Distribution Category:
Remedial Action and
Decommissioning Program
(UC-70A)

ANL-OHS/HP-84-105

ANL-OHS/HP--84-105

DE84 007819

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FORMERLY UTILIZED MED/AEC SITES
REMEDIAL ACTION PROGRAM
PROJECT MANAGEMENT PLAN
FOR THE DECONTAMINATION OF
JONES LABORATORY, RYERSON PHYSICAL LABORATORY,
AND ECKHART HALL
THE UNIVERSITY OF CHICAGO
CHICAGO, ILLINOIS

by

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January 1984

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TABLE OF CONTENTS

	<u>Page</u>
ABSTRACT	1
1. INTRODUCTION	2
2. FACILITIES DESCRIPTION	5
2.1 Purpose of the Facilities	5
2.2 Facility Location and Layout	6
2.3 Operational History	6
2.4 Present Condition	10
3. PROJECT OBJECTIVE	11
4. DISPOSITION MODE	12
5. ACTIVITY DESCRIPTION	12
5.1 Radiological Characterization	12
5.2 Personnel and Schedule	13
5.3 Subcontractor Use	14
5.4 Guidelines for Decontamination and Decommissioning Criteria	14
5.5 Radioactive Waste Disposal	15
5.6 Special Facilities and Equipment	15
5.7 Security	17
5.8 Operational Procedures	17
5.9 Onsite Training	17
5.10 Site Certification	18
5.11 Documentation	18
5.12 Public Relations	18
5.13 Personnel Bioassay	19
5.14 Site Decontamination	19
6. WASTE MANAGEMENT	20
6.1 Type and Volume	20
6.2 Packaging	21
6.3 Transport	21
6.4 Disposal	22
7. PROPERTY DISPOSITION	22
8. SAFETY EVALUATION	22
8.1 Safety Criteria	22
8.2 Radiological Safety	23
9. ENVIRONMENTAL ASSESSMENT	24
10. COST AND SCHEDULE	24
11. PROJECT CONTROL	26
12. PROJECT CLOSEOUT	27
REFERENCES	28

FIGURES

<u>No.</u>		<u>Page</u>
1	Site Location of The University of Chicago	7
2	The University of Chicago Campus	8
3	Waste Storage Bin M-III	16

TABLE

1	Cost Estimate for Decontamination of the Jones Chemical Laboratory, Ryerson Physical Laboratory, and Eckhart Hall . . .	25
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PROJECT MANAGEMENT PLAN FOR THE DECONTAMINATION OF
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ABSTRACT

The Department of Energy (DOE) has in place a plan for the decontamination and decommissioning of contaminated sites that had been formerly utilized by the Manhattan Engineering District (MED) and/or the Atomic Energy Commission. This plan is referred to as the "Formerly Utilized Sites Remedial Action Program" (FUSRAP). Among these sites are Jones Laboratory, Ryerson Physical Laboratory and Eckhart Hall of The University of Chicago at Chicago, Illinois.

This document represents the Project Management Plan for the decontamination of these facilities.

1. INTRODUCTION

During 1939 and 1940, U. S. interest in nuclear physics increased as a result of recent scientific discoveries, the war in Europe, and the possibility for development of an atomic bomb. During that time, the National Defense Research Committee (NDRC) was interested in constructing uranium piles that would maintain self-sustaining nuclear chain reactions. In connection with this interest, the NDRC in January 1941 contracted for the University of Chicago to make measurements on beryllium as a moderator for a uranium pile.

When the United States entered World War-II in December 1941, the nation's nuclear physics research effort was reorganized. The Office of Scientific Research and Development (OSRD) became responsible for all work related to nuclear chain reactions, and all emphasis was centered on production of an atomic bomb. The OSRD established the S-1 Committee to assume responsibility for scientific studies and measurements necessary to develop such a bomb. Individual committee members accepted responsibility for various aspects of the project. Dr. Arthur Compton, a professor at the University of Chicago, was responsible for the theoretical studies and experimental measurements necessary to produce element 94 (plutonium) for the bomb. Pursuant to this responsibility, a contract was initiated between the University of Chicago and OSRD in January 1942. Between then and the end of May 1942, pile experiments from Columbia and Princeton universities were transferred to the Metallurgical Laboratory (Met Lab), which was created on the University of Chicago campus.

