dose limit" is a prescribed standard from which limits for quantities that can be monitored and controlled are derived; it is specified in terms of the effective dose equivalent as defined by the International Commission on Radiological Protection (ICRP 1977, 1978). The basic dose limits are used for deriving guidelines for residual concentrations of radionuclides in soil. Guidelines for residual concentrations of thorium and radium in soil, concentrations of airborne radon decay products, allowable indoor external gamma radiation levels, and residual surface contamination concentrations are based on existing radiological protection standards (U.S. Environmental Protection Agency 1983; U.S. Nuclear Regulatory Commission 1982; and DOE Departmental Orders). Derived guidelines or limits based on the basic dose limits for those quantities are used only when the guidelines provided in the existing standards cited above are shown to be inappropriate.

A "guideline" for residual radioactive material is a level of radioactivity or radioactive material that is acceptable if use of the site is to be unrestricted. Guidelines for residual radioactive material presented herein are of two kinds: (1) generic, site-independent guidelines taken from existing radiation protection standards and (2) site-specific guidelines derived from basic dose limits using site-specific models and data. Generic guideline values are presented in this document. Procedures and data for deriving site-specific guideline values are given in the supplement. The basis for the guidelines is generally a presumed worst-case plausible-use scenario for the site.

An "authorized limit" is a level of residual radioactive material or radioactivity that must not be exceeded if the remedial action is to be considered completed and the site is to be released for unrestricted use. The authorized limits for a site will include (1) limits for each radionuclide or group of radionuclides, as appropriate, associated with residual radioactive material in soil or in surface contamination of structures and equipment, (2) limits for each radionuclide or group of radionuclides, as appropriate, in air or water, and, (3) where appropriate, a limit on external gamma radiation resulting from the residual material. Under normal circumstances, expected to occur at most sites, authorized limits for residual radioactive material or radioactivity are set equal to guideline values. Exceptional conditions for which authorized limits might differ from guideline values are specified in Sections D and F of this document. A site may be released for unrestricted use only if site conditions do not exceed the authorized limits or approved supplemental limits, as defined in Section F.1, at the time remedial action is completed. Restrictions and controls on use of the site must be established and enforced if site conditions exceed the approved limits, or if there is potential to exceed the basic dose limit if use of the site is not restricted (Section F.2). The applicable controls and restrictions are specified in Section E.

DOE policy requires that all exposures to radiation be limited to levels that are as low as reasonably achievable (ALARA). For sites to be released for unrestricted use, the intent is to reduce residual radioactive material to levels that are as far below authorized limits as reasonable considering technical, economic, and social factors. At sites where the residual material is not reduced to levels that permit release for unrestricted use, ALARA policy is implemented by establishing controls to reduce exposure to levels that are as low as reasonably achievable. Procedures for implementing ALARA policy are discussed in the supplement. ALARA policies, procedures, and actions shall be documented and filed as a permanent record upon completion of remedial action at a site.

B. BASIC DOSE LIMITS

The basic limit for the annual radiation dose received by an individual member of the general public is 100 mrem/yr. The internal committed effective dose equivalent, as defined in ICRP Publication 26 (ICRP 1977) and calculated by dosimetry models described in ICRP Publication 30 (ICRP 1978), plus the dose from penetrating radiation sources external to the body, shall be used for determining the dose. This dose shall be described as the "effective dose equivalent". Every effort shall be made to ensure that actual doses to the public are as far below the basic dose limit as is reasonably achievable.

Under unusual circumstances, it will be permissible to allow potential doses to exceed 100 mrem/yr where such exposures are based upon scenarios that do not persist for long periods and where the annual lifetime exposure to an individual from the subject residual radioactive material would be expected to be less than 100 mrem/yr. Examples of such situations include conditions that might exist at a site scheduled for remediation in the near future or a possible, but improbable, one-time scenario that might occur following remedial action. These levels should represent doses that are as low as reasonably achievable for the site. Further, no annual exposure should exceed 500 mrem.

C. GUIDELINES FOR RESIDUAL RADIOACTIVE MATERIAL

C.1 Residual Radionuclides in Soil

Residual concentrations of radionuclides in soil shall be specified as above-background concentrations averaged over an area of 100 m^2. Generic guidelines for thorium and radium are specified below. Guidelines for residual concentrations of other radionuclides shall be derived from the basic dose limits by means of an environmental pathway analysis using site-specific data where available. Procedures for these derivations are given in the supplement.

If the average concentration in any surface or below-surface area less than or equal to 25 m^2 exceeds the authorized limit or guideline by a factor of $(100/A)^{1/2}$, where A is the area of 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 supplement. 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.

Two types of guidelines are provided, generic and derived. The generic guidelines for residual concentrations of Ra-226, Ra-228, Th-230, and Th-232 are:

- 5 pCi/g, averaged over the first 15 cm of soil below the surface
- 15 pCi/g, averaged over 15-cm-thick layers of soil more than 15 cm below the surface

These guidelines take into account ingrowth of Ra-226 from Th-230 and of Ra-228 from Th-232, 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 appropriate guideline is applied as a limit to the radionuclide with 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 the ratios of the soil concentration of each radionuclide to the allowable limit for that radionuclide will not exceed 1 ("unity"). Explicit formulas for calculating residual concentration guidelines for mixtures are given in the supplement.

C.2 Airborne Radon Decay Products

Generic guidelines for concentrations of airborne radon decay products shall apply to existing occupied or habitable structures on private property that are intended for unrestricted use; structures that will be demolished or buried are excluded. The applicable generic guideline (40 CFR Part 192) is: In any occupied or habitable building, the objective of remedial action shall be, and a reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL.* In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL. Remedial actions by DOE are not required in order to comply with this guideline when there is reasonable assurance that residual radioactive material is not the cause.

*A working level (WL) is any combination of short-lived radon decay products in one liter of air that will result in the ultimate emission of 1.3×10^5 MeV of potential alpha energy.

C.3 External Gamma Radiation

The average level of gamma radiation inside a building or habitable structure on a site to be released for unrestricted use shall not exceed the background level by more than 20 μR/h and shall comply with the basic dose limit when an appropriate-use scenario is considered. This requirement shall not necessarily apply to structures scheduled for demolition or to buried foundations. External gamma radiation levels on open lands shall also comply with the basic dose limit, considering an appropriate-use scenario for the area.

C.4 Surface Contamination

The generic surface contamination guidelines provided in Table 1 are applicable to existing structures and equipment. These guidelines are adapted from standards of the U.S. Nuclear Regulatory Commission (NRC 1982)* and will be applied in a manner that provides a level of protection consistent with the Commission's guidance. These limits apply to both interior and exterior surfaces. They are not directly intended for use on structures to be demolished or buried, but should be applied to equipment or building components that are potentially salvageable or recoverable scrap. If a building is demolished, the guidelines in Section C.1 are applicable to the resulting contamination in the ground.

C.5 Residual Radionuclides in Air and Water

Residual concentrations of radionuclides in air and water shall be controlled to levels required by DOE Environmental Protection Guidance and Orders, specifically DOE Order 5480.1A and subsequent guidance. Other Federal and/or state standards shall apply when they are determined to be appropriate.

D. AUTHORIZED LIMITS FOR RESIDUAL RADIOACTIVE MATERIAL

Authorized limits shall be established to (1) ensure that, as a minimum, the basic dose limits specified in Section B will not be exceeded under the worst-case plausible-use scenario consistent with the procedures and guidance provided or (2) be consistent with applicable generic guidelines, where such guidelines are provided. The authorized limits for each site and its vicinity properties shall be set equal to the generic or derived guidelines except where it can be clearly established on the basis of site-specific data -- including health, safety, and socioeconomic considerations -- that the guidelines are not appropriate for use at the specific site. Consideration should also be given to ensure that the limits comply with or provide a level of protection equivalent to other appropriate limits and guidelines (i.e., state or

*These guidelines are functionally equivalent to Section 4 -- Decontamination for Release for Unrestricted Use -- of NRC Regulatory Guide 1.86 (U.S. Atomic Energy Commission 1974), but they are applicable to non-reactor facilities.

TABLE 1 SURFACE CONTAMINATION GUIDELINES

Radionuclides[b]	Allowable Total Residual Surface Contamination (dpm/100 cm^2)[a]		
	Average[c,d]	Maximum[d,e]	Removable[d,f]
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	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	5,000 α	15,000 α	1,000 α
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5,000 β-γ	15,000 β-γ	1,000 β-γ

[a] 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.

[b] 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.

[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 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 that area 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. The numbers in this column are maximum amounts.

other Federal). Documentation supporting such a decision should be similar to that required for supplemental limits and exceptions (Section F), but should be generally more detailed because the documentation covers the entire site.

Remedial action shall not be considered complete unless the residual radioactive material levels comply with the authorized limits. The only exception to this requirement will be for those special situations where the supplemental limits or exceptions are applicable and approved as specified in Section F. However, the use of supplemental limits and exceptions should be considered only if it is clearly demonstrated that it is not reasonable to decontaminate the area to the authorized limit or guideline value. The authorized limits are developed through the project offices in the field and are approved by the headquarters program office.

E. CONTROL OF RESIDUAL RADIOACTIVE MATERIAL AT FUSRAP AND REMOTE SFMP SITES

Residual radioactive material above the guidelines at FUSRAP and remote SFMP sites must be managed in accordance with applicable DOE Orders. The DOE Order 5480.1A and subsequent guidance or superceding Orders require compliance with applicable Federal and state environmental protection standards.

The operational and control requirements specified in the following DOE Orders shall apply to interim storage, interim management, and long-term management.

a. 5000.3, Unusual Occurrence Reporting System

b. 5440.1C, Implementation of the National Environmental Policy Act

c. 5480.1A, Environmental Protection, Safety, and Health Protection Program for DOE Operations, as revised by DOE 5480.1 change orders and the 5 August 1985 memorandum from Vaughan to Distribution

d. 5480.2, Hazardous and Radioactive Mixed Waste Management

e. 5480.4, Environmental Protection, Safety, and Health Protection Standards

f. 5482.1A, Environmental, Safety, and Health Appraisal Program

g. 5483.1A, Occupational Safety and Health Program for Government-Owned Contractor-Operated Facilities

h. 5484.1, Environmental Protection, Safety, and Health Protection Information Reporting Requirements

i. 5820.2, Radioactive Waste Management

E.1 Interim Storage

a. Control and stabilization features shall be designed to ensure, to the extent reasonably achievable, an effective life of 50 years and, in any case, at least 25 years.

b. Above-background Rn-222 concentrations in the atmosphere above facility surfaces or openings shall not exceed (1) 100 pCi/L at any given point, (2) an annual average concentration of 30 pCi/L over the facility site, and (3) an annual average concentration of 3 pCi/L at or above any location outside the facility site (DOE Order 5480.1A, Attachment XI-1).

c. Concentrations of radionuclides in the groundwater or quantities of residual radioactive material shall not exceed existing Federal or state standards.

d. Access to a site shall be controlled and misuse of on-site material contaminated by residual radioactive material shall be prevented through appropriate administrative controls and physical barriers -- active and passive controls as described by the U.S. Environmental Protection Agency (1983--p. 595). These control features should be designed to ensure, to the extent reasonable, an effective life of at least 25 years. The Federal government shall have title to the property or shall have a long-term lease for exclusive use.

E.2 Interim Management

a. A site may be released under interim management when the residual radioactive material exceeds guideline values if the residual radioactive material is in inaccessible locations and would be unreasonably costly to remove, provided that administrative controls are established to ensure that no member of the public shall receive a radiation dose exceeding the basic dose limit.

b. The administrative controls, as approved by DOE, shall include but not be limited to periodic monitoring as appropriate, appropriate shielding, physical barriers to prevent access, and appropriate radiological safety measures during maintenance, renovation, demolition, or other activities that might disturb the residual radioactive material or cause it to migrate.

c. The owner of the site or appropriate Federal, state, or local authorities shall be responsible for enforcing the administrative controls.

E.3 Long-Term Management

Uranium, Thorium, and Their Decay Products

a. Control and stabilization features shall be designed to ensure, to the extent reasonably achievable, an effective life of 1,000 years and, in any case, at least 200 years.

b. Control and stabilization features shall be designed to ensure that Rn-222 emanation to the atmosphere from the wastes shall not (1) exceed an annual average release rate of 20 $pCi/m^2/s$ and (2) increase the annual average Rn-222 concentration at or above any location outside the boundary of the contaminated area by more than 0.5 pCi/L. Field verification of emanation rates is not required.

c. Prior to placement of any potentially biodegradable contaminated wastes in a long-term management facility, such wastes shall be properly conditioned to ensure that (1) the generation and escape of biogenic gases will not cause the requirement in paragraph b. of this section (E.3) to be exceeded and (2) biodegradation within the facility will not result in premature structural failure in violation of the requirements in paragraph a. of this section (E.3).

d. Groundwater shall be protected in accordance with appropriate Departmental Orders and Federal and state standards, as applicable to FUSRAP and remote SFMP sites.

e. Access to a site should be controlled and misuse of on-site material contaminated by residual radioactivity should be prevented through appropriate administrative controls and physical barriers -- active and passive controls as described by the U.S. Environmental Protection Agency (1983--p. 595). These controls should be designed to be effective to the extent reasonable for at least 200 years. The Federal government shall have title to the property.

Other Radionuclides

f. Long-term management of other radionuclides shall be in accordance with Chapters 2, 3, and 5 of DOE Order 5820.2, as applicable.

F. SUPPLEMENTAL LIMITS AND EXCEPTIONS

If special site-specific circumstances indicate that the guidelines or authorized limits established for a given site are not appropriate for a portion of that site or for a vicinity property, then the field office may request that supplemental limits or an exception be applied. In either case, the field office must justify that the subject guidelines or authorized limits are not appropriate and that the alternative action will provide adequate

protection, giving due consideration to health and safety, the environment, and costs. The field office shall obtain approval for specific supplemental limits or exceptions from headquarters as specified in Section D of these guidelines and shall provide to headquarters those materials required for the justification as specified in this section (F) and in the FUSRAP and SFMP protocols and subsequent guidance documents. The field office shall also be responsible for coordination with the state or local government of the limits or exceptions and associated restrictions as appropriate. In the case of exceptions, the field office shall also work with the state and/or local governments to ensure that restrictions or conditions of release are adequate and mechanisms are in place for their enforcement.

F.1 Supplemental Limits

The supplemental limits must achieve the basic dose limits set forth in this guideline document for both current and potential unrestricted uses of a site and/or vicinity property. Supplemental limits may be applied to a vicinity property or a portion of a site if, on the basis of a site-specific analysis, it is determined that (1) certain aspects of the vicinity property or portion of the site were not considered in the development of the established authorized limits and associated guidelines for that vicinity property or site and, (2) as a result of these unique characteristics, the established limits or guidelines either do not provide adequate protection or are unnecessarily restrictive and costly.

F.2 Exceptions

Exceptions to the authorized limits defined for unrestricted use of a site or vicinity property may be applied to a vicinity property or a portion of a site when it is established that the authorized limits cannot be achieved and restrictions on use of the vicinity property or portion of the site are necessary to provide adequate protection of the public and the environment. The field office must clearly demonstrate that the exception is necessary and that the restrictions will provide the necessary degree of protection and will comply with the requirements for control of residual radioactive material as set forth in Section E of these guidelines.

F.3 Justification for Supplemental Limits and Exceptions

Supplemental limits and exceptions must be justified by the field office on a case-by-case basis using site-specific data. Every effort should be made to minimize use of the supplemental limits and exceptions. Examples of specific situations that warrant use of the supplemental standards and exceptions are:

a. Where remedial action would pose a clear and present risk of injury to workers or members of the general public, notwithstanding reasonable measures to avoid or reduce risk.

b. Where remedial action -- even after all reasonable mitigative measures have been taken -- would produce environmental harm that is clearly excessive compared to the health benefits to persons living on or near affected sites, now or in the future. A clear excess of environmental harm is harm that is long-term, manifest, and grossly disproportionate to health benefits that may reasonably be anticipated.

c. Where it is clear that the scenarios or assumptions used to establish the authorized limits do not, under plausible current or future conditions, apply to the property or portion of the site identified and where more appropriate scenarios or assumptions indicate that other limits are applicable or necessary for protection of the public and the environment.

d. Where the cost of remedial action for contaminated soil is unreasonably high relative to long-term benefits and where the residual radioactive material does not pose a clear present or future risk after taking necessary control measures. The likelihood that buildings will be erected or that people will spend long periods of time at such a site should be considered in evaluating this risk. Remedial action will generally not be necessary where only minor quantities of residual radioactive material are involved or where residual radioactive material occurs in an inaccessible location at which site-specific factors limit their hazard and from which they are costly or difficult to remove. Examples include residual radioactive material under hard-surface public roads and sidewalks, around public sewer lines, or in fence-post foundations. A site-specific analysis must be provided to establish that it would not cause an individual to receive a radiation dose in excess of the basic dose limits stated in Section B, and a statement specifying the level of residual radioactive material must be included in the appropriate state and local records.

e. Where there is no feasible remedial action.

C. SOURCES

Limit or Guideline	Source
Basic Dose Limits	
Dosimetry model and dose limits	International Commission on Radiological Protection (1977, 1978)
Generic Guidelines for Residual Radioactivity	
Residual concentrations of radium and thorium in soil	40 CFR Part 192
Airborne radon decay products	40 CFR Part 192
External gamma radiation	40 CFR Part 192
Surface contamination	Adapted from U.S. Nuclear Regulatory Commission (1982)
Control of Radioactive Wastes and Residues	
Interim storage	DOE Order 5480.1A and subsequent guidance
Long-term management	DOE Order 5480.1A and subsequent guidance; 40 CFR Part 192; DOE Order 5820.2

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APPENDIX B

STATE OF ILLINOIS
RESIDUAL CONTAMINATION GUIDELINES

	Allowable Residual Surface Contamination (dpm/100 cm^2)	
	Average	Maximum
Alpha Emitters		
Removable	33	100
Total	1,000	5,000
	0.25 mrem/h at 1 cm	
Beta-Gamma Emitters		
Removable (except H-3)	220	1,100
(H-3)	2,200	11,000
Total (fixed)	0.25 mrem/h at 1 cm	

Source: Illinois Department of Nuclear Safety, 1981, *Regulations for Radiation Protection,* Springfield, Ill.

