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NSP

Northern States Power Company

414 Nicollet Mall
Minneapolis, Minnesota 55401-1927
Telephone (612) 330-5500

May 22, 1992

10 CFR Part 30

U S Nuclear Regulatory Commission
Region IV
Material Radiation Protection Section
611 Ryan Plaza Drive, Suite 1000
Arlington, TX 76011

JUL 4 1992

Pathfinder
Byproduct Material License No. 22-08799-02

Amendment Request No. 11

Enclosed please find two copies of the application for Amendment No. 11 to Byproduct Material License No. 22-08799-02. This amendment requests unrestricted use status for the Reactor Building and the Fuel Handling Building.

Amendment No. 10 was issued on June 28, 1990, which authorized the decommissioning of the Reactor Building and the Fuel Handling Building. We have completed decontamination and decommissioning operations in the Fuel Handling Building and the Reactor Building (including the Fuel Transfer Vault). As part of the decommissioning activities, a final survey was performed by NSP to verify that contamination levels of the Fuel Handling Building, the Reactor Building, and the Fuel Transfer Vault were below the Regulatory Guide 1.86 standards for unrestricted public use. The results of the final survey are enclosed as Attachment 1. Upon issuance of Amendment No. 11 and the granting of unrestricted access to the decommissioned buildings, we plan to demolish the Reactor Building and use the Fuel Handling Building as part of the fossil generating facility.

The Pathfinder Atomic Power Plant was converted from a nuclear reactor facility to a fossil fueled generating plant in the late 60's. Fossil fueled boilers use the steam plant originally used by the nuclear reactor. Small quantities of byproduct material exist in the plant today. The nuclear portion of the plant has been dismantled and decommissioned in accordance with Amendment No. 10.

This Amendment No. 11 will allow NSP to maintain the 10 CFR Part 30 license at the Pathfinder site for the possession of minimal quantities of byproduct material in the plant. Normal maintenance will be conducted under this license until the plant is retired from service. At that time, the remaining contaminated areas will be surveyed and decontaminated as necessary and we will request the termination of the 10 CFR Part 30 license.

License Fee Information
on appl

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DECOMMISSIONING RECORDS

Northern States Power Company

Please contact us if you have any questions regarding this amendment request.

Thomas M Parker
Manager
Nuclear Support Services

c: Director NMSS, NRC
D Fauver, NMSS, NRC (3 copies)
W Fisher, Region IV
Catherine Hunt

Attachments:

1. NRC Form 313
2. Supplemental Information for the Proposed Amendment No. 11
3. Qualifications and Experience of Myron A Davis
4. Pathfinder Final Survey Report

NRC FORM 313
(9-88)
10 CFR 30, 32, 33, 34, 35 and 40

COPY

APPLICATION FOR MATERIAL LICENSE

COPY

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED BY OMB
3150-0120
Expires: 6-30-90

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATIONS FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

U.S. NUCLEAR REGULATORY COMMISSION
DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY, NMSS
WASHINGTON, DC 20555

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS. IF YOU ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION I
NUCLEAR MATERIALS SAFETY SECTION B
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION II
NUCEAR MATERIALS SAFETY SECTION
101 MARIETTA STREET SUITE 2900
ATLANTA, GA 30323

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION III
MATERIALS LICENSING SECTION
799 ROOSEVELT ROAD
GLEN ELLYN, IL 60137

ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
MATERIAL RADIATION PROTECTION SECTION
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TX 76011

ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION V
NUCLEAR MATERIALS SAFETY SECTION
1450 MARIA LANE, SUITE 210
WALNUT CREEK, CA 94596

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTION.

1. THIS IS AN APPLICATION FOR (*Check appropriate item*)

- [ ] A. NEW LICENSE
- [X] B. AMENDMENT TO LICENSE NUMBER 22-08799-02
- [ ] C. RENEWAL OF LICENSE NUMBER ______

2. NAME AND MAILING ADDRESS OF APPLICANT (*Include Zip Code*)

Northern States Power Company
Nuclear Support Services Department
414 Nicollet Mall
Minneapolis, MN 55401

3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED.

Pathfinder Generating Plant
Route 2
Sioux Falls, South Dakota

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Thomas M Parker, Manager - Nuclear Support Services

TELEPHONE NUMBER

612-337-2030

SUBMIT ITEMS 5 THROUGH 11 ON 8½ x 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL
a. Element and mass number, b. chemical and/or physical form, and c. maximum amount which will be possessed at any one time.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSEE FEES (*See 10 CFR 170 and Section 170.31*)

FEE CATEGORY 14

AMOUNT ENCLOSED $ 0.00

13. CERTIFICATION. (*Must be completed by applicant*) THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, AND 40 AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948, 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

SIGNATURE—CERTIFYING OFFICER	TYPED/PRINTED NAME	TITLE	DATE
Thomas M Parker	Thomas M Parker	Manager Nuclear Support Services	

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	COMMENTS
AMD	June 3 TV	14	Full Cost

AMOUNT RECEIVED	CHECK NUMBER
—	—

APPROVED BY

DATE 6/16/92

NRC FORM 313 (9-88)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 7.5 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE OFFICE OF INFORMATION AND REGULATORY AFFAIRS, OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

Attachment 2

Supplemental Information for Proposed Amendment No. 11
to Byproduct Material License No. 22-08799-02

NRC Form 313, Item 5 - "Radioactive Material"

a. Element and Mass Number :

Any Byproduct Material

b. Chemical and/or Physical Form :

Materials and corrosion products activated by Pathfinder nuclear reactor operations during the period from 1964 - 1967.

c. Maximum Amount Which Will Be Possessed At Any One Time

Not to exceed 0.041 Curies total.