To produce the large quantities of plutonium that was needed for the bomb, an intense source of neutrons was needed. (Plutonium is produced when neutrons

are absorbed by uranium.) Only uranium piles offered the possibility of creating this neutron source by producing a self-sustaining nuclear chain reaction. The first pile that was large enough to sustain a chain reaction was composed of uranium and graphite. It was constructed beneath the west stands of Stagg Field at the University of Chicago under the direction of Dr. Enrico Fermi. The self-sustaining condition was achieved on December 2, 1942.

During 1942, Dr. Compton also transferred all work on the development of methods for the purification of plutonium to the Met Lab. In April 1942, Dr. Glenn Seaborg arrived in Chicago with a group from the University of California at Berkeley to continue their chemical work on element 94 separation and purification. The work on plutonium chemistry and pile experiments, which involved use of the Kent Chemical Laboratory, the Ryerson Physical Laboratory, Eckhart Hall, and Jones Laboratory was conducted exclusively at the University of Chicago. At that time, the Clinton Laboratories in Tennessee (now Oak Ridge National Laboratory) started their pilot plant.

By June 1942 the Army Corps of Engineers took over responsibility for atomic bomb development and production forming the Manhattan Engineer District (MED) for this purpose. After the feasibility of producing plutonium had been demonstrated, the contract with the Met Lab at the University of Chicago was transferred from OSRD to MED on May 15, 1943. Experimental work at the Met Lab continued under MED until 1946, when the Atomic Energy Commission (AEC), a civilian organization, was created. At that time the name of the laboratory was changed from the Metallurgical Laboratory to Argonne National Laboratory (ANL).

Work under the AEC contract continued through 1952; when most of the activities were moved from the University of Chicago campus to the new site of Argonne National Laboratory in DuPage County.

A record search conducted in the 1970s did not reveal any documentation relative to radiation surveys or decontamination efforts that had been conducted in the University of Chicago facilities after termination of MED/AEC activities. Therefore, the U. S. Department of Energy (DOE) directed the Argonne National Laboratory (ANL) Radiological Survey Group (RSG) to perform radiation surveys of the facilities of concern to determine if any detectable radioactive contamination remained. The surveys were performed during the fall of 1976 and the summer of 1977. The results, as reported in earlier documents^{1 2 3 4}, indicated that some remedial action was needed in order to meet current radioactive material contamination guidelines.

Since 1977, the University has decontaminated Kent Chemical Laboratory prior to and concurrent with some facility renovations. In May 1983, DOE requested that the ANL Radiological Survey Group conduct a post-remedial-action survey of Kent Laboratory. The results are reported elsewhere.⁵ DOE also has requested ANL to perform the necessary remedial action on the remaining three facilities of interest (Jones and Ryerson Laboratories and Eckhart Hall) and to conduct an assessment of the radiological conditions of the sewer system for all four buildings. An assessment of the sewer system was not accomplished during the 1976-1977 radiological survey activities in accordance with DOE program directives at that time.

A plan for the decontamination of Jones Laboratory, Ryerson Physical Laboratory, and Eckhart Hall is presented in this document.

2. FACILITIES DESCRIPTION

2.1 Purpose of the Facilities

The three facilities covered in this decontamination plan are currently used for teaching and research purposes as a part of a major university complex. From 1942 until 1952, the Metallurgical Laboratory-Argonne National Laboratory utilized portions of these buildings for nuclear research and development activities that included the establishment of the first self-sustaining nuclear chain reaction. During the war years, research was primarily oriented toward military applications. After the war, nuclear research and development were oriented toward peaceful objectives, primarily reactor development and physical sciences research. However, as a consequence of nuclear research and development activities in the 1940s and 1950s, some small surface areas in the three facilities remain contaminated with low levels of radioactive material. Since the levels of contamination do exceed current day criteria, remedial action is specified.