APPENDIX C

LETTERS FROM ILLINOIS HISTORIC PRESERVATION AGENCY

Illinois Historic Preservation Agency
Old State Capitol • Springfield • 62701

217/785-4512

COOK COUNTY
Chicago
Eckhart Lab
(University of Chicago)

July 29, 1987

Mr. John F. Hoffecker
Energy & Environmental Systems Division
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439

Dear Mr. Hoffecker:

We have reviewed the proposed project to perform radiological decontamination and characterization at the University of Chicago for the above mentioned building.

In our opinion, the project as proposed will have no effect on the Hyde Park - Kenwood Historic District which was listed on the National Register of Historic Places on February 14, 1979. We, therefore, have no objection to the undertaking proceeding as planned.

A copy of this letter should be kept on file as evidence of compliance with section 106 of the National Historic Preservation Act of 1966, as amended.

If you have any questions, please contact Anne Haaker, Cultural Resources Coordinator at 217/785-3977.

Sincerely,

Theodore Hild

Theodore W. Hild
Deputy State Historic
Preservation Officer

THH:AMH:bv

cc: Julia Hertenstein
U.S. Department of Energy

Illinois Historic Preservation Agency
Old State Capitol • Springfield • 62701

217/785-4512

COOK COUNTY
Chicago
George Herbert Jones Laboratory - Room 405
(University of Chicago)

July 29, 1987

Mr. John F. Hoffecker
Energy & Environmental Systems Division
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439

Dear Mr. Hoffecker:

We have reviewed the proposed project to perform radiological decontamination and characterization at the University of Chicago for the above mentioned building.

In our opinion, the project as proposed will have no effect on the George Herbert Jones Laboratory - Room 405 which was listed on the National Register of Historic Places on May 28, 1967. We, therefore, have no objection to the undertaking proceeding as planned.

A copy of this letter should be kept on file as evidence of compliance with section 106 of the National Historic Preservation Act of 1966, as amended.

If you have any questions, please contact Anne Haaker, Cultural Resources Coordinator at 217/785-3977.

Sincerely,

Theodore Hild

Theodore W. Hild
Deputy State Historic
Preservation Officer

TWH:AMH:bv

cc: Julia Hertenstein
U.S. Department of Energy

Illinois Historic Preservation Agency
Old State Capitol • Springfield • 62701

217/785-4512

COOK COUNTY
Chicago
Ryerson Physical Laboratory
(University of Chicago)

July 29, 1987

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Argonne, Illinois 60439

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We have reviewed the proposed project to perform radiological decontamination and characterization at the University of Chicago for the above mentioned building.

In our opinion, the project as proposed will have no effect on the Hyde Park - Kenwood Historic District which was listed on the National Register of Historic Places on February 14, 1979. We, therefore, have no objection to the undertaking proceeding as planned.

A copy of this letter should be kept on file as evidence of compliance with section 106 of the National Historic Preservation Act of 1966, as amended.

If you have any questions, please contact Anne Haaker, Cultural Resources Coordinator at 217/785-3977.

Sincerely,

Theodore Hild

Theodore W. Hild
Deputy State Historic
Preservation Officer

TWH:AMH:bv

cc: Julia Hertenstein
U.S. Department of Energy

NOV 1 8 1983

054477

U.S. DEPARTMENT OF ENERGY

memorandum

DATE: NOV 15 1983

REPLY TO ATTN OF: NE-24

SUBJECT: NEPA Action Description Memorandum for the University of Chicago Remedial Action Project Under the Formerly Utilized Sites Remedial Action Program (FUSRAP)

TO: J. LaGrone, Manager
Oak Ridge Operations Office

The draft Action Description Memorandum (ADM) for the subject project was reviewed by this office and appears to be satisfactory and may be finalized. The proposed action is to decontaminate those areas of Eckhart Hall, Ryerson Physical Laboratory, and Jones Chemical Laboratory, that are contaminated with radioactive residual material as a result of programs conducted by the Manhattan Engineer District and the Atomic Energy Commission. The contamination in these three buildings is located in several laboratories and adjoining areas. The concentration of radioactivity as a result of this contamination is low except for isolated small areas. The objective of this remedial action is to decontaminate the areas such that residual radioactivity is below the established FUSRAP cleanup criteria for unrestricted use of the facility, and to dispose of the waste from cleanup at the DOE Hanford disposal site.

Based on review of the ADM and other pertinent facts, I have determined that the remedial action at the University of Chicago site is an action which in and of itself will have a clearly insignificant impact on the quality of the human environment within the meaning of the National Environmental Policy Act.

Franklin E. Coffman, Director
Office of Terminal Waste Disposal
and Remedial Action
Office of Nuclear Energy

cc:
R. Stern, EP-36
S. Greenleigh, GC-30

1 of 2
Final Version
University of Chicago
Jones/CHR/LA

ATTENTION: JIM ALEXANDER

July, 2, 1987

Lowell Campbell
Idaho National
Engineering Lab

The University and the U.S. Department of Energy are working out the details of a plan to have exhaust ducts in Jones Chemical Laboratory examined for low levels of radioactivity and cleaned or removed during the building's renovation this summer.

The work, which is expected to begin this month, is part of a continuing DOE program at 29 sites where government nuclear research was conducted during and just after World War II.

A similar cleanup took place on campus in 1983. Then, emphasis was given to Kent Hall because that building was being extensively renovated.

Officials stress that there has been no health hazard to anyone at the University from the materials that will be removed.

"The Department of Energy made it clear to us in 1979 that they saw no health hazard to any faculty members, students or staff from the very low levels of contamination left from the Manhattan Project," said Gregory Boshart, Executive Officer in Chemistry. "As was the case in Kent, this disposal of ducts will be done to comply with federal regulations and because we're now renovating for new laboratories in Jones."

Kent, Jones, Ryerson and Eckhart were used by scientists during World War II as part of the government's Manhattan Project, during which Enrico Fermi and his colleagues created the first man-made, self-sustaining nuclear chain reaction. When the buildings were returned for University use after the war, they were certified by the government as having no radioactive stains or contamination above the then-accepted standards. But in the 1970s, more restrictive standards were put in place and many buildings that had been used for nuclear research did not meet the new standards.

In its survey at that time of 18 such sites around the country, the DOE determined that levels of contamination in University buildings were so low that no immediate action

was needed. In fact, a DOE spokesman described the contamination at the University as "probably the lowest" of any of the sites. The DOE agreed, however, to pay for disposal of any slightly radioactive building material removed during future renovations.

During the 1983 cleanup, objects such as workbench tops and patches of concrete surfaces on floors and walls were replaced.

This summer, DOE has proposed that ducts from fume hoods be examined and, if necessary, cleaned or replaced. A trained crew from Bechtel National Inc., under contract to DOE, will perform the work, which is scheduled to be completed by the time classes begin in October.

Although the cleanup should have little or no effect on classes, the dirt and dust it generates may cause temporary disruption of some research projects.

The renovation of the third floor of Jones will create new research laboratory space for organic and inorganic chemistry, according to Boshart.

"With our large classes of entering graduate students the last two years, we've seen some increase in the size of research groups," he said. "Searle can no longer provide all the space we need, so we've begun expanding back into Jones, which was our original research building."

###

Larry Arbeiter
702-8358

2.5 ACCESS AGREEMENTS

A two-party agreement, executed between the Department of Energy, Oak Ridge Operations Office, and the University of Chicago and a supplemental agreement are provided in this section.

file cy.

Department of Energy
Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37831

NOV 3 1983

University of Chicago
ATTN: Mr. Samuel D. Golden
5801 Ellis Avenue
Chicago, IL 60637

Gentlemen:

TWO-PARTY AGREEMENT FOR CLEAN-UP OF UNIVERSITY FACILITIES

The subject document, properly executed by DOE-Oak Ridge Operations, is enclosed.

Please contact me or Jake Alexander of my staff, Area Code 615-576-0948, if we can be of further assistance.

Sincerely,

E. L. Keller

E. L. Keller, Director
Technical Services Division

CE-53:JKA

Enclosure:
As Stated

bcc: W. Latham, AD-422, w/encl.
C. Seehorn, CC-10, w/encl.
D. L. Bray, CH, w/encl.
J. P. Kennedy, CH, w/encl.
R. W. Vocke, ANL, w/encl.
R. A. Wynveen, ANL, w/encl.
R. L. Rudolph, BNI, w/encl.

AGREEMENT BETWEEN THE DEPARTMENT OF ENERGY-OAK RIDGE OPERATIONS OFFICE AND THE UNIVERSITY OF CHICAGO

This agreement is entered into this 3rd day of November, 1983, effective the first day of October, 1983, by and between the UNITED STATES OF AMERICA (hereinafter called the "Government") acting through the U. S. DEPARTMENT OF ENERGY (hereinafter called "DOE"), and THE UNIVERSITY OF CHICAGO, a corporation not for pecuniary profit, organized under the laws of the State of Illinois (hereinafter called the "University").

RECITALS

The University has been a contractor of the Government from the period of the Manhattan Engineer District during World War II through the establishment of the Atomic Energy Commission and its successor agencies, the Energy Research and Development Administration and the Department of Energy. During the period of the Manhattan Engineer District and early Atomic Energy Commission, Ryerson Physical Laboratory, George Herbert Jones Chemical Laboratory, Eckhart Hall and Kent Chemical Laboratory were used to perform certain functions within the program. As a result of these activities, small amounts of low level contamination were left in portions of the building structure. While Government surveys of the sites in the

1940s and 1950s following earlier decontamination activities found that the buildings were safe for normal personnel use, later surveys made in 1977 suggested that at the appropriate time it would be advisable to eliminate the low level radioactive spots in the buildings when this was feasible. The University recently engaged in extensive renovations of Kent Chemical Laboratory. In the process, following further DOE-sponsored surveys, the University through its own and contractor personnel arranged for removal and safe disposal of residual radioactivity in the building. DOE has now made available funds in the amount of $300,000 from the fiscal year 1984 budget beginning October 1, 1983 for the elimination of the radioactive spots in the other three buildings.

The parties have agreed that the decontamination will be carried on utilizing staff of Argonne National Laboratory and other employees as agreed upon by the University with the Argonne staff. This agreement states the understandings with respect to the performance of the decontamination work and its reimbursement by DOE.

The parties therefore agree as follows:

1. Staff of Argonne National Laboratory will perform the work described in the scope of work attached to this agreement as Appendix A. The Argonne staff involved will

include members of the Radiological Survey Group, Health Physics Section, Occupational Health and Safety Division under the general direction of Robert A. Wynveen, Health Physics Manager, and the specific direction of Walter H. Smith, Senior Health Physicist, as well as Waste Management Operations personnel in the Plant Facilities and Services Division, under the direction of Lyle Cheever, Waste Manager. Argonne shall report any key personnel changes to the University and shall secure permission for replacement personnel from the University. The schedule and details of decontamination activities will be worked out between the Argonne representatives and Gregory L. Boshart, Executive Officer of the University's Physical Sciences Division. Access of Argonne staff (who are in any case employees of the University) will be arranged through Mr. Boshart.

2. DOE has made available through the Argonne National Laboratory prime contract the sum of up to $300,000 to complete the scope of work during Fiscal Year 1984 beginning October 1, 1983. Should subsequent events indicate that this sum is inadequate DOE will entertain requests to increase the amount, probably for work to be performed in a subsequent fiscal year.

3. If Argonne and the University determine that some decontamination work can be better performed through employees of the University campus or contractors engaged by the University campus, Argonne may arrange to transfer the

necessary funds from the Argonne Prime Contract to the University's campus to cover such work, subject to approval by DOE.

4. The work to be done by Argonne will take place at such times as are convenient to the University and the Argonne Staff and will not interfere with ongoing work on the campus. Radiological physics staff of the University under the general direction of Edward W. Mason, Health Physicist and Director of the Radiation Protection Services, will be allowed to review the work and to make their own measurements or check Argonne's measurements of radioactivity.

5. Argonne's activities will include removing contaminated materials to a disposal facility, and restoring the property to a condition comparable to its original condition by such techniques as backfilling, seeding, repair or replacement and other methods to be agreed upon by the Argonne and University campus staff.

6. Upon completion of the work by Argonne in each affected area the Argonne staff will examine the area, and prepare a final report upon the condition of the area and its decontamination and shall maintain records of same. Before issuing the final report the Argonne staff will elicit any comments by University campus staff concerning the work under this agreement.

7. Argonne staff while working on the University campus will be covered by the Argonne prime contract for compensation, benefits, worker's compensation and all other types of insurance and liability for accidents or damage arising from their activities on the site. Should any injury to persons or damage to property occur as a result of the activities of Argonne staff which are not covered by the Argonne Prime Contract, the Government agrees to indemnify and save harmless the University for any damages or claims for damages arising out of or in connection with the remedial action plan described in this agreement, subject to the availability of funds appropriated by the Congress which the DOE may legally spend for such purpose.

8. This Agreement shall terminate upon completion of the restoration work (subject only to the availability of funds to complete project work) in accordance with the terms and conditions of this Agreement and upon certification by the DOE that the University's property meets applicable radiological criteria to the maximum extent practicable.

9. Should ongoing surveys indicate that further remedial work is needed in Kent Chemical Laboratory, Argonne will have the authority to perform such work within the funding limitation of this Agreement and if additional funds are needed the University can request same in the same manner as additional funds may be requested for the three buildings

for which decontamination and restoration work are provided for under this Agreement.

IN WITNESS WHEREOF, the parties have executed this Agreement in several counterparts.

THE UNIVERSITY OF CHICAGO

By: _____

Robert McC. Adams

Title: Provost

THE UNITED STATES OF AMERICA

By: _____

Department of Energy

Title: Contracting Officer

046390

P. Crotwell

Department of Energy
Oak Ridge Operations
Post Office Box E
Oak Ridge, Tennessee 37831

July 16, 1987

Mr. Samuel Golden
University of Chicago
5801 Ellis Avenue
Chicago, Illinois 60637

Dear Mr. Golden:

SUPPLEMENTAL AGREEMENT FOR ADDITIONAL REMEDIAL ACTION ACTIVITIES AT THE UNIVERSITY OF CHICAGO FACILITIES

The subject document, properly executed by DOE Oak Ridge Operations, is enclosed.

Sincerely,

S. Ahrends

S. W. Ahrends, Director
Technical Services Division

CE-53:Campbell

Enclosure:
As stated

SUPPLEMENTAL AGREEMENT
Between
The Department of Energy--Oak Ridge Operations Office
and
The University of Chicago

This agreement is entered into this 15th day of July, 1987, effective the 8th day of July, 1987, by and between THE UNITED STATES OF AMERICA (hereinafter called the "Government"), acting through the U. S. DEPARTMENT OF ENERGY (hereinafter called "D.O.E."), and THE UNIVERSITY OF CHICAGO, an Illinois not-for-profit corporation (hereinafter called the "University").

Recitals

The D.O.E. and the University entered into an agreement effective October 1, 1983, under which D.O.E. undertook to perform certain work in the decontamination of areas of certain University buildings--Ryerson Physical Laboratory, George Herbert Jones Chemical Laboratory, Eckhart Hall, and Kent Chemical Laboratory--which had small amounts of low-level contamination left from the period of the Manhattan Engineer District and the early establishment of the Atomic Energy Commission. The D.O.E. performed the decontamination work through funding added to the Argonne National Laboratory prime contract in a sum up to $300,000 of fiscal year 1984 funds. Upon the completion of this work the parties recognized that

there remained the possibility of certain residual radioactivity in the hood duct system in Jones Chemical Laboratory and that further work might be required in the future. The D.O.E. is now in a position to perform additional decontamination work with additional funds being made available and utilizing the services of Bechtel National Inc (hereinafter referred to as "Bechtel").

The parties, therefore, agree to supplement the agreement effective October 1, 1983, as follows:

1. Section 1 of the agreement is revised by the addition of the following: Bechtel, at the expense of D.O.E., will perform the work described in the scope of work attached to this agreement as Appendix A-1. The schedule and details of decontamination activities will be worked out between representatives of Bechtel and the University, including access of Bechtel's staff to all building areas.

2. References to Argonne National Laboratory in the agreement of October 1, 1983 do not apply to the work to be conducted by Bechtel under Appendix A-1.

3. Bechtel shall perform all remedial action and restoration work with the exception of initial access to each of the existing hood exhaust ducts as stated below.

Independent verification shall be performed by Oak Ridge Associated Universities. In addition, radiological physics staff of the University, under the general direction of Edward W. Mason, health physicist and Director of the Radiation Protection Services, will be allowed to review the work and to make their own measurements or check Bechtel's or Oak Ridge Associated University's measurements of radioactivity.

4. Initial access to each of the existing hood exhaust ducts shall be performed through the University and the University costs thereof shall be reimbursed by the Department of Energy.

5. The radiological work will be completed if possible by October 1, 1987, before the opening of the Autumn Quarter. Restoration work is expected to be completed by the end of November 1987.

6. According to the Department of Energy report filed after the agreement of October 1, 1983, certain campus sewers were found to have some radioactivity in them, but if left alone represented no hazard. In the future, as it becomes necessary to remove campus sewer lines that lead from the four buildings, the Government will agree, to the extent permitted by law and/or to the extent that funds may be made available,

to pay for the expense of removal and disposal of contaminated material. Nothing in this agreement shall commit D. O. E. to the performance of work for which funding does not exist at the time work is scheduled to begin.