(561.816 Ci)

During decommissioning activities, a total of approximately 562 Curies of radioactive waste materials were removed from the buildings and shipped offsite for processing and/or burial at licensed facilities. The remaining byproduct material of less than 0.041 Curies is contained in the Pathfinder fossil plant systems. These systems consist of all the equipment in contact with the steam generated or condensate produced by the nuclear plant. The radioactive material in this system is the result of initial deposits accumulated during nuclear plant operations.

An area in the Turbine Building basement, where the reactor system penetrations into the reactor containment were capped, was caged to isolate this area from the rest of the Turbine Building. This area was previously used to store solid radioactive waste materials until sufficient quantities could be accumulated to warrant offsite shipment for burial. During decommissioning operations, the radioactive material in this caged area was removed and shipped offsite. The caged area was then dismantled and surveyed as part of the decommissioning process.

NRC Form 313, Item 6 - "Purpose For Which Licensed Material Will be Used"

The byproduct materials contained in the fossil plant are a result of the previous operation of the plant as an atomic power station from 1964 to 1967. In 1968, the plant was repowered for operation as a fossil peaking facility. In 1970, the nuclear fuel was removed from the plant site. The nuclear steam supply and associated systems, along with the nuclear related facilities, were then partially decommissioned and placed in a safe storage (SAFSTOR) configuration in 1971. The 10 CFR Part 30 license number 22-08799-02, as amended through Amendment No. 10, currently allows long term storage of byproduct material at the Pathfinder site.

Decommissioning activities have removed all but a very small portion of the byproduct materials from the plant site. The remaining byproduct material is in the form of fixed contamination in the current fossil plant. There is no practical way to remove the remaining byproduct material, which is estimated to total less than 0.041 Curies.

NRC Form 313, Item 7 - "Individual(s) Responsible for Radiation Safety Program"

During decommissioning activities at the Pathfinder site, Albert Kuroyama (NSP), Pathfinder Decommissioning Project Manager, was assigned the responsibility for the project radiation safety program. Since decommissioning activities have now been completed, the responsibility for the project radiation safety program has been reassigned to Myron A. Davis. Mr. Davis was the Pathfinder Radiation Protection Supervisor during decommissioning activities at the plant and had the responsibility for the day to day implementation of the radiation safety program. Prior to decommissioning, Mr. Davis was in charge of radiation control at the Pathfinder nuclear plant during its initial operating phase from 1964 to 1967 and subsequent placement in safe storage configuration (SAFSTOR) in 1971. He also worked as a Radiation Protection Specialist at the NSP Monticello Nuclear Plant prior to his reassignment to the Pathfinder plant for decommissioning. A record of Mr. Davis' job qualifications and work experience is included in Attachment 3.

NRC Form 313, Item 8 - "Training for Individuals Working in or Frequenting Restricted Areas"

The completion of decommissioning activities in the Fuel Handling Building and the Reactor Building has reduced the amount of radioactive material remaining in the Pathfinder plant to insignificant quantities.

The Pathfinder steam plant contains less than 0.041 Curies of radioactive material. Essentially all of this activity is entrapped within the oxide scales of the system. Although corrosive and erosive actions resulted in the distribution of small amounts of activity throughout other areas of the steam plant, the major portion of this material remains where it was originally deposited when the plant was operated as a nuclear facility.

Except for maintenance activities, the fossil system is sealed. The radiation levels on the exterior surfaces of the fossil system generally fall below the 10 CFR Part 20, Section 20.1301 radiation dose limits for permissible levels of radiation in an unrestricted area.

Radiation protection training will not be required for personnel involved in normal plant operation or maintenance. Whenever maintenance is performed where the radiation dose limits of 10 CFR Part 20, Section 20.1301 could be exceeded, workers will receive General Employee Training which complies with Institute of Nuclear Power Operation standards. In addition, maintenance in an area which is restricted or posted will be supervised by the Radiation

Safety Officer or a Radiation Protection Specialist from one of Northern States Power Company's operating nuclear power plants.

NRC Form 313, Item 9 - "Facilities and Equipment"

Decommissioning activities have been completed in the Fuel Handling Building, the Fuel Transfer Vault, and the Reactor Building including a final survey of the buildings. The completion of these activities has resulted in the removal of all structures, components, and piping from the Pathfinder Dismantled Facilities which were placed in SAFSTOR. This reduction in the amount of byproduct material contained on the Pathfinder site has significantly reduced the potential for radiological hazards.