2.2 Facility Location and Layout

The campus of the University of Chicago is on a 171-acre site in the City of Chicago, seven miles south of Chicago's Loop. It includes 127 buildings (Fig. 1). As shown in the campus plan (Fig. 2), Jones Laboratory, Ryerson Physical Laboratory, and Eckhart Hall are located in the approximate center of the campus, facing the central quadrangle.

2.3 Operational History

2.3.1 From Inception to Relocation in DuPage County

Starting in January 1941, the University of Chicago contracted with the Federal Government to perform certain research and development activities that included work involving uranium. The contract initially was with the National Defense Research Committee (NDRC). In January 1942, the Metallurgical Laboratory was organized on the university campus under the Office of Scientific Research and Development (OSRD). Nuclear research and development conducted during this period resulted in the establishment of the first controlled self-sustaining nuclear chain reaction in what was known as Chicago Pile-1 (CP-1). This occurred on December 2, 1942, under the West Stands of Stagg Field. Also at the University of Chicago, the element

Figure 1. Site Location of The University of Chicago.
ANL-HP Drawing No. 83-43.

Figure 2. The University of Chicago Campus.
ANL-HP Drawing No. 83-42.

plutonium was first isolated (August 18, 1942) and weighed (September 10, 1942) in Room 405 of the Jones Laboratory.

Responsibility for management of the nuclear research and development projects was transferred to the Army Corps of Engineers in June 1942. The projects were then associated with the Manhattan Engineer District (MED), formed to develop the atomic bomb. The Metallurgical Laboratory was transferred to the Army Corps of Engineers during May 1943. In 1946, following World War II, the responsibility was transferred back to civilian authorities, namely the Atomic Energy Commission (AEC). The name of the Metallurgical Laboratory was changed to Argonne National Laboratory, and in the early 1950s, operations were transferred from the University campus to the new Argonne National Laboratory site in DuPage County.

2.3.2 Deactivation of Campus Facilities

Upon transfer of nuclear activities to the DuPage site in the 1950s, the University campus facilities that had been used by Argonne National Laboratory and its predecessor, the Metallurgical Laboratory, were decontaminated to levels consistent with criteria then in force. These facilities included (among others) Jones Laboratory, Kent Chemical Laboratory, Ryerson Physical Laboratory, and Eckhart Hall. All radiological measurements associated with the decontamination effort of that time were conducted using state-of-the-art instrumentation and techniques prevalent in the early 1950s.

2.3.3 Radioactive Materials

Radioactive materials involved in the nuclear activities conducted on the campus ranged from activation and fission products through and including transuranic elements.

Based on initial radiological observations made during the 1976-1977 surveys, the predominant contaminants are expected to be natural uranium and normal uranium. The plutonium involved in this early work was in such miniscule quantities that it is not expected to contribute significantly to present contamination.

2.4 Present Condition

The three buildings Jones Laboratory, Ryerson Physical Laboratory, and Eckhart Hall are scheduled for remedial action in accordance with this plan. These buildings are now, and have been in the past, used as normal academic laboratories, classrooms, and offices. Contaminated areas, as determined by the ANL-Radiological Survey Group, are identified in reports DOE/EV-0005/23,⁴, DOE/EV-0005/24,³ and DOE/EV-0005/26.¹

At present, Kent Chemical Laboratory, which also was used for nuclear research in the 1940s and 1950s, is being gutted as part of a complete remodeling of the interior. The exterior portion of the

building will remain the same as the initial construction in the late 1890's. Kent Laboratory was decontaminated by the University of Chicago personnel to background levels, and verified by a post-remedial-action assessment conducted by the ANL Radiological Survey Group (ANL-RSG).⁵ During that assessment, ANL-RSG personnel determined that the building's sewer lines were radioactively contaminated. It is also suspected that radioactive contamination may be present in the sewer lines of the other three buildings. Assessment of the sewer lines was not conducted during the initial radiological assessment of the four buildings during 1976 and 1977. The DOE program office had determined at that time that such an assessment could be conducted in the future along with any remedial action activities.

3. PROJECT OBJECTIVE

The objectives of the Jones Laboratory, Ryerson Physical Laboratory, and Eckhart Hall remedial action are to (a) decontaminate (to levels commensurate with criteria for unrestricted use) those areas that were found to exceed the appropriate criteria during the 1976-1977 radiological assessment, (b) remove all contaminated items and decontamination material for disposal as radioactive waste, and (c) restore those areas defaced by decontamination efforts.