7. As modified by this agreement, all provisions of the original agreement remain in effect.

IN WITNESS WHEREOF, the parties have executed this agreement and several counterparts.

THE UNIVERSITY OF CHICAGO

By: _____
Alexander E. Sharp

Title: Vice President for Business and Finance

THE UNITED STATES OF AMERICA

By: _____
Department of Energy
S. W. Ahrends

Title: Director, Technical Services Division

Appendix A-1
to Agreement between Department of Energy and The University of Chicago

WORK SCOPE/PLAN

A. Ducts and Wall Renovation in Jones Laboratory

1. Characterization of Ducts

   a. Access to obtain samples from point of entry and exit to each of 64 ducts.
   b. Take samples at each opening.
   c. Analyze samples for radioactivity.
   d. Determine which ducts require remedial action.

2. Take remedial action on ducts and associated equipment as follows:

   a. No radioactivity found--leave in place.
   b. If contaminated, ducts and equipment will be cleaned to radiological guidelines or removed.

3. Restoration

   a. Replace ducts and equipment that have been removed and are still required by University.
   b. Renovate walls per University specifications.

4. Waste

   a. Package all radiological waste.
   b. Transport and dispose of all waste in appropriate manner.

5. Prepare and publish Post Remedial Action Report.

B. Other Areas

1. Drains

   a. Characterize drains in Jones, Eckhart and Ryerson.
   b. Submit letter report of findings.

2. Sewers

   a. Provide one-time sample effluent and sludge per ANL Drawing No. 85-32.
   b. Submit letter report.

2.6 POST-REMEDIAL ACTION REPORTS

The following reports document remedial action activities performed at the University of Chicago and the post-remedial action radiological status for the property.

THE UNIVERSITY OF CHICAGO
OFFICE OF FACILITIES PLANNING & MANAGEMENT
5555 SOUTH ELLIS AVENUE
CHICAGO, ILLINOIS 60637
(312) 702-1700

April 20, 1989

Mr. David Adler
c/o FUSRAP
Bechtel National
P.O. Box 350
Oak Ridge, Tennessee 37831-350

RE: KENT HALL - Removal of basement drainlines

Dear Mr. Adler:

Per our phone conversation on April 12, 1989 I am writing this letter to confirm the fact that the contaminated drainlines and surrounding soil, in the basement of Kent Hall, were excavated and legally disposed of in 1983. This work was carried out in conjunction with the total gutting and renovation of the building.

If you need additional information please contact me.

Sincerely,

Lynn C. Bender
Director

LCB:bg

cc: Sam Golden
Roy Mackal

2.7 VERIFICATION REPORTS

The following verification reports are included in this docket by reference.

	Page
Oak Ridge Associated Universities. Verification of Remedial Action on Ventilation Systems, Jones Chemical Laboratory, University of Chicago, Chicago, Illinois, Oak Ridge, Tenn., January 1989.	ref.
Oak Ridge Associated Universities. Letter Report - Verification Activities at University of Chicago, Chicago, Illinois, Oak Ridge, Tenn., June 1989.	ref.

2.8 STATE, COUNTY, AND LOCAL COMMENTS ON REMEDIAL ACTION

The State of Illinois was kept fully informed of all DOE activities in connection with remedial actions performed at the University of Chicago. Communication was maintained with the Illinois Department of Nuclear Safety during the development of site-specific remedial action activities.

2.9 RESTRICTIONS

There are no radiologically based restrictions on the future use of the subject site.

2.10 FEDERAL REGISTER NOTICE

Following certification of the property, a notice will be published in the Federal Register to document that the property is in compliance with DOE criteria and standards established to protect members of the general public and occupants of the site. This exhibit contains the text of the notice that will appear in the Federal Register. After the publication in the Federal Register, a copy of the actual notice will be substituted for the text that follows.

[Docket No. 6450-01]
DEPARTMENT OF ENERGY

Certification of the Radiological Condition of the
University of Chicago
in Chicago, Illinois

AGENCY: Office of Remedial Action and Waste Technology, Department of Energy.

ACTION: Notice of certification.

SUMMARY: The Department of Energy has completed radiological surveys and taken remedial action to decontaminate the George Herbert Jones Chemical Laboratory, Ryerson Physical Laboratory, and Eckhart Hall of the University of Chicago, Chicago, Illinois. The University of Chicago decontaminated the Kent Chemical Laboratory. The site was found to contain quantities of radioactive material remaining from wartime research activities conducted at the site by the Manhattan Engineer District/Atomic Energy Commission.

FOR FURTHER INFORMATION CONTACT:

J. J. Fiore
Division of Facility and Site Decommissioning Projects
Office of Remedial Action and Waste Technology
U.S. Department of Energy
Washington, D.C. 20545
(301) 353-5272

SUPPLEMENTARY INFORMATION:

The Department of Energy (DOE), Office of Nuclear Energy, Office of Remedial Action and Waste Technology, Division of Facility and Site Decommissioning Projects, implemented a remedial action project at the University of Chicago in Chicago, Illinois, area as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), which was initiated by the United States Government in 1974 to identify, clean up, or otherwise control sites in accordance with DOE decontamination criteria and standards where residual radioactive material remains from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has mandated DOE to remedy.

The University of Chicago was involved in theoretical, radiochemical, and physical research associated with the first successful nuclear pile (CP-1) that was constructed and operated in the West Stands (racquet courts) under Stagg Field. Research conducted under the MED and the AEC during the 1940s and 1950s included development of a process for producing high-purity uranium compounds, the testing of uranium metal, research associated with operation of the pile, and plutonium separation.

Records indicated that all buildings were decontaminated prior to release; however, some documentation was unavailable. During the period of September 1976 to September 1977, radiological surveys were performed by Argonne National Laboratory (ANL) under FUSRAP. Survey results indicated widespread contamination throughout the laboratories, but at fairly low levels except for isolated small areas. Analyses of potential exposure conditions indicated that

persons would not receive exposures exceeding current guidelines under present usage. However, remodeling or demolition activities could free fixed contamination, resulting in potential doses that could exceed guidelines. Analyses of soil samples taken outside the buildings indicated that contamination is confined to the buildings.

Remedial action of the accessible surface areas, under the direction of ANL, was completed during 1982 and 1983. Remedial action at the Ryerson, Eckhart, and Jones buildings was performed by ANL, while the university conducted the remedial work at Kent Chemical Laboratory. As the project management contractor for DOE, Bechtel National, Inc. (BNI) cleaned and radiologically surveyed the 64 exhaust ducts in the Jones Laboratory in 1987. A survey of the ventilation systems and related surfaces was conducted by BNI. Based on the results, it was determined that the radiological condition of the sewers and drainlines were below existing guidelines.

The post-remedial action survey was conducted by an independent verification contractor. It demonstrated and DOE has certified that radiological conditions at the affected buildings are in compliance with DOE decontamination criteria and standards and that the future use of the property will result in no radiological exposure above applicable radiological guidelines established to protect members of the general public or site occupants. These findings are supported by the DOE Certification Docket for the Remedial Action Performed at University of Chicago in Chicago, Illinois. Accordingly, this property is released from the Formerly Utilized Sites Remedial Action Program. The certification docket will be available for review between 9:00 a.m. and 4:00 p.m., Monday through Friday (except on federal holidays), in the Department of Energy Public Reading room located in Room 1E-190 of the Forrestal Building, 1000 Independence Avenue, SW, Washington, D.C. Copies will also be in the Public Document Room, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, Tennessee.

The Department of Energy, through the Oak Ridge Operations Office, Technical Services Division, has issued the following statement:

STATEMENT OF CERTIFICATION: UNIVERSITY OF CHICAGO, CHICAGO, ILLINOIS

The Oak Ridge Operations Office, Technical Services Division, has reviewed the radiological data obtained following the remedial action at the subject property. Based on this review, DOE has certified that the University of Chicago 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 radiological guidelines established to protect members of the general public or site occupants . Accordingly, the University of Chicago property is released from the Formerly Utilized Sites Remedial Action Program.

_____ Dated: _____

J.E. Baublitz, Acting Director
Office of Remedial Action
and Waste Technology
Office of Nuclear Energy
U.S. Department of Energy

2.11 APPROVED CERTIFICATION STATEMENT

When approved, the following statements will document the certification of the subject property for appropriate future use.

NE-23: Fiore

Recommendation for Certification of Remedial Action performed at the University of Chicago Site in Chicago, Illinois

J.E. Baublitz, Acting Director
Office of Remedial Action and Waste Technology, NE-20

I am attaching for your signature the Federal Register notice for the University of Chicago site in Chicago, Illinois.

Research conducted at the University of Chicago under the Manhattan Engineering District/Atomic Energy Commission (MED/AEC) contracts during the 1940s and 1950s included development of a process for producing high-purity uranium compounds, the testing of uranium metal, and research associated with operation of the pile and plutonium separation.

Based on a review of all documents related to this property, we have concluded that it should be certified to be in compliance with DOE decontamination criteria and standards established for the remedial action conducted at the University of Chicago.

The Division of Facility and Site Decommissioning Projects has provided the attached docket to effect the certification of the subject property.

Following your approval of the certification, this office and/or the Oak Ridge Operations Office, Technical Services Division, will notify interested state and local agencies, the public, local land offices, and the specific property

owner of the certification action by correspondence and local newspaper announcements, as appropriate. The documents transmitted with the Statement of Certification and the Federal Register notice will be compiled in final docket form by the Division of Facility and Site Decommissioning Projects for retention in accordance with DOE Order 1324.2 (Disposal Schedule 25).

J. J. Fiore, Director
Division of Facility and Site
Decommissioning Projects
Office of Nuclear Energy
U.S. Department of Energy

Attachments:
As Stated

STATEMENT OF CERTIFICATION:
UNIVERSITY OF CHICAGO SITE,
CHICAGO, ILLINOIS

The U.S. Department of Energy, Oak Ridge Operations Office, Technical Services Division, has reviewed and analyzed the radiological data obtained following remedial action at the University of Chicago, which was contaminated by uranium materials used for research activities during the Manhattan Engineer District/Atomic Energy Commission era. Based on this analysis of all data collected, the Department of Energy certifies that the University of Chicago is in compliance with the Department of Energy decontamination criteria and standards developed to protect health, safety, and the environment.

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.

By: _____ Date: _____

Peter J. Gross, Director
Technical Services Division
Oak Ridge Operations Office
U.S. Department of Energy

Exhibit III *Diagrams of the Remedial Action Performed at the University of Chicago, Chicago, Illinois, from December 1982 to October 1987*

EXHIBIT III

DIAGRAMS OF THE REMEDIAL ACTION PERFORMED AT THE UNIVERSITY OF CHICAGO, CHICAGO, ILLINOIS, FROM DECEMBER 1982 TO OCTOBER 1987

The figures provided on the following pages are taken from the post-remedial action reports; they illustrate the extent and types of remedial action performed at the subject property.

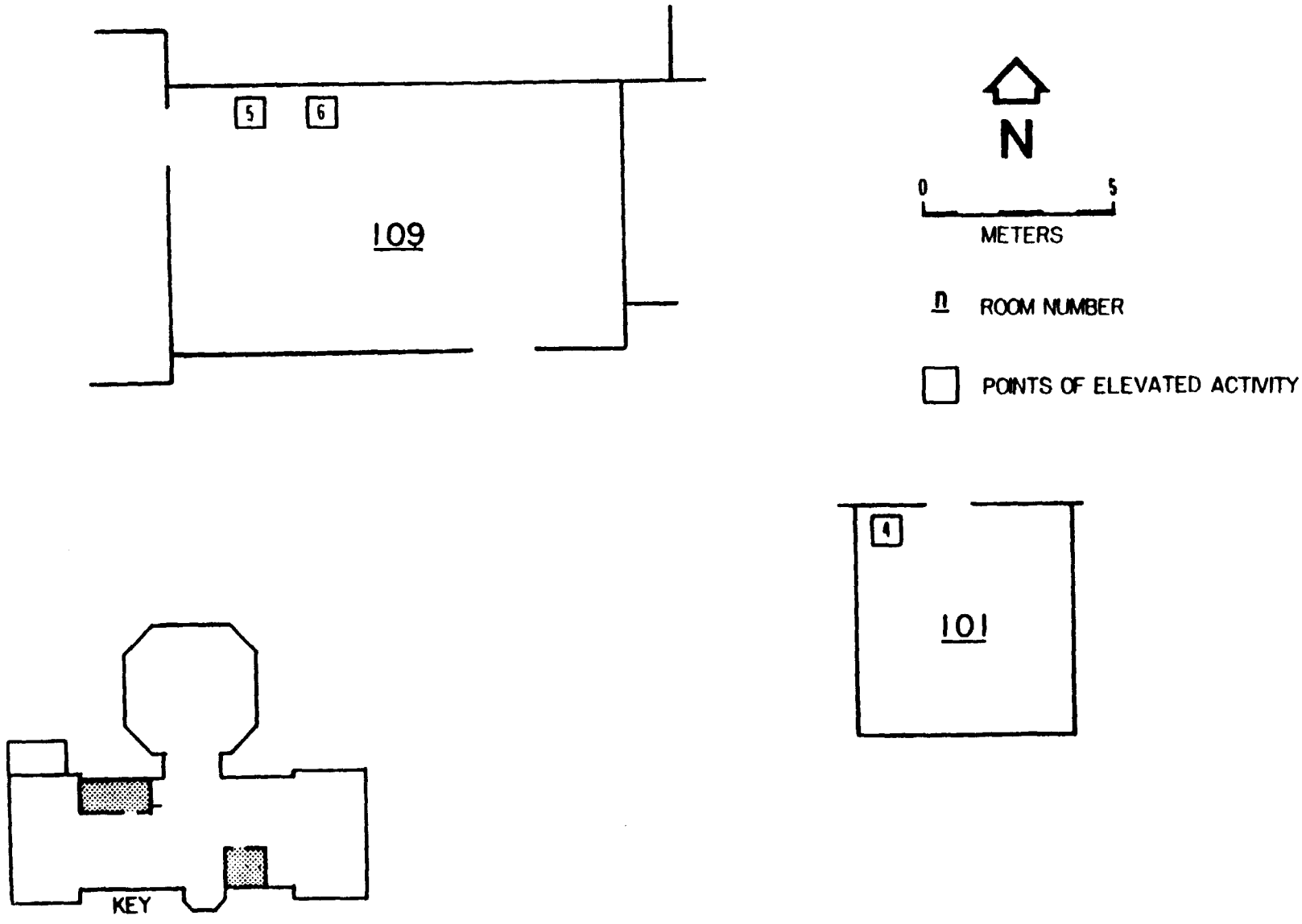


Figure 4. Kent Laboratory First Floor.
ANL-HP Dwg. No. 83-45.

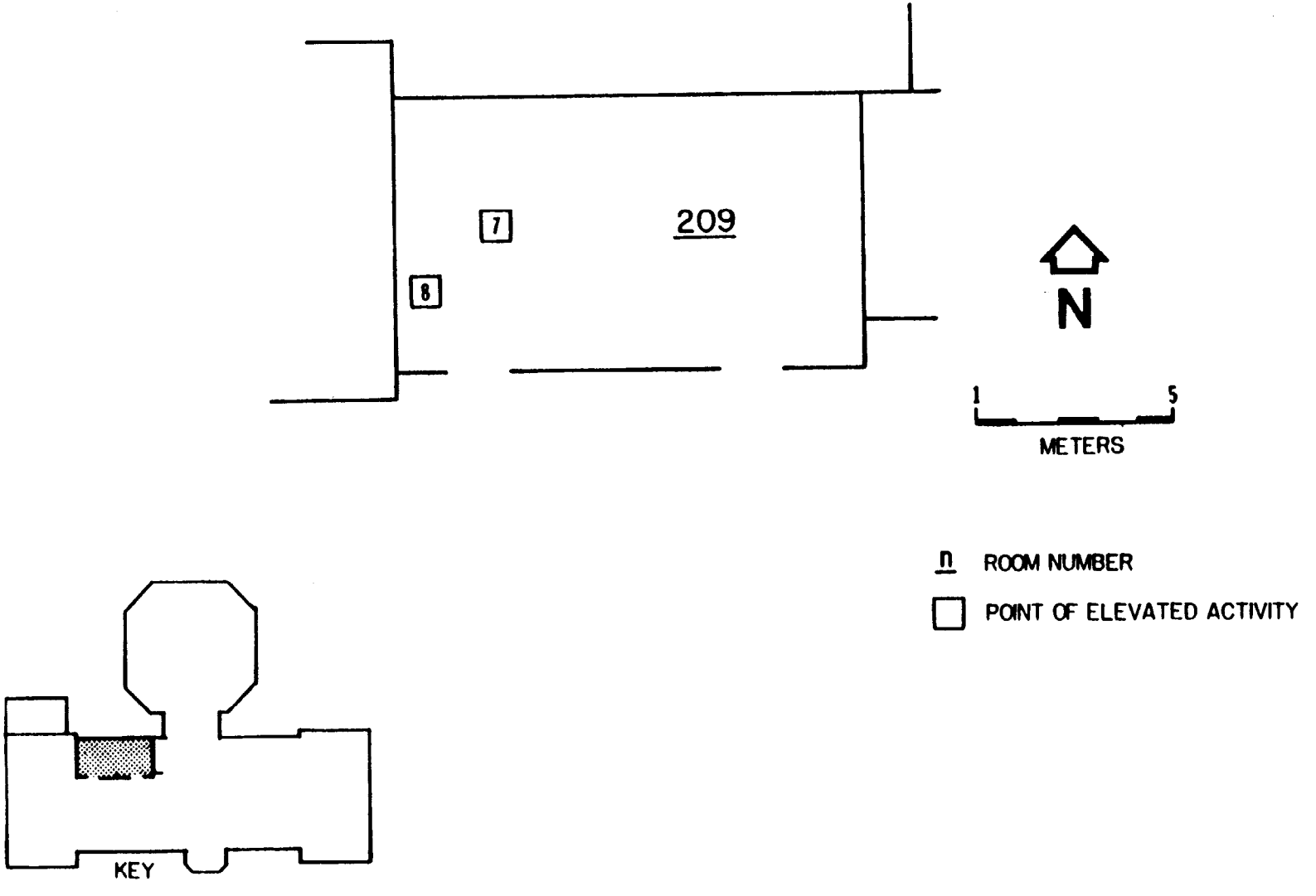


Figure 5. Kent Laboratory Second Floor.
ANL-HP Dwg. No. 83-46.

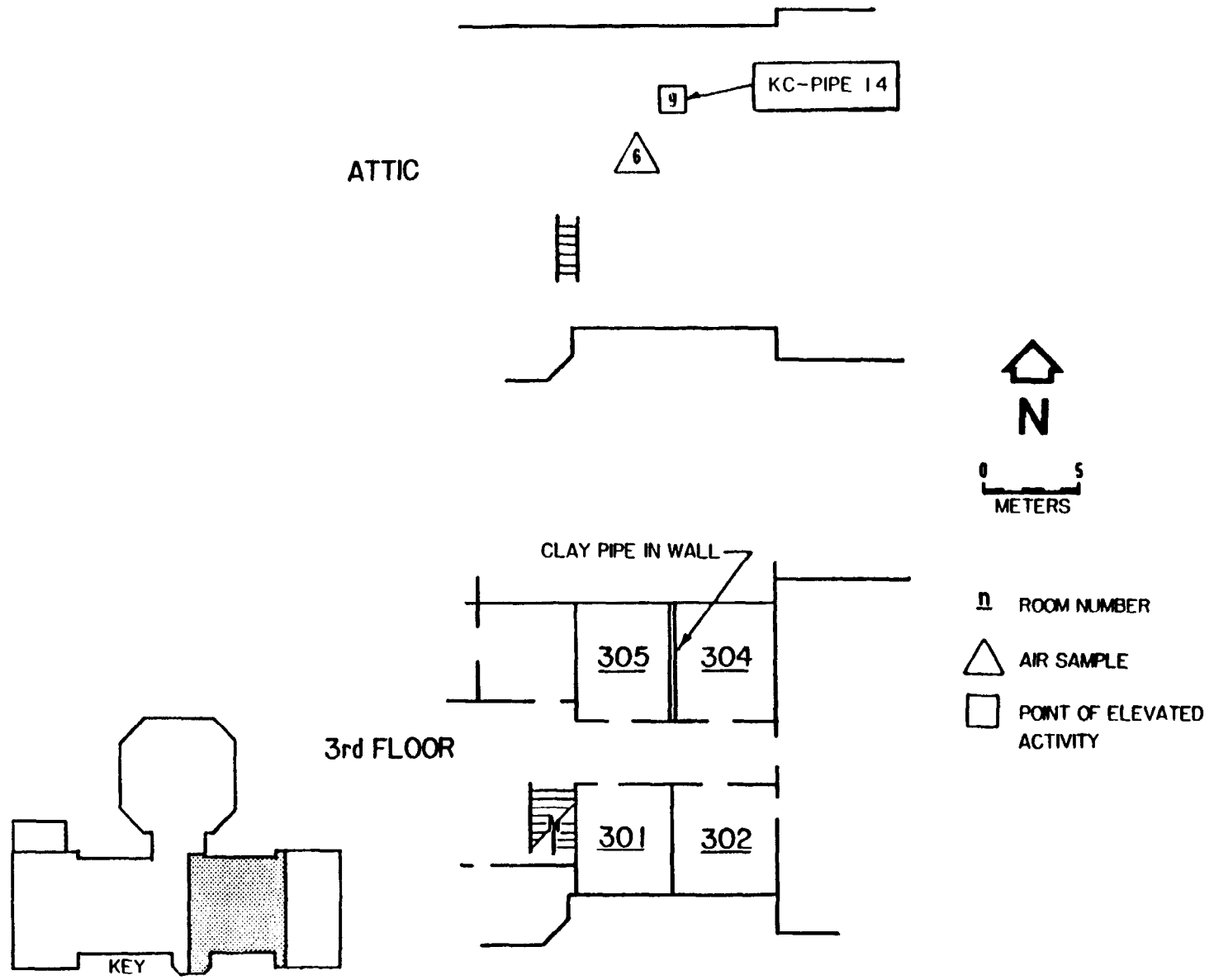


Figure 6. Kent Laboratory Third Floor and Attic. ANL-HP Dwg. No. 83-47.

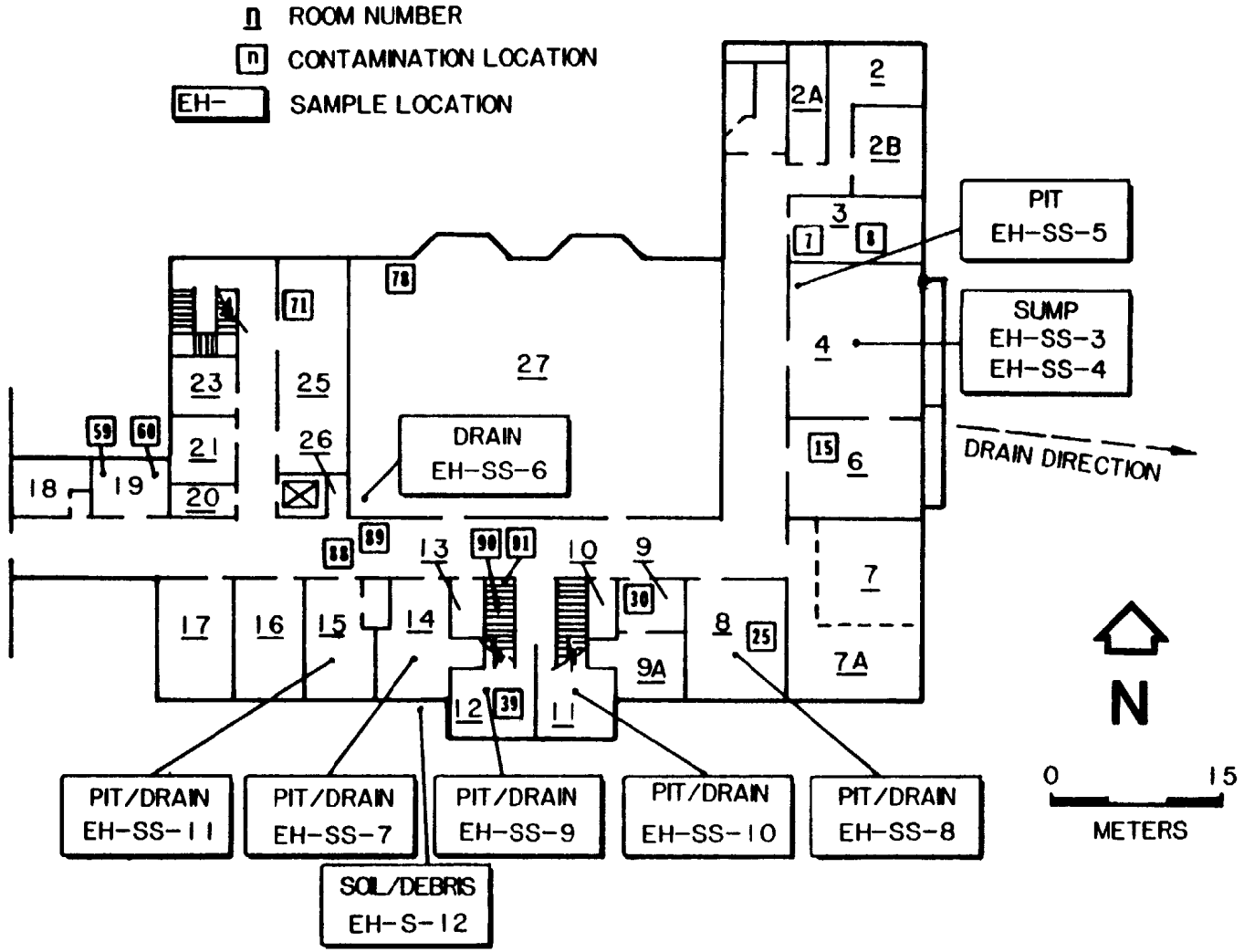


Figure 4. Eckhart Hall Basement.

ANL-HP DWG. NO. 84-17

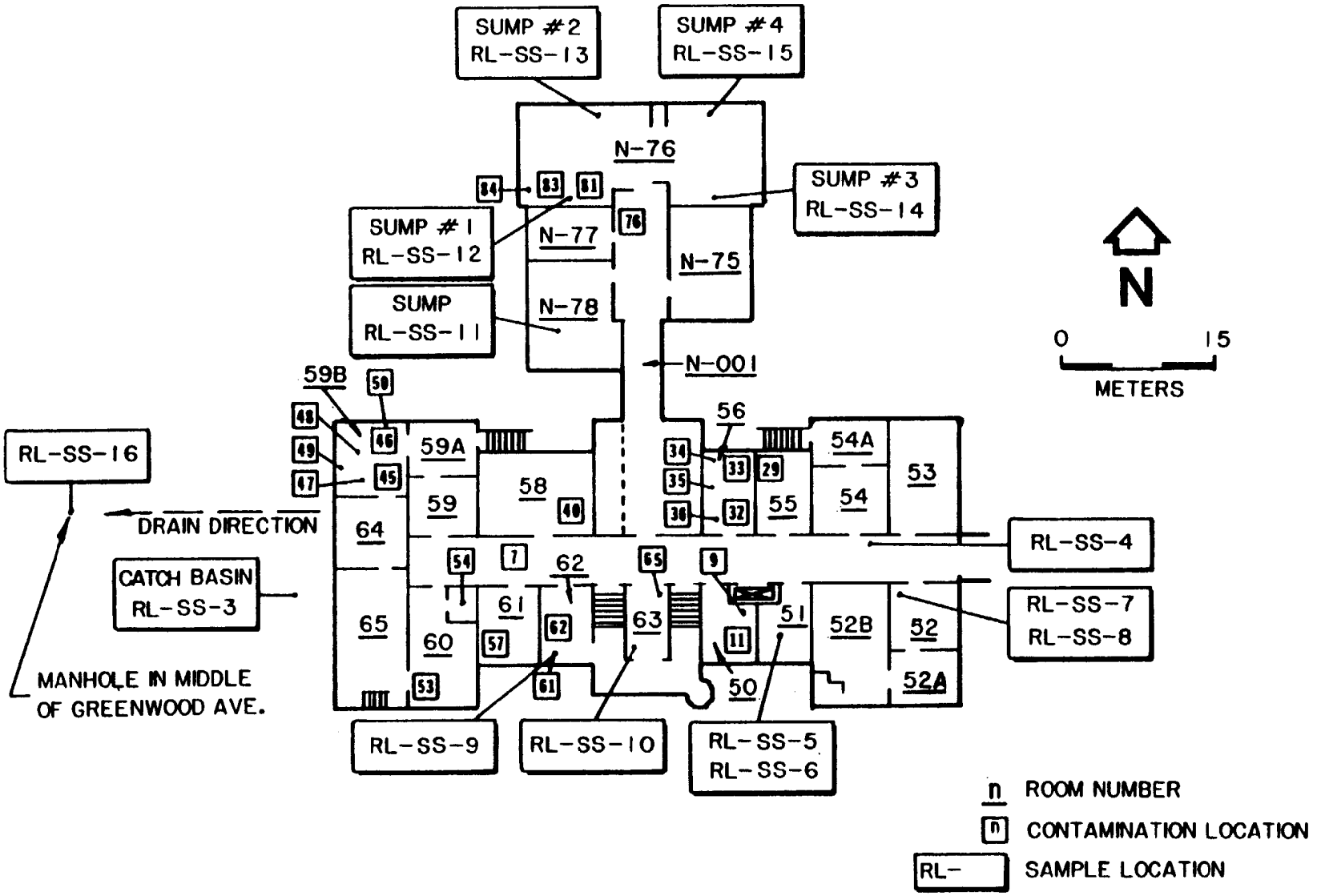


Figure 5. Ryerson Laboratory Basement.

ANL-HP DWG.NO. 84-18

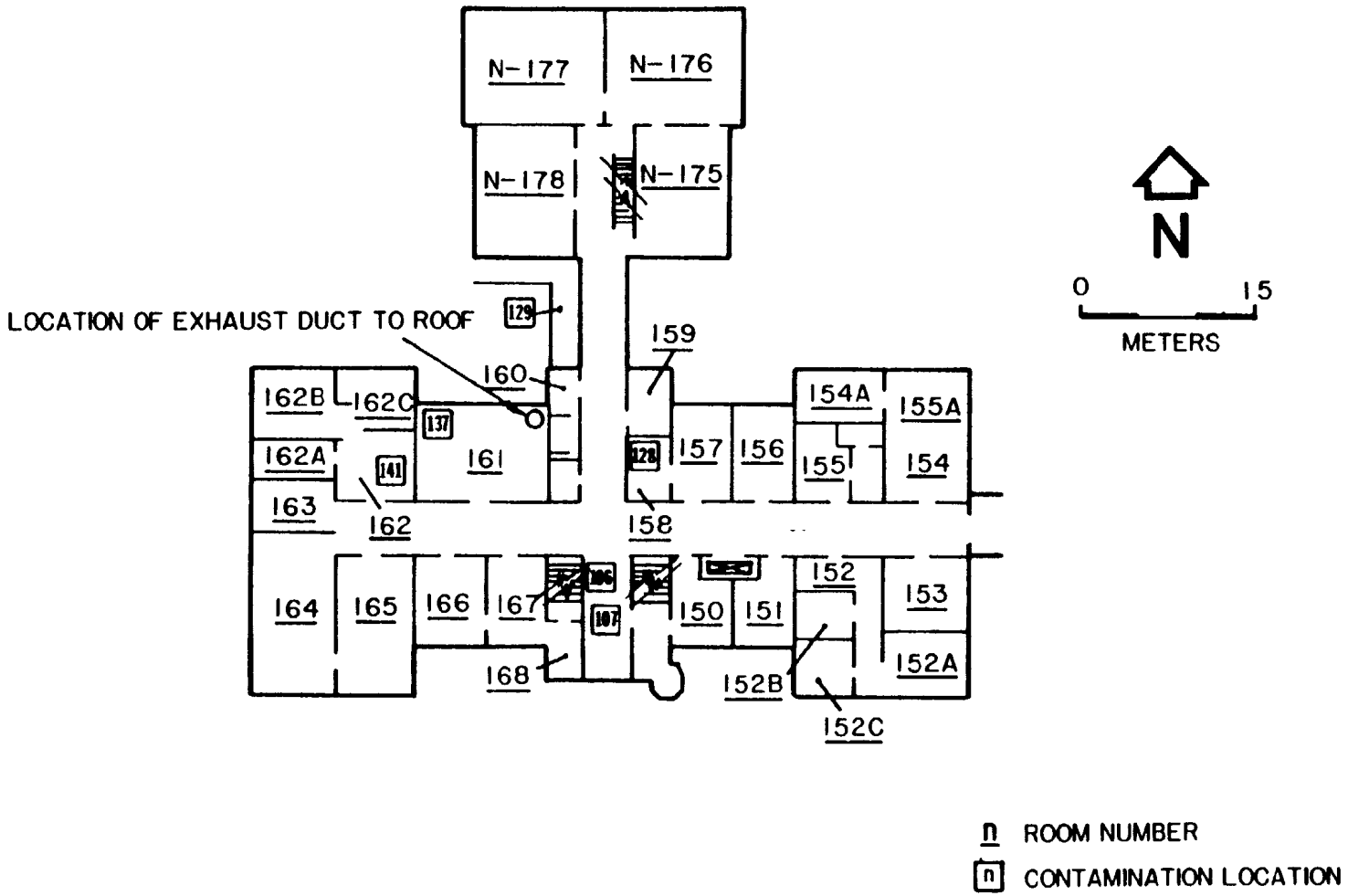


Figure 6. Ryerson Laboratory First Floor.