4. DISPOSITION MODE

Before the facilities are released for unrestricted use, all surface areas exhibiting contamination will be decontaminated and/or removed, and any areas defaced as a result of the decontamination operations will be restored. A comprehensive, documented radiological survey will be conducted to verify the final radiological status of the facilities and to ensure that appropriate levels of decontamination have been achieved prior to any recommendation for release of the facilities.

5. ACTIVITY DESCRIPTION

The lead contractor for this remedial action is Argonne National Laboratory (ANL). The Health Physics Section of ANL's Occupational Health and Safety Division will be responsible for all of the decontamination activities as described below.

5.1 Radiological Characterization

Results of the radiological characterization surveys conducted during 1976 and 1977 by the ANL-RSG will constitute the data base for all decontamination activities. In addition, an evaluation of the

radiological conditions of the sewer system associated with the facilities will be conducted.

5.2

Personnel and Schedule

Experienced health physics and reclamation specialists from ANL will constitute the primary source of operating (working) personnel. Ancillary personnel from disciplines such as industrial hygiene and safety engineering will be consulted as the need arises during the decontamination activities. Radiochemical analyses capabilities currently existing at ANL will be utilized as necessary. All scheduled work effort will be carefully coordinated with the designated representative from the University of Chicago. Every effort will be made to minimize any disruption of University of Chicago activities. The preliminary schedule is as follows:

Completion of Decontamination Plan	12/83
Completion of Remedial Action of Eckhart Hall	2/84
Completion of Remedial Action of Ryerson	
Physical Laboratory	4/84
Completion of Remedial Action of Jones Laboratory	8/84
Completion of Draft Decontamination Report	9/84

5.3 Subcontractor Use

When necessary, a subcontractor mutually agreed upon by Argonne National Laboratory and the University of Chicago will be used to restore areas defaced or removed during decontamination activities. Certain restoration activities may be conducted by tradesmen from Argonne National Laboratory and/or the University of Chicago as mutually agreed upon and as listed in the Two-Party Agreement⁶.

5.4 Guidelines for Decontamination and Decommissioning Criteria

Remedial Action Program Guidelines, as specified in DOE documents ORO-831⁷ and ORO-832⁸, will be applied. These guidelines generally embody Draft American National Standard N13.12⁹ and NRC Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source or Special Nuclear Material, July 1982¹⁰. The criteria applied will be at least as stringent as those specified in Rules and Regulations for Protection Against Radiation, Illinois Department of Public Health (as amended through July 1980)¹¹. "As-Low-As-Reasonably-Achievable" (ALARA) concepts will always be applied.

5.5 Radioactive Waste Disposal

All radioactive waste resulting from the decontamination activities will be packaged in M-3 bins (see Fig. 3) and transported to Argonne National Laboratory for shipment. It is recognized that the radioactive waste to be generated during this remedial action will be essentially material from previous occupancy of the facilities by the Metallurgical Laboratory-Argonne National Laboratory.

5.6 Special Facilities and Equipment

Decontamination activities will require only special instrumentation and equipment already available at ANL. This will include a mobile Health Physics Laboratory (Winnebago) equipped for direct surveys and field analysis at the decontamination site. Samples such as soil, water, sludge, etc., will be processed and analyzed at Argonne National Laboratory's analytical facilities. Decontamination equipment, solvents, radioactive waste containers, and similar materials will be supplied and maintained by ANL reclamation services (Waste Management Operations). All health physics and reclamation equipment and instrumentation to be used in the decontamination operations will be drawn from stock on hand. No need for procurement of additional special equipment or instrumentation is currently anticipated.

Figure 3. Waste Storage Bin M-III.
ANL-HP Drawing No. 84-3.

5.7 Security

Security for all facilities undergoing remedial action will remain the responsibility of the University of Chicago Security. Security of all ANL government property used at the site by ANL health physics and reclamation personnel shall be the respective responsibility of each ANL group.

5.8 Operational Procedures

State-of-the-art decontamination equipment, radiological survey techniques, safety requirements, and quality assurance measures will be used in the decontamination operations. Current surface contamination criteria will be applied. These criteria are as outlined primarily in ANSI 13.12⁹, NRC Guidelines,¹⁰ and the Illinois Rules and Regulations for Radiation Protection,¹¹ and are consistent with the proposed criteria of DOE's Remedial Action Program.

5.9 Onsite Training

All decontamination and health physics personnel engaged in the remedial action will be experienced or will work under the direct supervision of experienced personnel. Onsite training will only be provided if it is determined that such training is necessary for any subcontractor personnel or University of Chicago tradesmen that might be used during the onsite decontamination activities.

5.10 Site Certification

The U. S. Department of Energy Program Office has determined that second-party certification of the subject facilities will not be necessary¹². Results of a final radiological survey will be included in the decontamination report to be provided at the conclusion of the remedial action effort.

5.11 Documentation

Documentation of the remedial action will include a running log of the daily activities at each facility, sample records, photographs of the affected areas, maps and diagrams, and any other pertinent data relating to the decontamination operations. Radiological assessment data will include measurements of radiation levels before and after decontamination; air, sludge, and water sample data; and radionuclide identification where possible. Instrumentation calibration and operational checks will be recorded in accordance with ANL standard operating practice.

5.12 Public Relations

Upon request, ANL's Radiological Survey Group will provide DOE and the University of Chicago with assistance and technical information relative to inquiries and requests from the news media or the general public.

5.13 Personnel Bioassay

Personnel bioassays for those individuals involved in the actual decontamination efforts will be conducted in accordance with the prevailing routine now in force for the Radiological Survey Group and Reclamation Service personnel. In the event of an accidental release of radioactive materials, special samples will be submitted by all personnel involved. No other personnel bioassays should be necessary.

5.14 Site Decontamination

Decontamination of the residual radioactivity in Jones Laboratory, Ryerson Physical Laboratory, and Eckhart Hall will be accomplished utilizing standard procedures such as the application of solvents for metals, scabbling for concrete, etc. Items and materials that cannot be readily decontaminated will be removed and replaced as necessary. Areas and items to be decontaminated in the three buildings are those identified as contaminated in the Radiological Survey Reports DOE/EV-0005/23,⁴ DOE/EV-0005/24,³ and DOE/EV-0005/26.¹ All items and areas identified in those reports as being contaminated will be subject to an initial survey and as many followup surveys as needed to determine that the appropriate criteria, as established in section 5.4 of this Plan, have been met. Additional surveys will be conducted in those areas previously identified as contaminated when it appears that translocation of equipment or furniture has occurred.

Hoods and/or duct work suspected or known to be contaminated, as a result of Met. Lab-ANL activities, will be removed and disposed of as radioactive waste. Decisions on such matters will be made on a case-by-case basis.

Items and areas affected by decontamination operations will be restored or replaced (as determined on a case-by-case basis) subject to agreement between DOE, ANL, and the University of Chicago. A verbal agreement will be considered sufficient for these decisions.

Radiological assessments will be made of sewer lines and drains associated with Kent Chemical Laboratory, Jones Laboratory, Ryerson Physical Laboratory, and Eckhart Hall, but these lines and drains will not be removed as a part of this operation, even if they are known or suspected of being contaminated. Based on the results of the radiological assessments, a further determination will be made as to the need for future remedial action on the sewer lines.

6. WASTE MANAGEMENT

6.1 Type and Volume

An estimated 17 m^3 (600 ft^3) of solid, low activity contaminated building and decontamination materials will be removed from the remedial action sites. These materials are projected to be classified as Low Specific Activity (LSA) material as defined by the U. S.

Department of Energy and the U. S. Department of Transportation. Based on initial observations and 1976-1977 survey results, the predominant contaminants are expected to be natural uranium (uranium in equilibrium with its daughters) and normal uranium (uranium separated from its daughters).

No significant quantities of liquids are expected to be generated during the decontamination activities. Any small quantities of potentially contaminated liquids that are generated during the decontamination effort will be concentrated, solidified, and disposed of as contaminated solid waste.