ANL-HP DWG. NO. 84-19

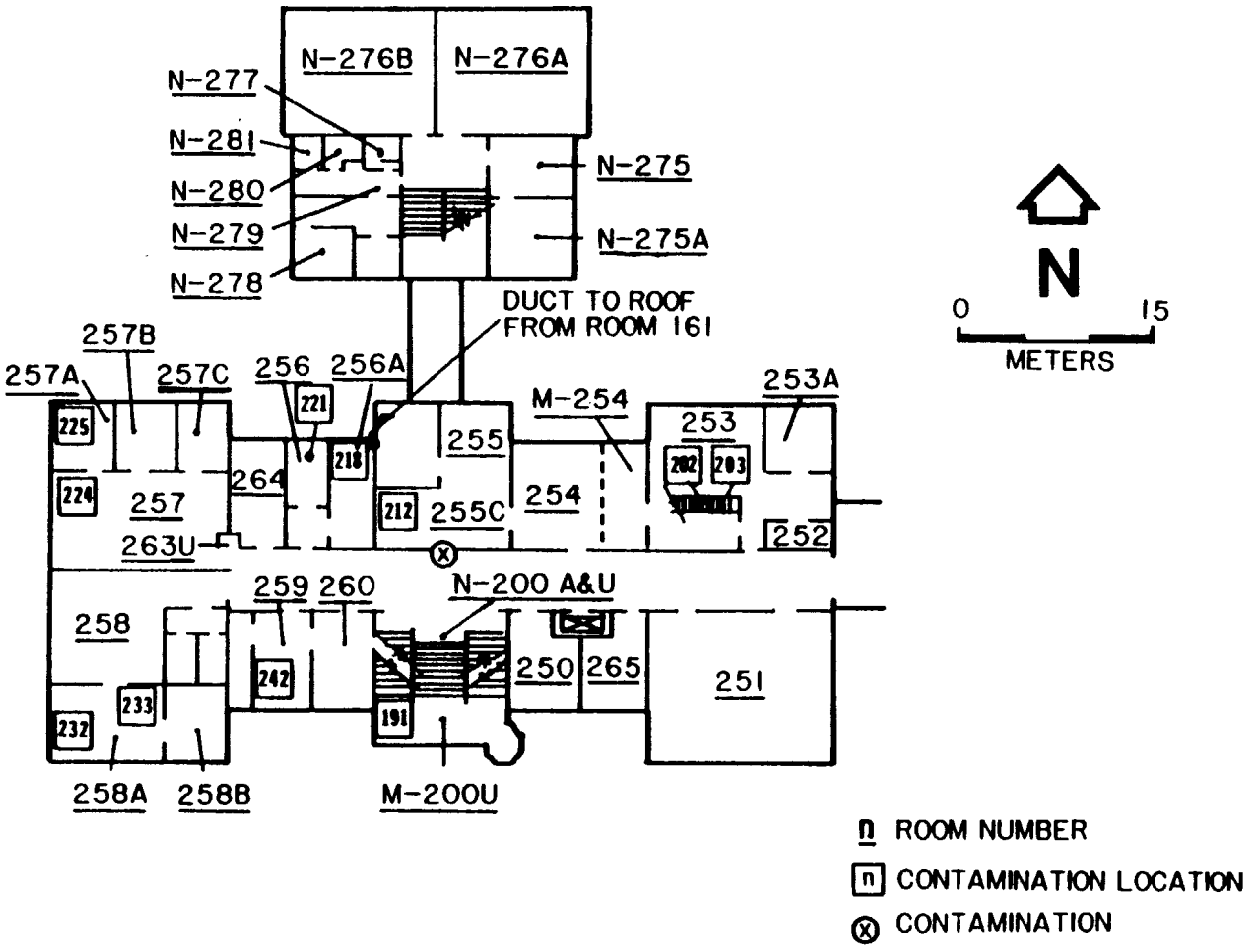


Figure 7. Ryerson Laboratory Second Floor.

ANL-HP DWG. NO. 84-20

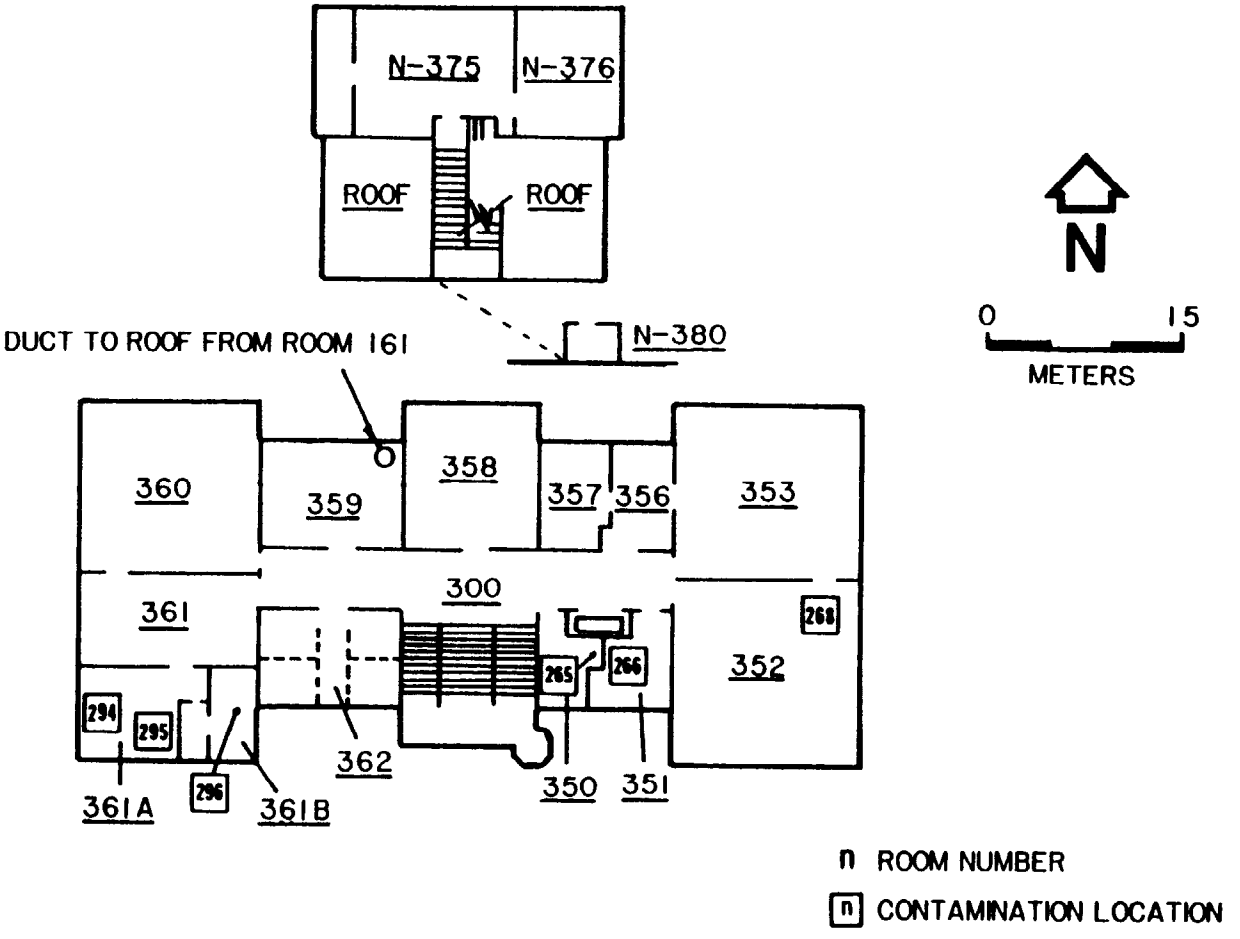


Figure 8. Ryerson Laboratory Third Floor.

ANL-HP DWG. NO. 84-21

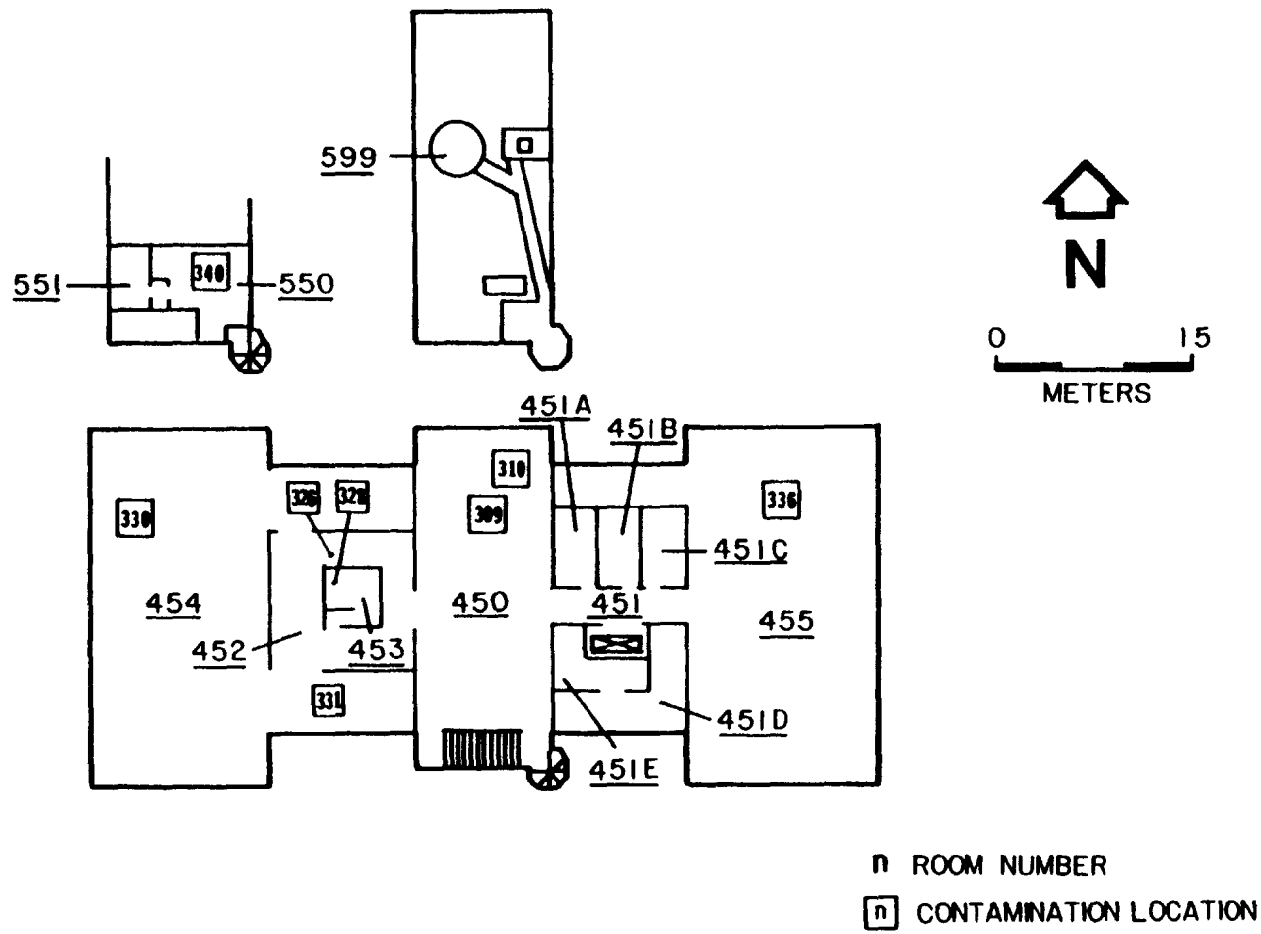


Figure 9. Ryerson Laboratory Fourth and Fifth Floors.

ANL-HP DWG. NO. 84-22

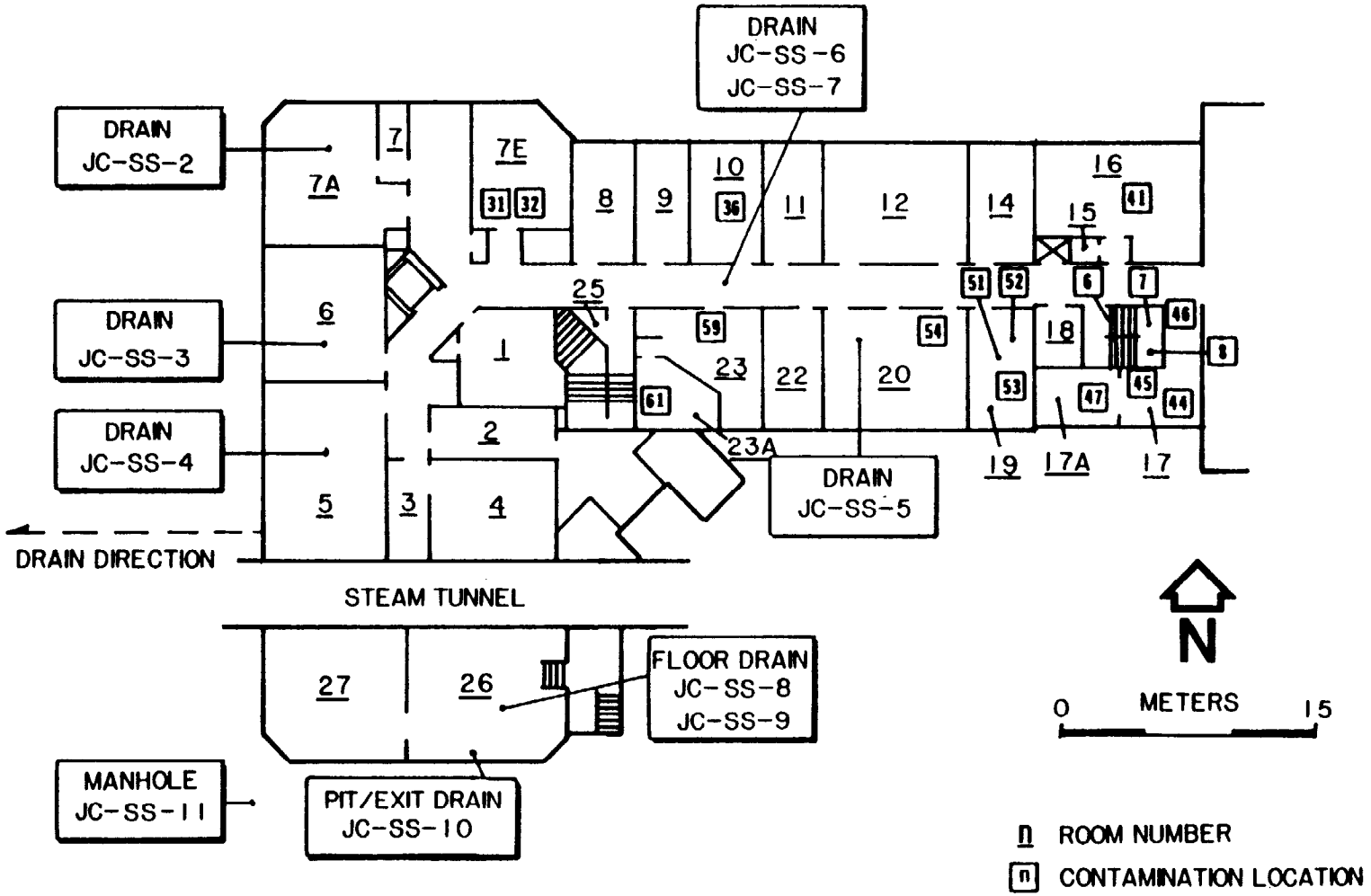


Figure 10. Jones Laboratory Basement.

ANL-HP DWG. NO. 84-24

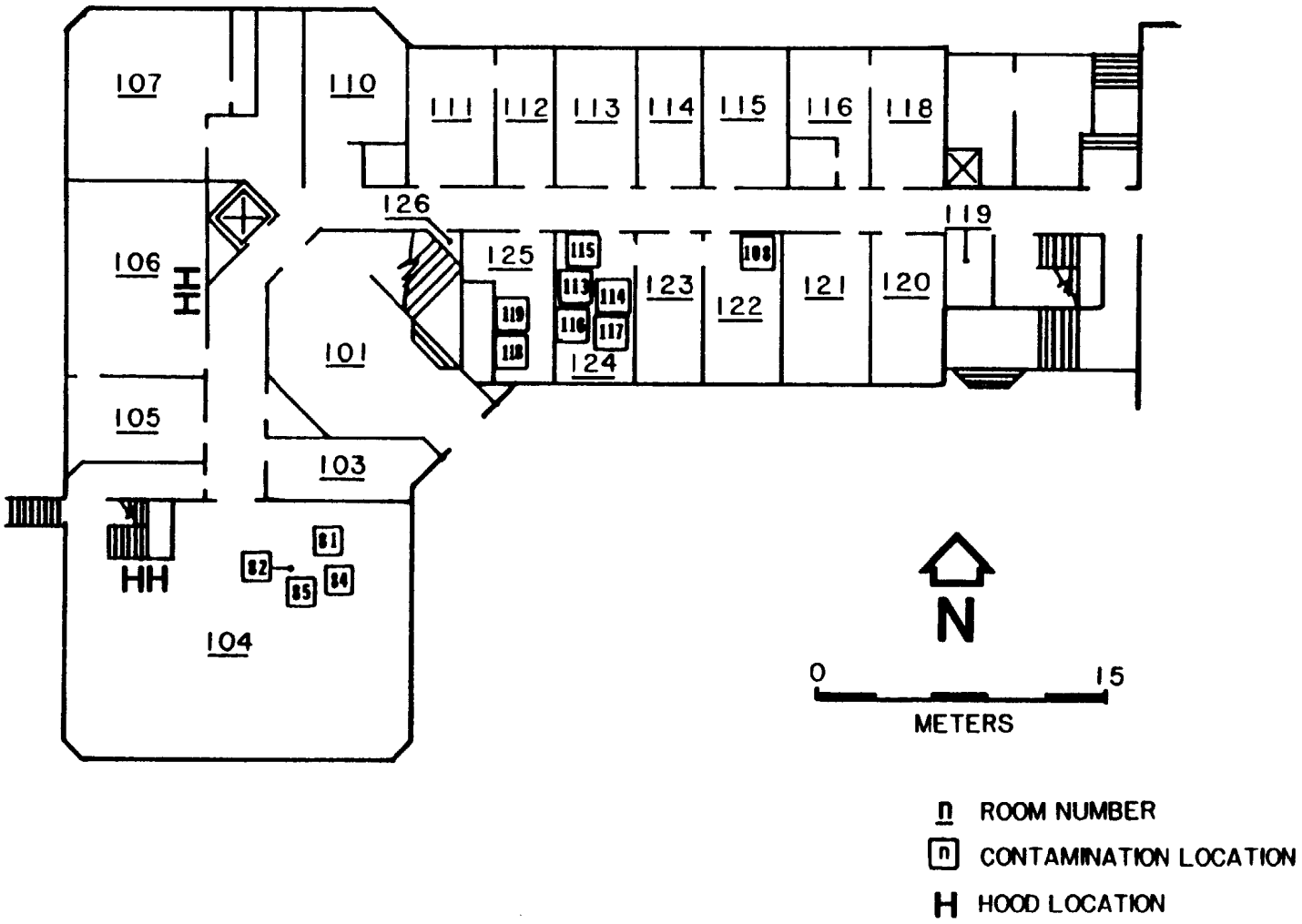


Figure 11. Jones Laboratory First Floor.

ANL-HP DWG. NO. 84-25

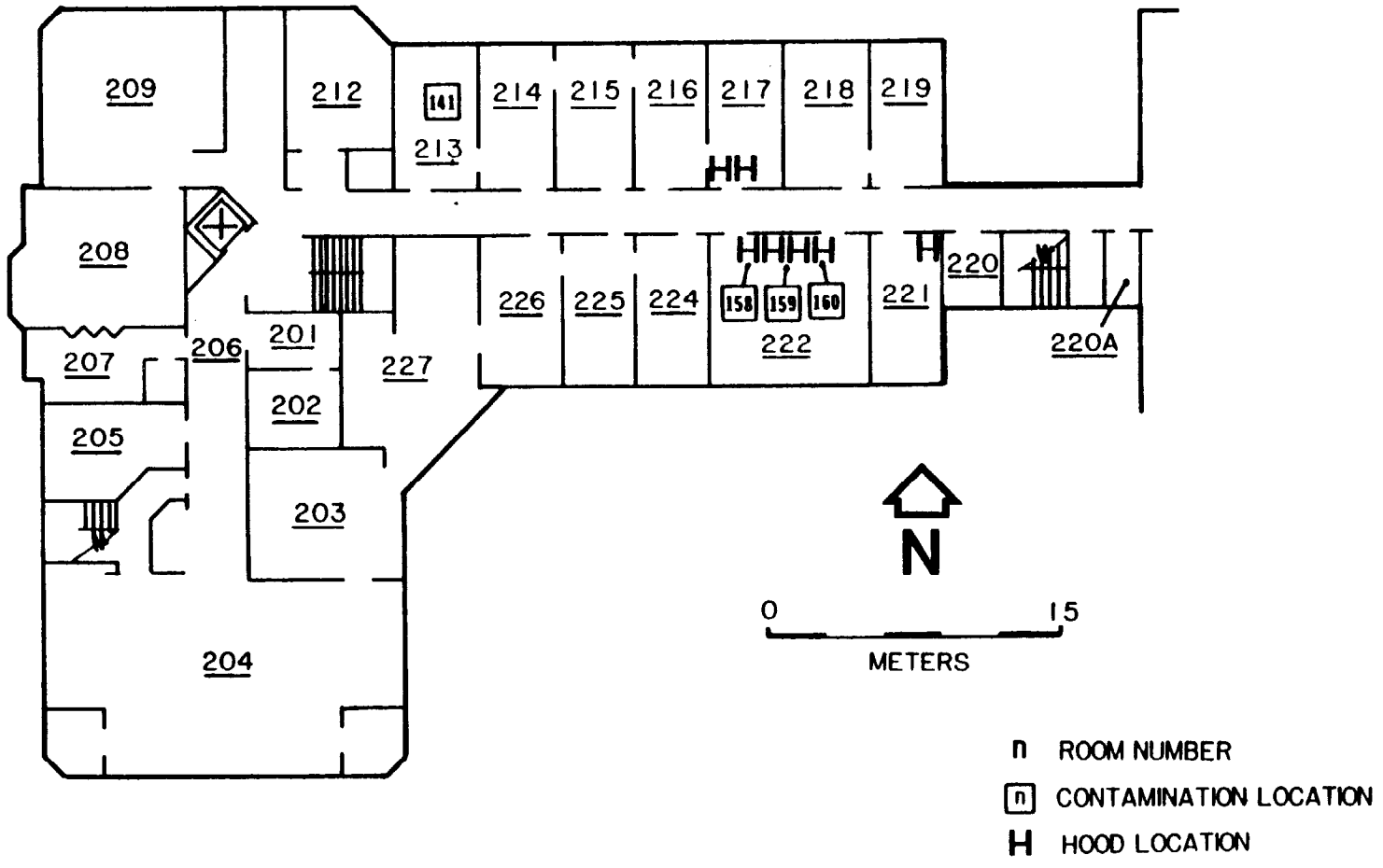


Figure 12. Jones Laboratory Second Floor.

ANL-HP DWG. NO. 84-26

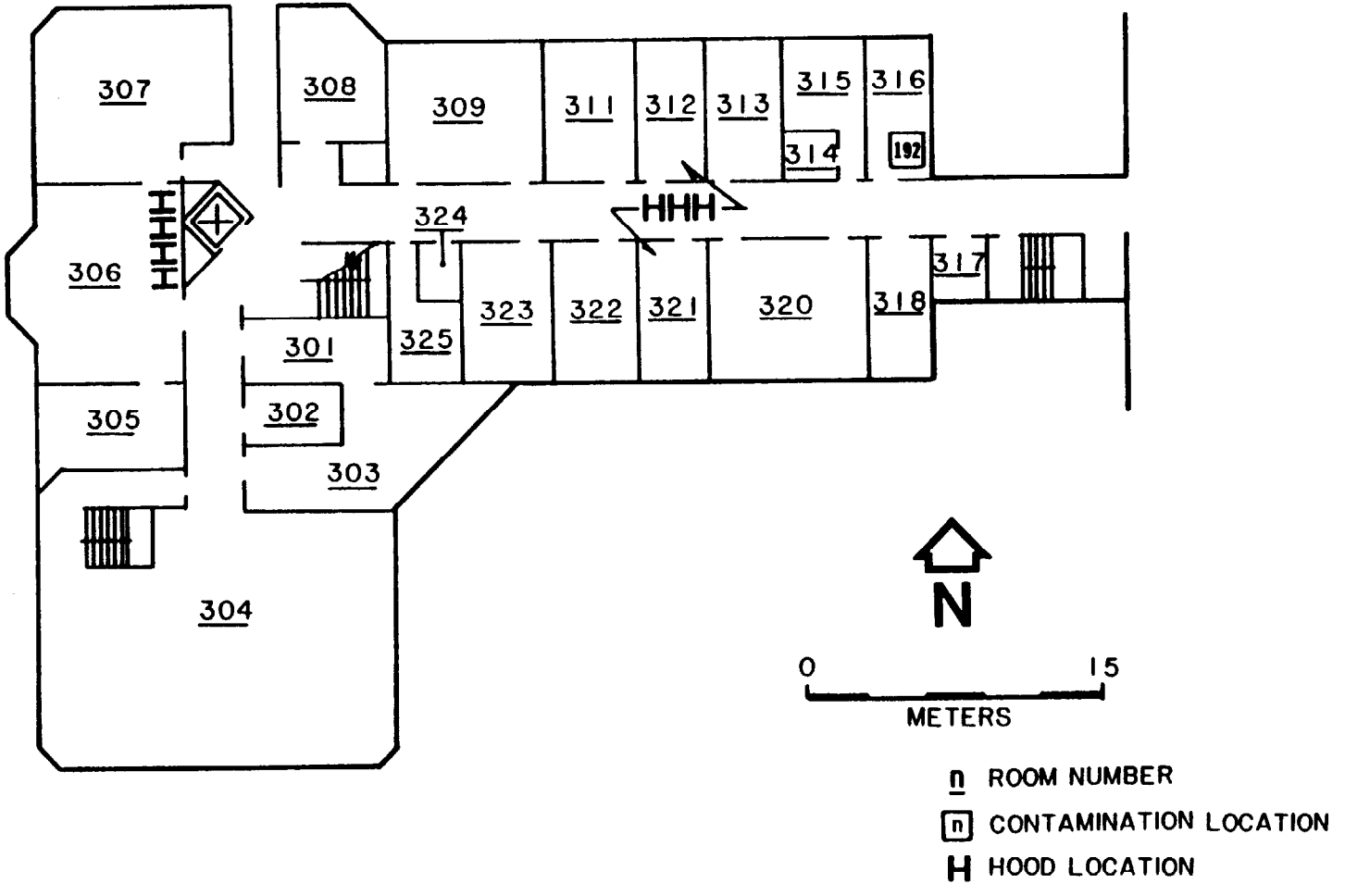


Figure 13. Jones Laboratory Third Floor.

ANL-HP DWG. NO. 84-27

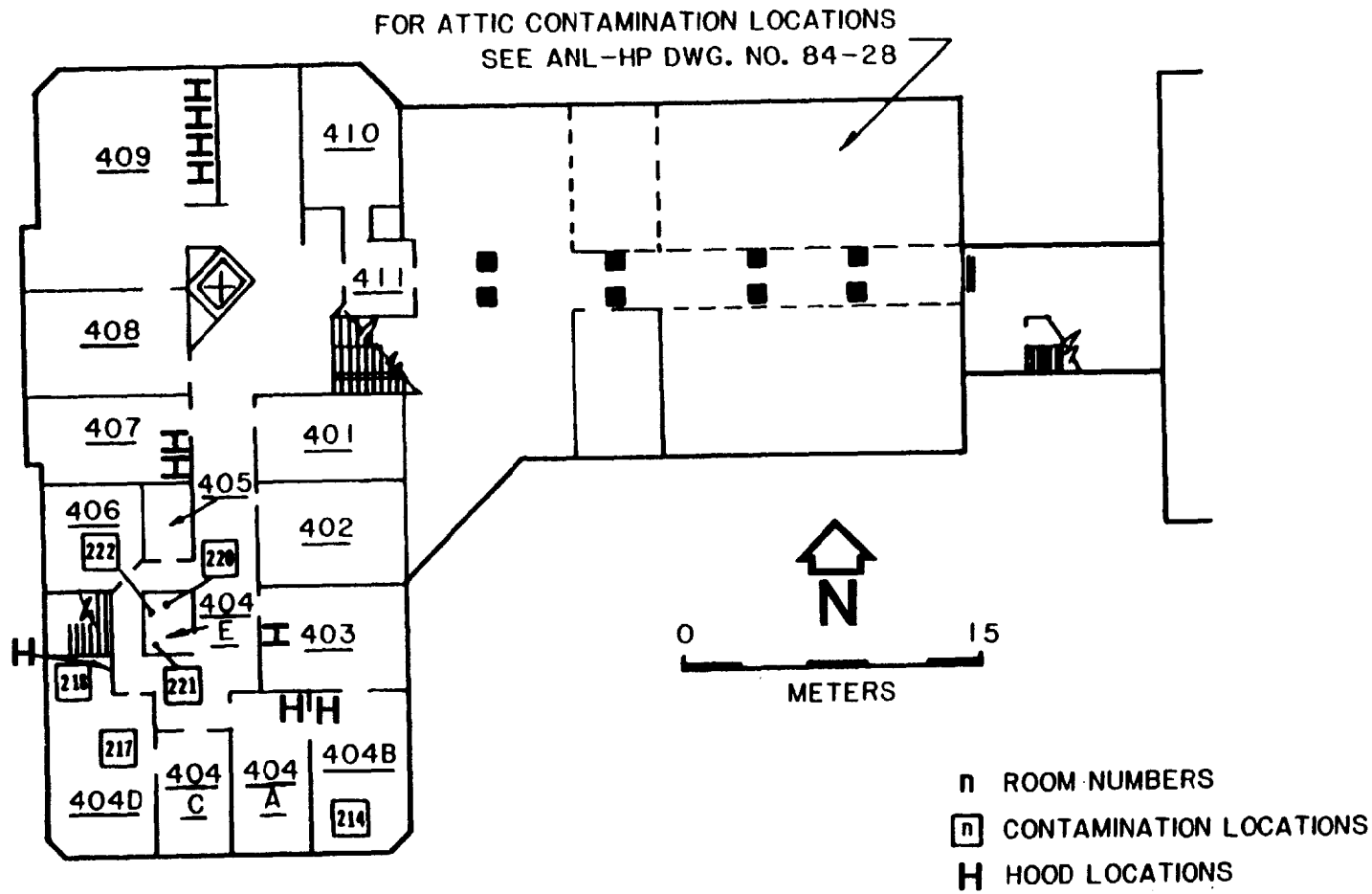


Figure 14. Jones Laboratory Fourth Floor.

ANL-HP DWG. NO. 84-30

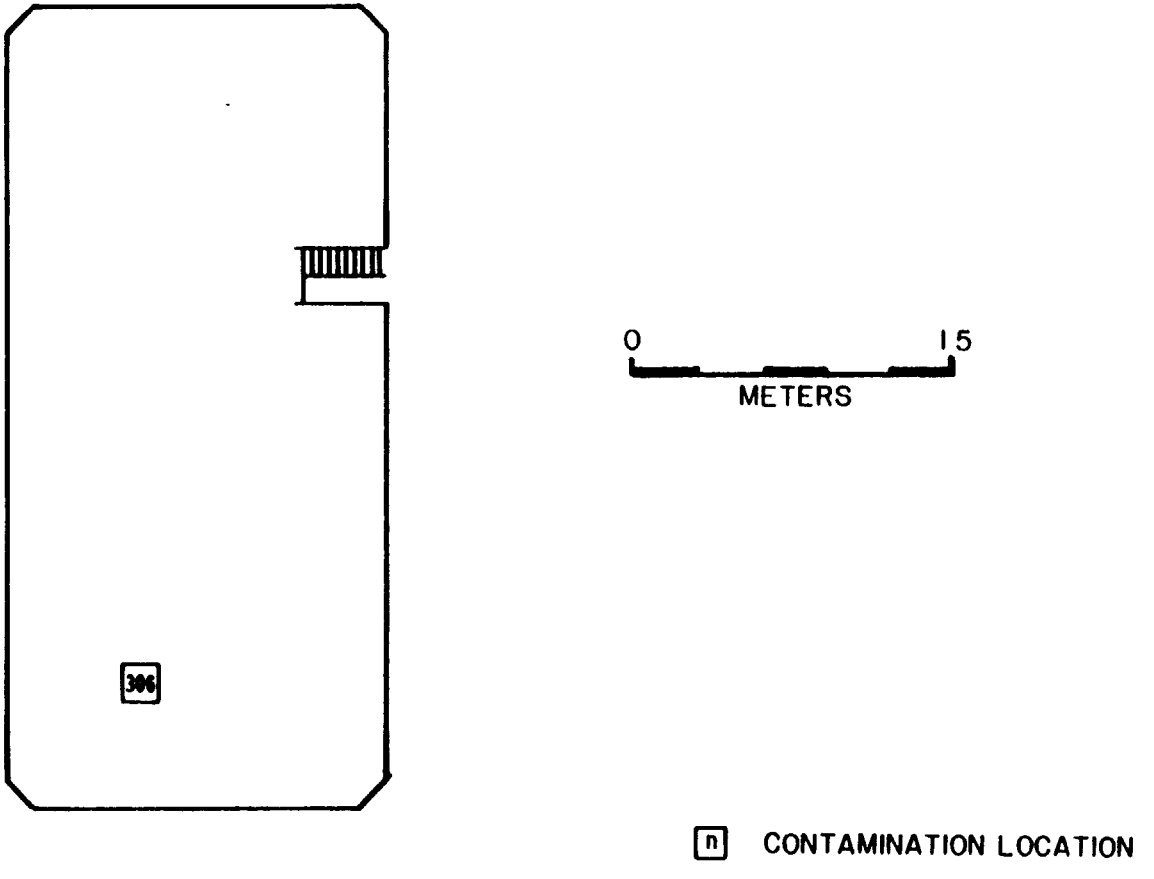


Figure15. Jones Laboratory Fifth Floor Fan Loft.

ANL-HP DWG. NO. 84-28

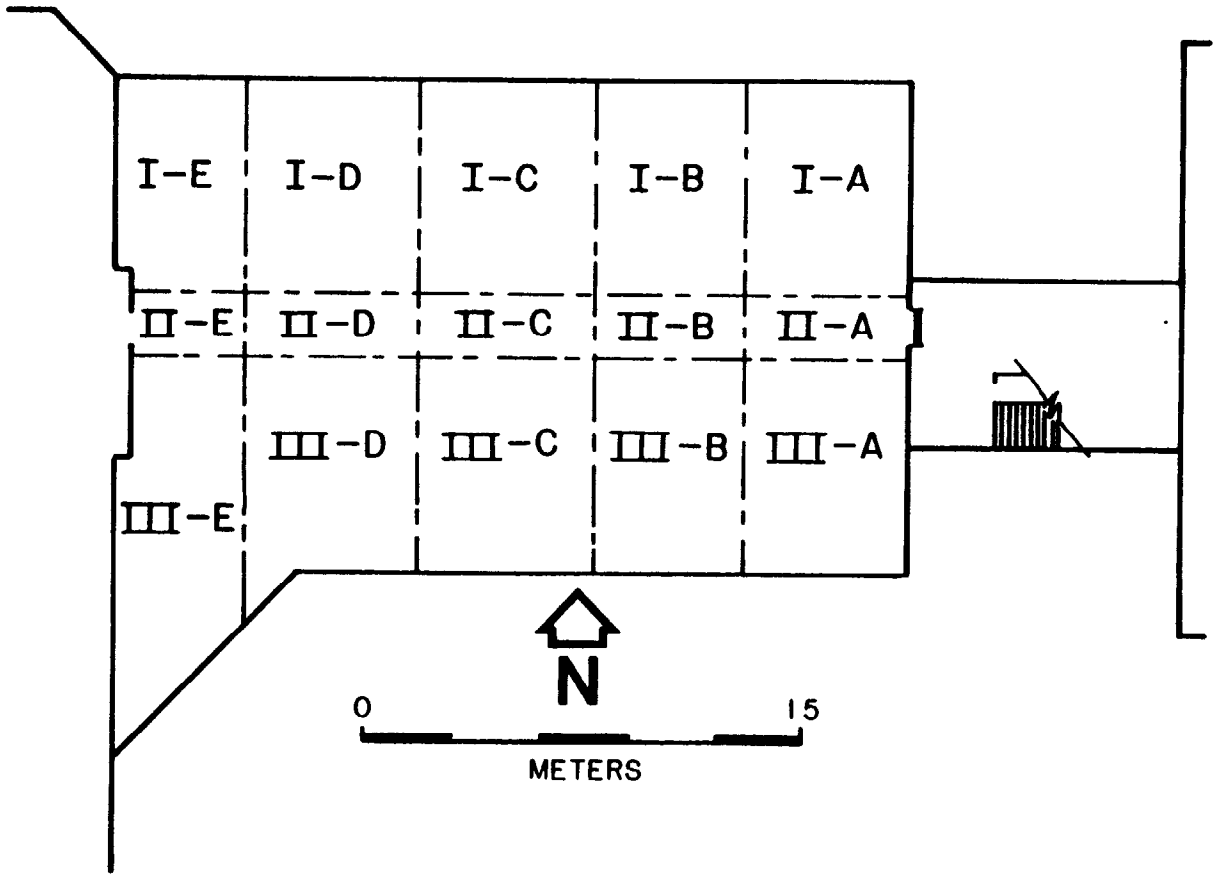


Figure 16. Jones Laboratory Fourth Floor Attic Sections.