6.2 Packaging

All contaminated materials will be placed in standard M-3 ANL shipping bins (see Fig. 3) that meet DOT and DOE standards. These bins qualify as "Type A packaging" (49 CFR 171) and are acceptable at low-level waste disposal sites.

6.3 Transport

The waste bins will be transported to the ANL site in DuPage County by an ANL vehicle. The total quantity of waste generated by this remedial action should not exceed a single shipment.

6.4 Disposal

The radioactive wastes generated will be disposed of by Argonne National Laboratory.

7. PROPERTY DISPOSITION

Decontamination of the entire site to levels consistent with unrestricted release criteria, except the sewer systems, is expected to be completed during FY 1984. Uncontaminated rubble that might be generated will be disposed of locally.

Comprehensive health physics surveys, as specified in Section 5, will be used to ensure the appropriate disposition of radioactive and nonradioactive wastes.

8. SAFETY EVALUATION

8.1 Safety Criteria

All decontamination activities will be performed with the highest regard for employee and public safety. Working procedures will conform with DOE health and safety criteria and guidelines. These guidelines cover general safety, industrial hygiene, environmental health, fire protection, and radiation safety.

8.2 Radiological Safety

Trained health physics personnel will supervise radiation protection of the personnel engaged in the remedial action and provide advice on the disposition of material. The health physics effort during the decontamination will have the following purposes:

- a. To ensure that the decontamination effort is carried out in accordance with the radiation protection standards contained in DOE Order 5480.1 and in 10 CFR 20, and especially with regard to the as-low-as-reasonably-achievable (ALARA) principle.
- b. To provide radiation surveys and evaluations of work procedures and to ensure that exposures of personnel and spread of contamination are minimized.
- c. To make radiation field measurements and radionuclide identifications and to assess the type and activity concentration of radioactive material contained in waste.
- d. To maintain records of instrument and smear surveys, air sampling data, radionuclide identification and concentration, and personnel exposures.

- e. To perform radiation surveys and other necessary evaluations to determine the disposition of materials with respect to the release criteria.
- f. To document by final in-situ radiation surveys and analyses of samples that decontamination efforts have achieved the desired results and that all release criteria have been met.

9. ENVIRONMENTAL ASSESSMENT

An evaluation of the effort that will be involved in this decontamination activity has led to the conclusion that a formal environmental assessment for this project is unnecessary.¹³

10. COST AND SCHEDULE

The decontamination of these facilities will be conducted with the convenience of the University of Chicago in mind so as to minimize any interference with classroom and/or laboratory activities. The projected schedule is outlined in Section 5.2; the cost estimate is detailed in Table 1.

Table 1

Cost Estimate for Decontamination of the Jones Chemical Laboratory,
Ryerson Physical Laboratory, and Eckhart Hall

University of Chicago

Waste Management Operations	\$ 37,400.00
Manpower Costs	
Repair/Restoration Costs	46,100.00
Health Physics Field Supervision and Surveillance	45,000.00
Analyses and Documentation, including Final Report	31,500.00
Sewer Line Assessment	15,000.00
Waste Packaging, Shipment, and Burial	15,000.00
Contingency	50,000.00
ANL Laboratory Overhead	<u>60,000.00</u>
	\$300,000.00

11. PROJECT CONTROL

The U. S. Department of Energy (DOE) has the overall responsibility for this project. The Oak Ridge Operations Office (ORO) has been delegated the responsibility for overseeing the activities of the lead contractor. All activity will be conducted with the full knowledge of the DOE-Chicago Operations Office. To assist in accomplishing this disclosure of activity, the Chicago Operations Office will receive copies of all reports and correspondence, related to the remedial action. In addition, verbal progress reports will be periodically provided to the Chicago Operations Office contact.

The lead contractor (ANL) will manage and control all decontamination work. Contractor responsibilities will include planning, budgeting, scheduling, and documentation, as well as managing the work force.

Details of each stage of the decontamination will be documented in monthly progress reports through the standard monthly reporting process. These progress reports will serve as the basis for a control mechanism to identify deficiencies and ensure that any necessary corrective action is taken prior to completion of the project.

12. PROJECT CLOSEOUT

A final project report documenting the final state of the facilities will be issued upon completion of the scheduled tasks.

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