ANL-HP DWG. NO. 84-29

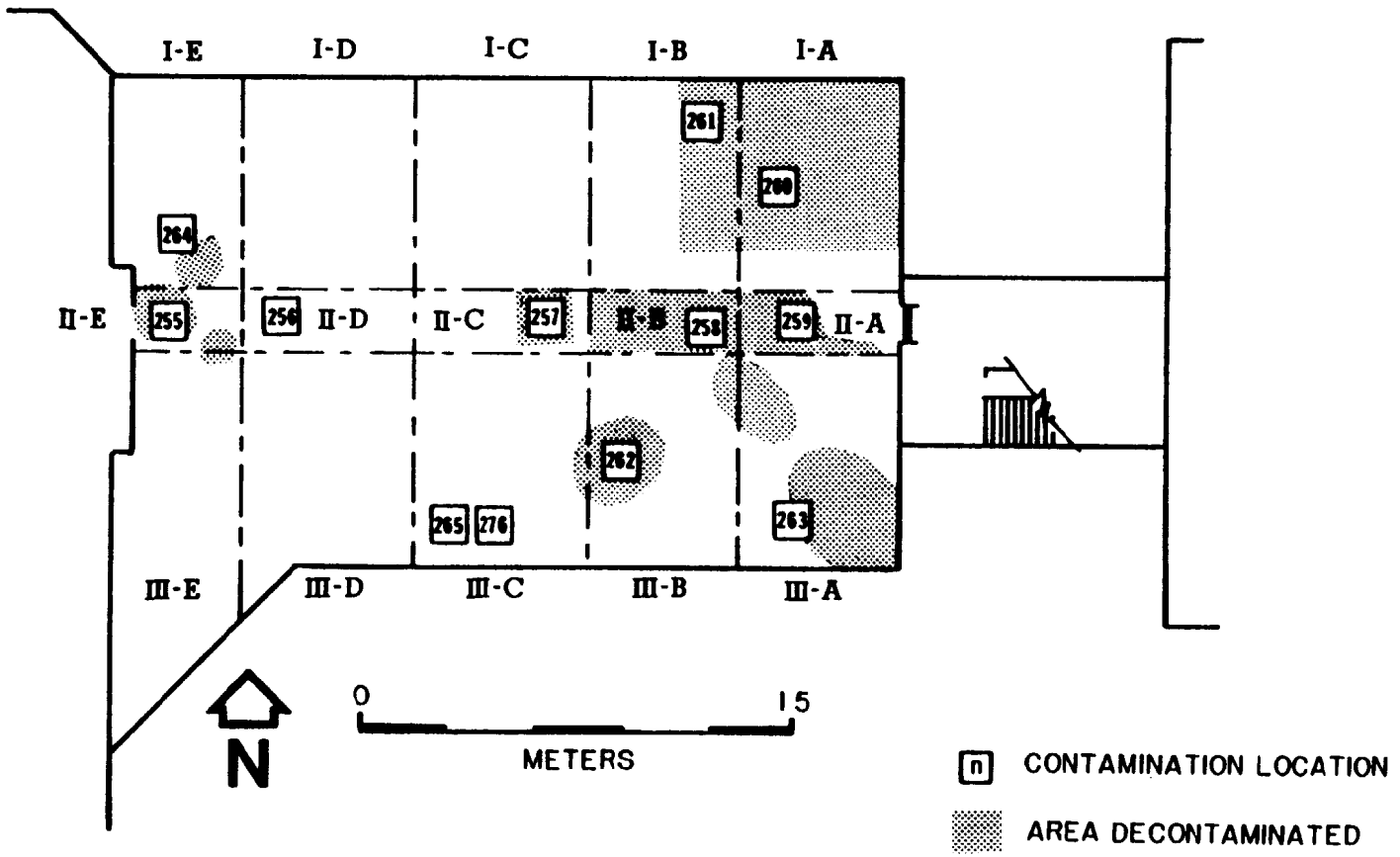


Figure 17. Jones Laboratory Attic Decontaminated Areas.

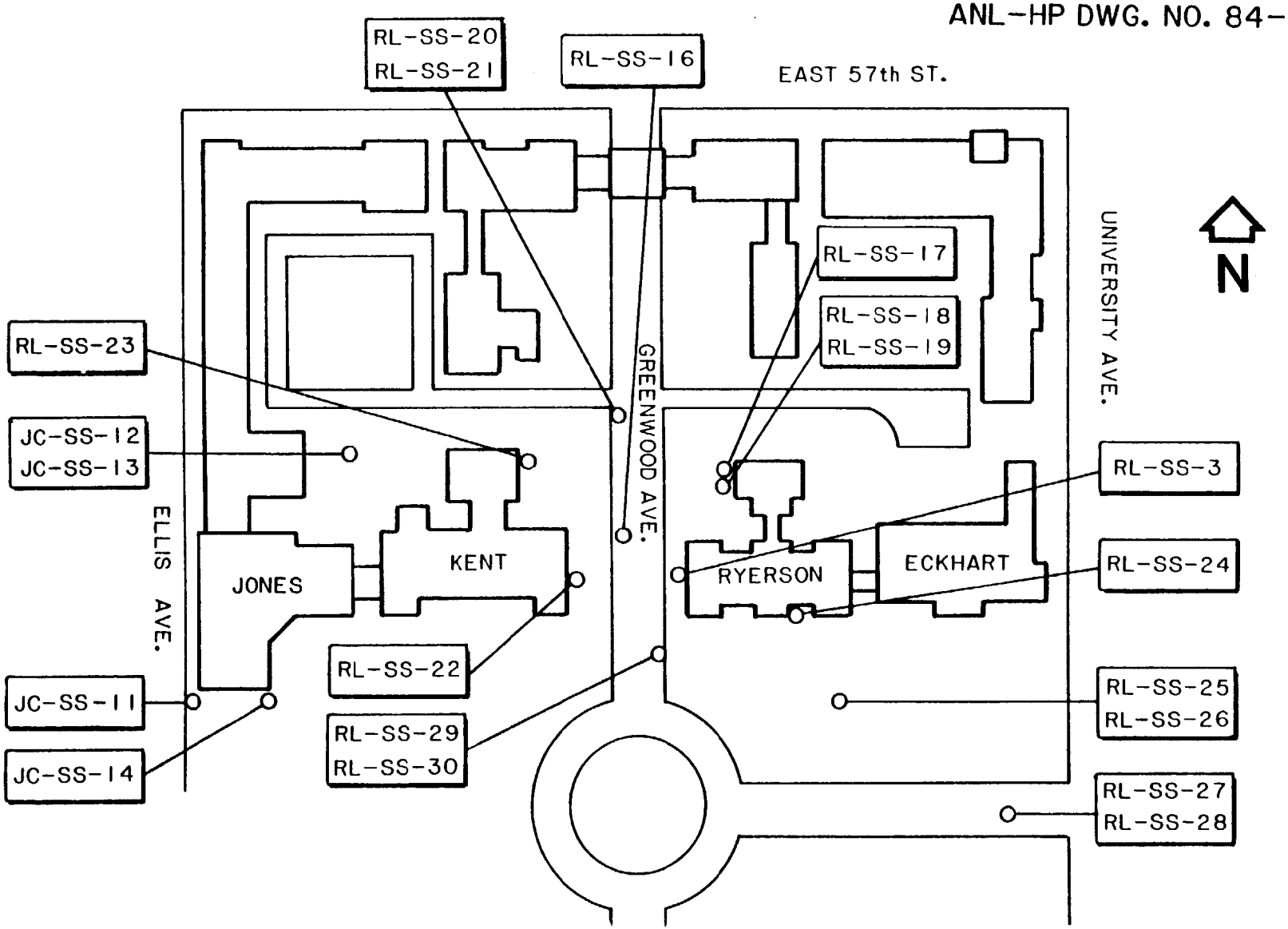


Figure18. Outside Sewer Sample Locations.

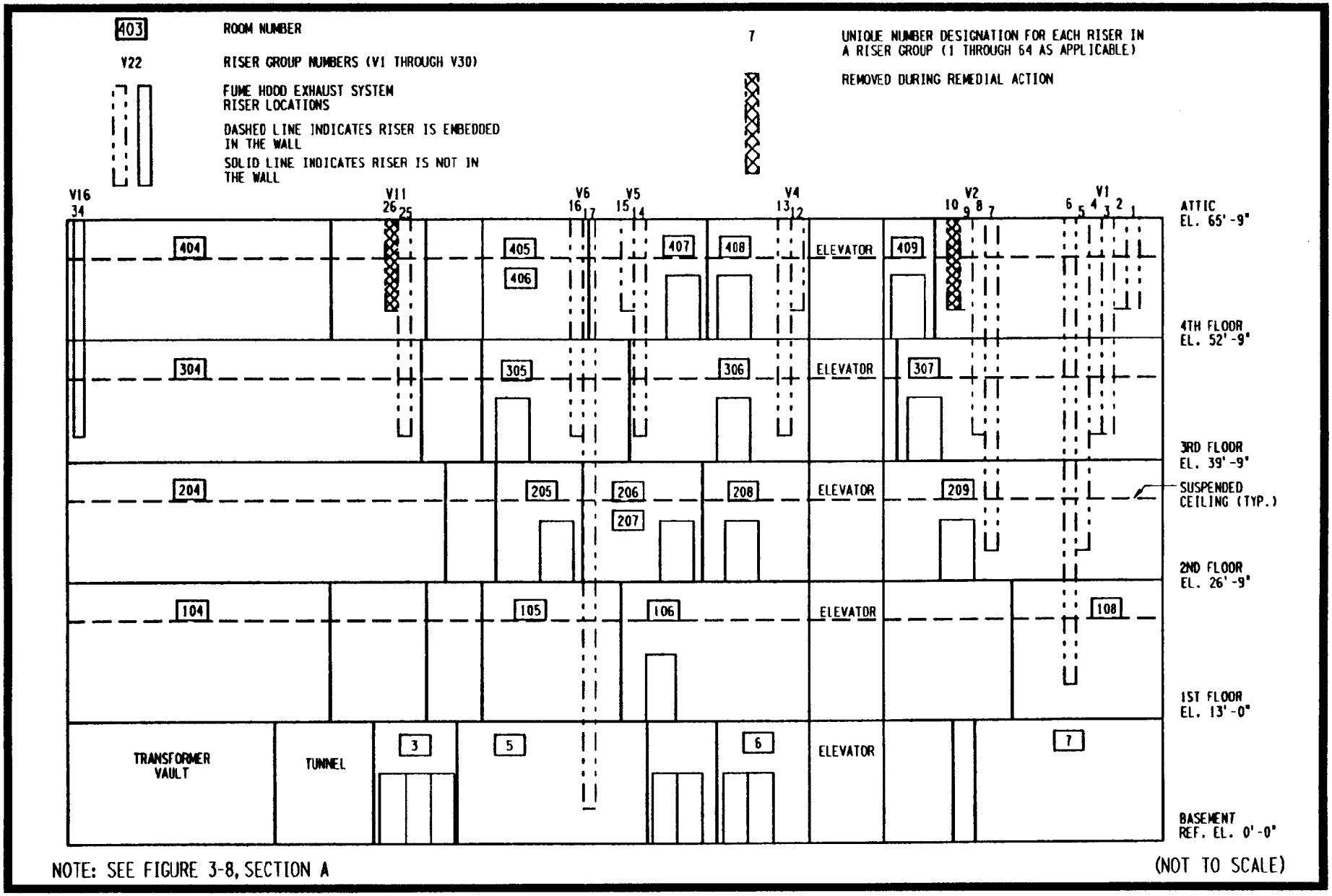


FIGURE 3-9 LOCATIONS OF DUCTS 10 AND 26

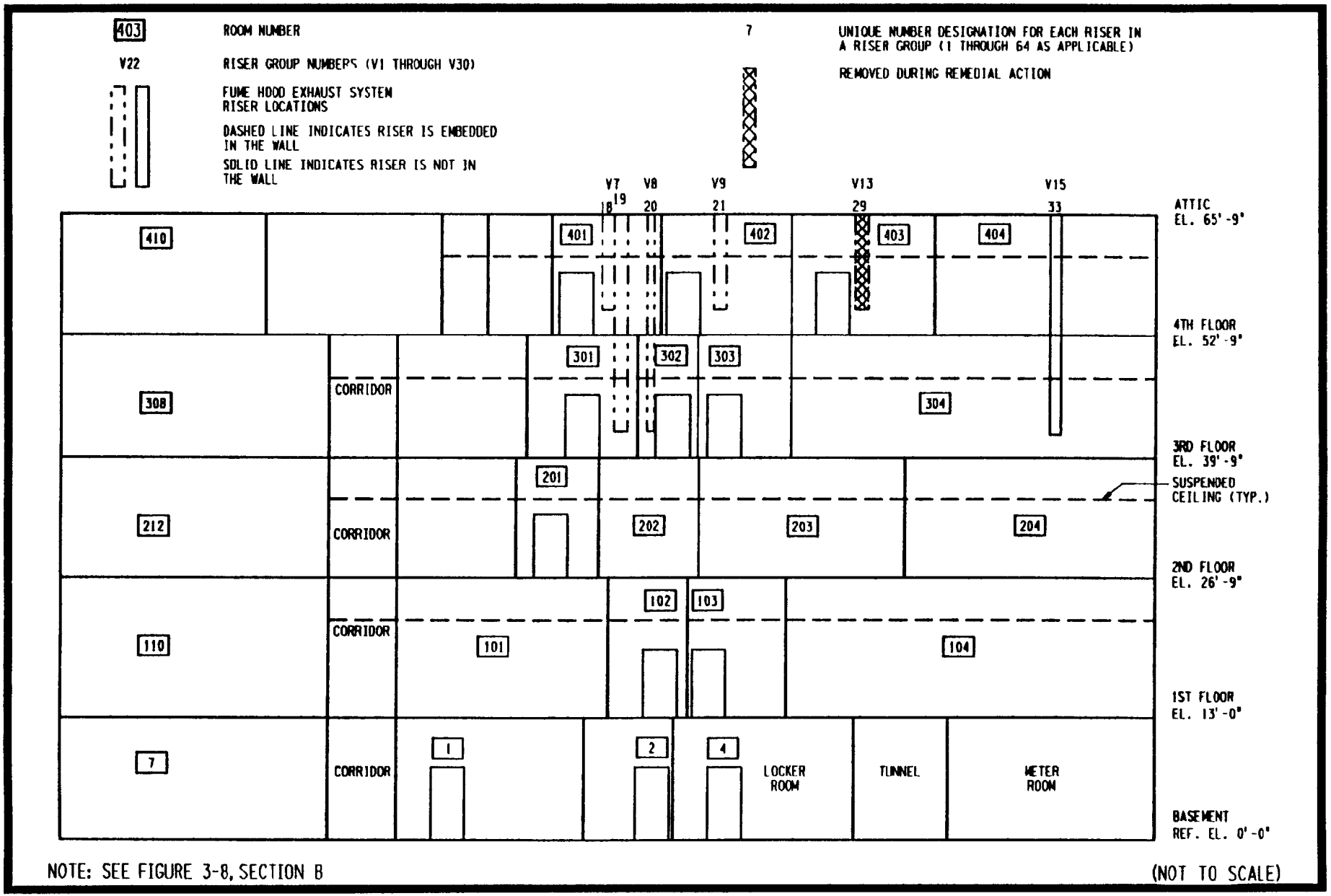
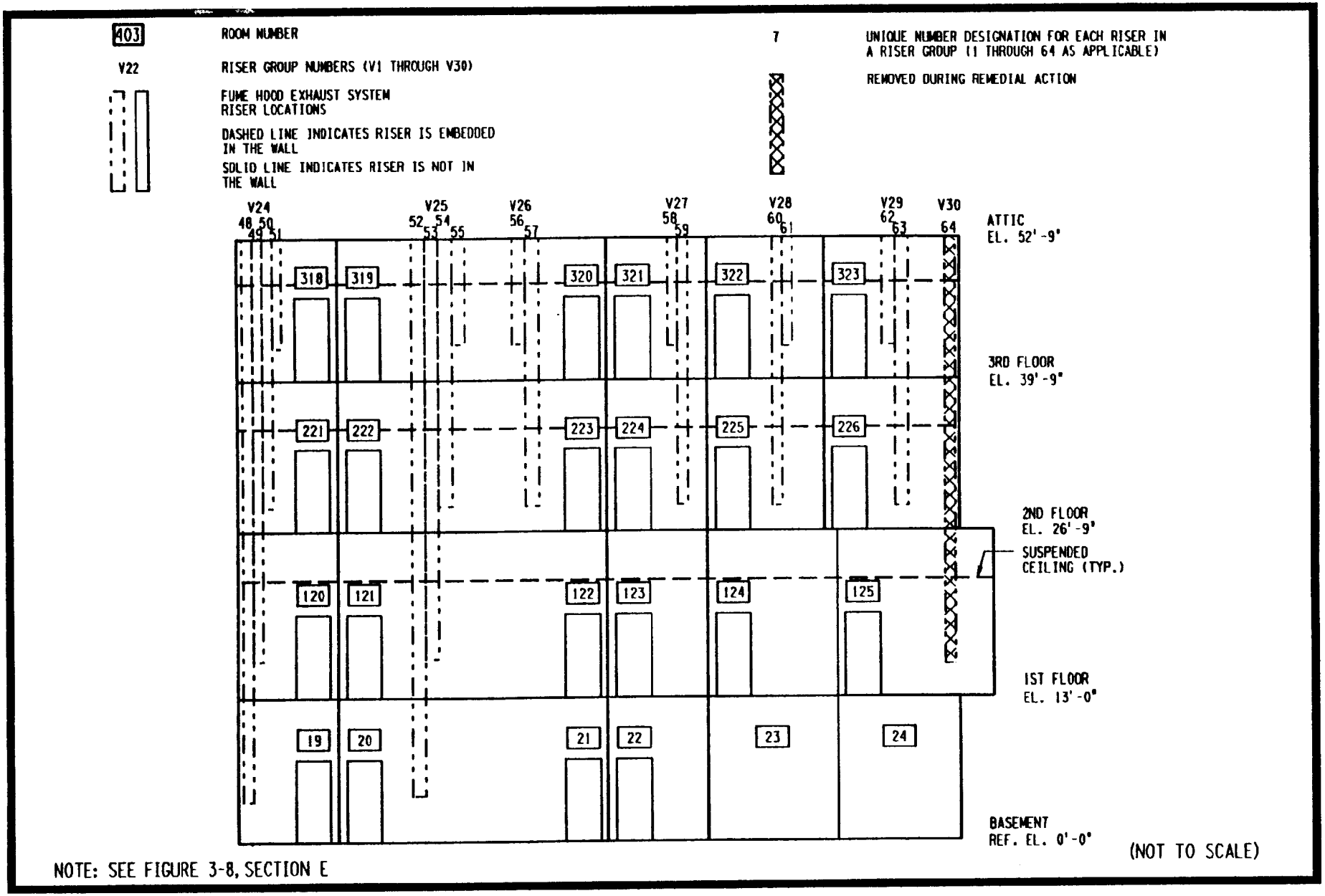


FIGURE 3-10 LOCATION OF DUCT 29

III-20

[42,12] C3IW9820.DGN



III-21

FIGURE 3-11 LOCATION OF DUCT 64

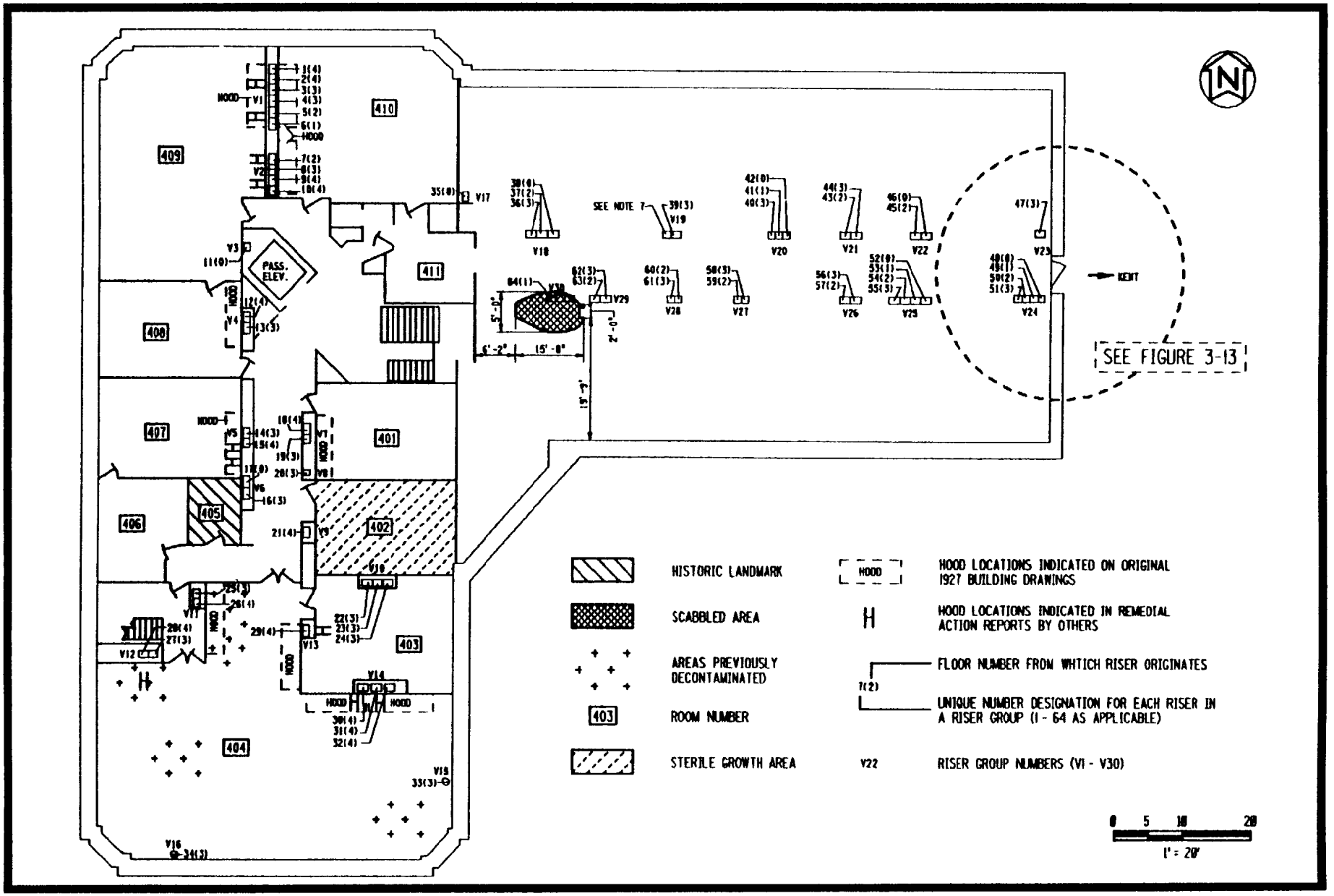


FIGURE 3-12 AREAS SCABBLED ON THE FOURTH FLOOR

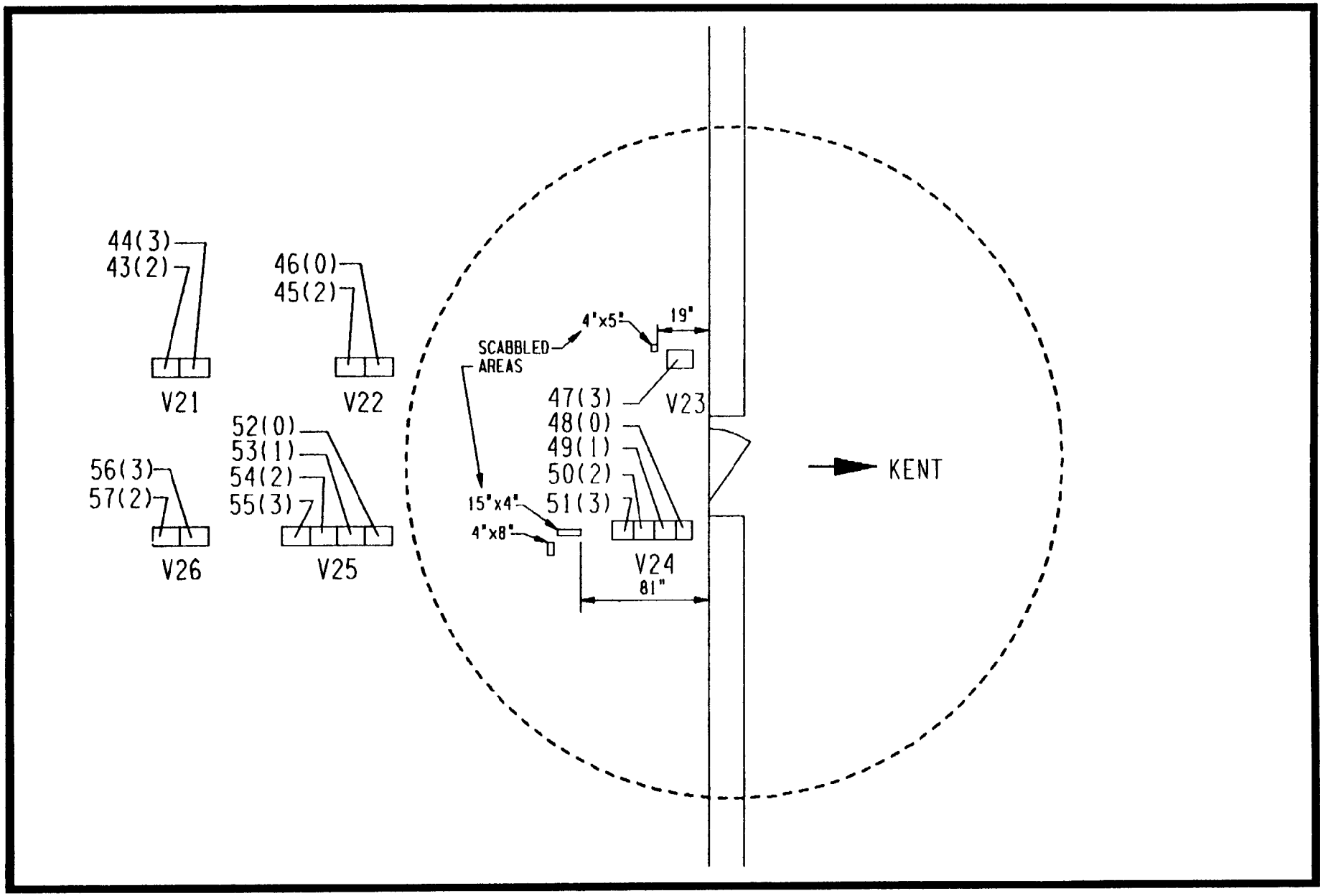


FIGURE 3-13 AREAS SCABBLED ON THE FOURTH FLOOR ATTIC FLOOR

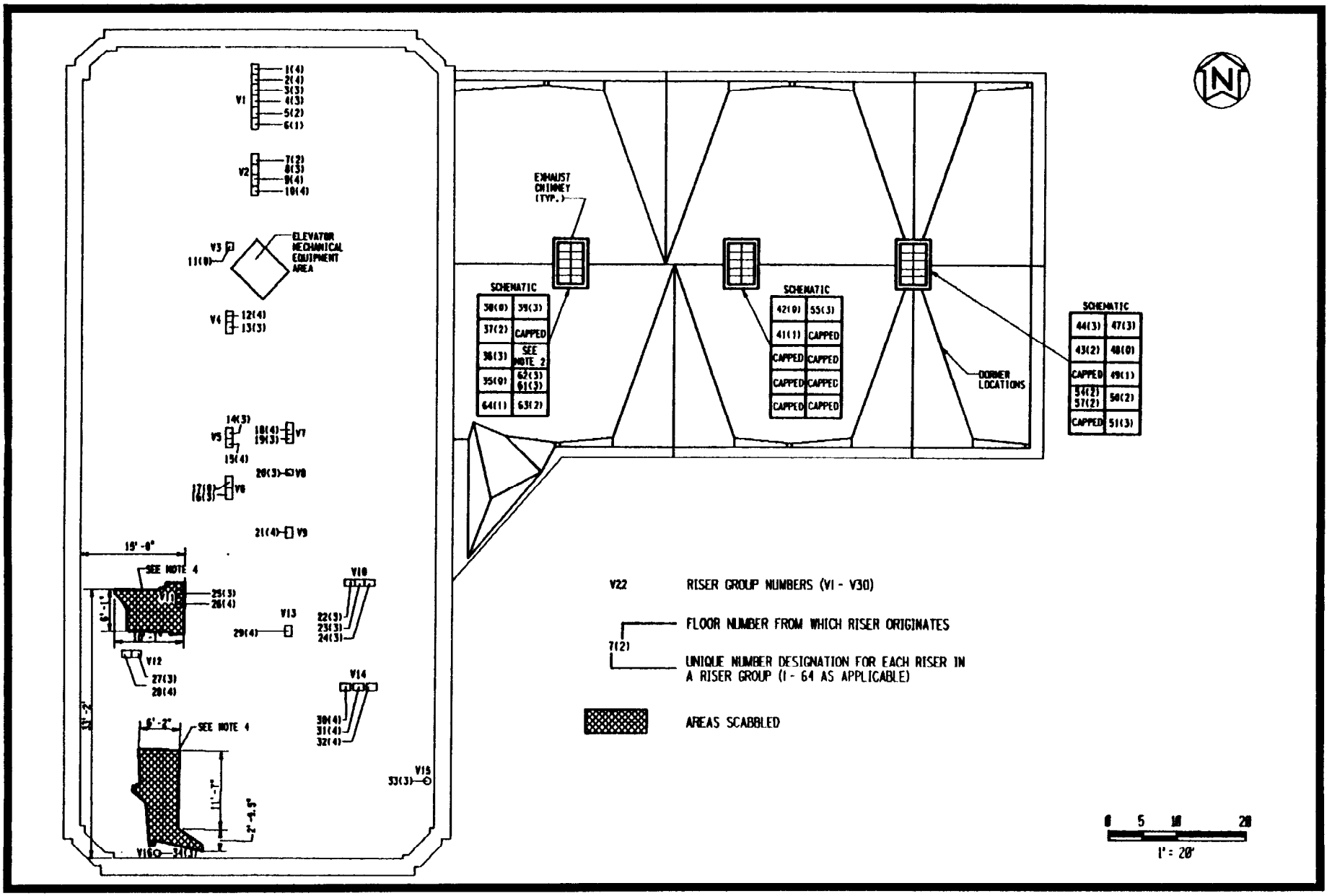


FIGURE 3-14 AREAS SCABBLED IN THE ATTIC

GRB: [42,12] C31W9823.DGN

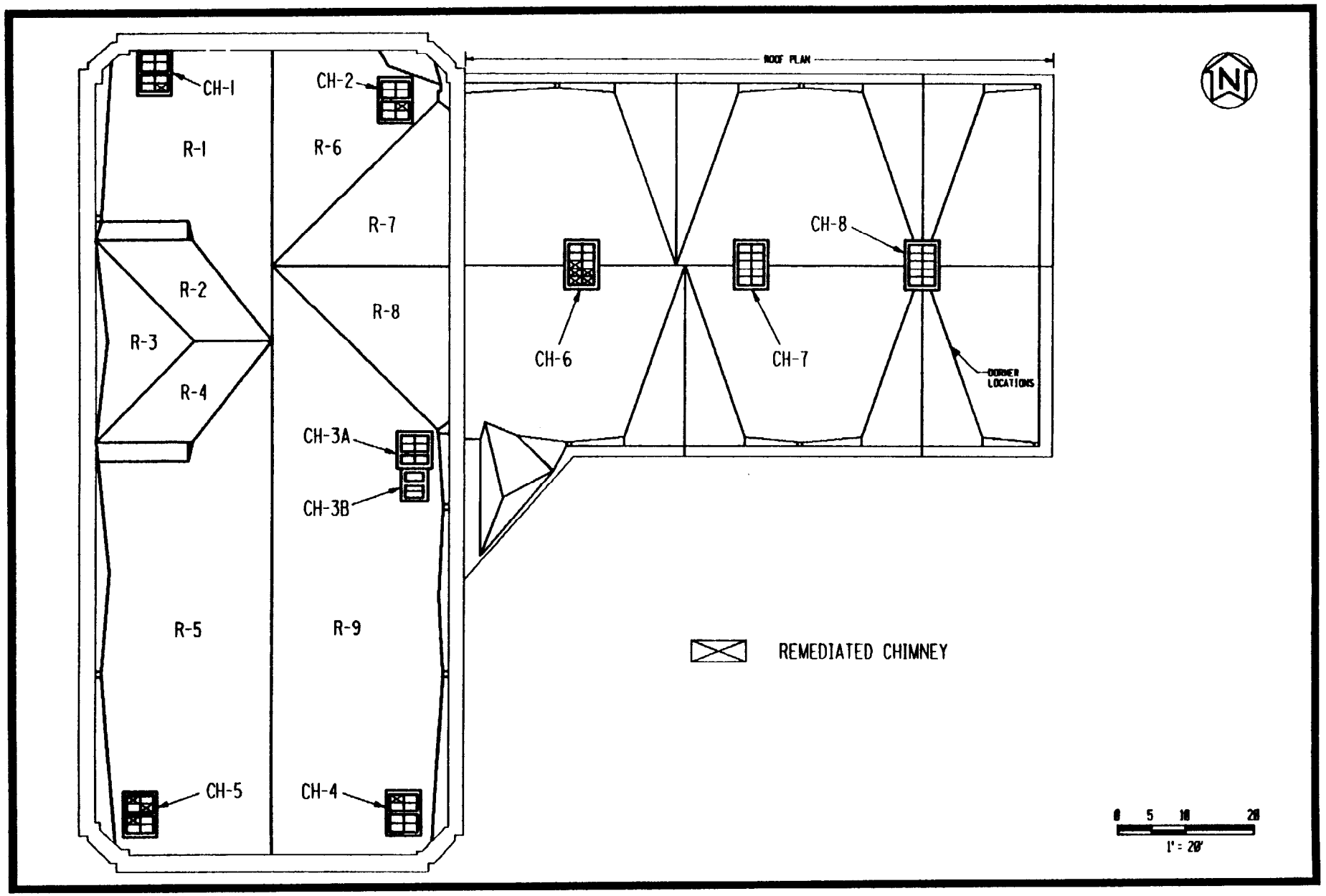


FIGURE 3-15 LOCATIONS OF CHIMNEYS THAT WERE REMEDIATED