The decommissioning consisted of removing the contamination from the Reactor Building, the Fuel Transfer Vault, and the Fuel Handling Building to meet NRC Regulatory Guide 1.86 criteria.

The Pathfinder Generating Plant is operational as a fossil plant and provides power during periods of peak demand. The plant is currently staffed 8 hours per day during a normal work week (Monday through Friday). A security force and restricted area fence are not required. There will no longer be a need to maintain the security force and the restricted area boundary fence around the Pathfinder plant. These security measures were required during decommissioning activities when contaminated systems in the Reactor Building and the Fuel Handling Building were being dismantled. As a security measure, the Turbine Building will generally be manned or locked.

Presently there are less than 0.041 Curies located in steam plant systems. Radioactive contamination levels on all accessible exterior surfaces in the plant will be maintained below 1,000 dpm beta-gamma per 100 cm^2 averaged over a square meter.

The radiation levels at the exterior surfaces of the fossil system generally fall below the following 10 CFR Part 20, Section 20.1301 radiation dose limits for permissible levels of radiation in an unrestricted area:

a.) 100 millirems/yr
b.) 2 millirems/hr

A recent survey of the fossil system in April, 1992 determined that the highest measurements exist in the condensate pump suction lines from the condenser hotwell, which is located in the Turbine Building basement. These areas were found to have radiation exposure levels significantly below 1 mr/hr at one foot. These areas are slightly above 1 mr/hr at 1 cm but do not extend into normal operating areas. They will be posted and access of non-workers into these areas will be controlled. Over six years of general area surveys have shown that the background radiation in these areas does not exceed 0.1 mr/hr. Operators on rounds will spend no more than four hours per operator per week in these areas. Rarely, "if at all," are close approaches to the areas required. All of these areas have been marked with warning signs which caution operating personnel to limit exposure.

Personnel radiation exposure records maintained over the last two years show no radiation exposure above background was received by the operations and maintenance personnel at the Pathfinder Site.

It should also be noted that all of these areas of measurable contamination are located in areas that, during normal operations, are not occupied. Further, whenever the plant is manned, these areas are inspected at least once every four hours by operators making their routine plant rounds. The "accidental" undetected wandering of any person into these areas for the length of time required (approx. 250 hours/quarter) to obtain an exposure above the permissible levels of radiation in an unrestricted area is unlikely.

Accordingly, it can be concluded that the presence and operation of the Pathfinder Fossil System with its contained byproduct material will not result in significant or unreasonable radiation exposure to plant personnel or the general public.

<u>NRC Form 313, Item 10 - "Radiation Safety Program"</u>

The completion of decommissioning of the Reactor Building and the Fuel Handling Building have resulted in a significant reduction of byproduct material at the Pathfinder site. The byproduct material existing within the fossil plant consists of less than 0.041 Curies of radioactive material. All of this material is the result of deposits accumulated in the systems used during reactor operation. Essentially all of this activity is entrapped within the oxide scales. Although corrosive and erosive actions have resulted in the distribution of small amounts throughout much of the new fossil system, the major portion of this material remains fixed where originally deposited.

Except for maintenance activities, the existing plant systems are closed. Access to the interior requires equipment disassembly. Entrance into components of the plant where the radiological hazard potential is unknown or where a significant radiological hazard is known to exist will be in accordance with an NSP radiation protection procedure and records will be maintained. Significant special plant maintenance which could cause a radiological hazard will be performed with adequate radiological protection prescribed. All entrances will be conducted in a manner that complies with the requirements of 10 CFR Part 20, "Standards for Protection Against Radiation".

A surveillance program will be implemented to periodically survey the plant. The surveys will measure radiation levels, surface contamination levels, and check for physical deterioration. These surveys will be performed every 18 months plus or minus 25%. In addition, a survey of all affected areas will be performed any time a condition has occurred or is detected that may have or has jeopardized the integrity of the contaminated area piping or structural boundaries.

Radiation surveys will be performed for the pertinent areas prior to and during special maintenance which could present a significant radiological hazard. Procedural guidance as to when surveys are required will be maintained at the site.

The radiation on the exterior surfaces of the plant systems will generally be below 10 CFR Part 20, Section 20.1301 levels for unrestricted areas, but localized areas with radioactivity above 1 mr/hr at 1 cm will be permitted, provided the following requirements are met:

- The localized area does not extend into the normal daily operating areas.

- The area will be conspicuously marked and the area will be posted as necessary to meet the requirements of 10 CFR Part 20, Section 20.1901 and Section 20.1902.

- All non-workers entering into any of the areas will be escorted by a Pathfinder plant or NSP employee.

Removable contamination levels within all unrestricted areas of the plant will be maintained below 1,000 dpm beta-gamma per 100 cm^2 average over a square meter. All radiation levels are to be measured in accordance with established procedures and with calibrated measuring devices.

Prior to use, in support of the radiological control program, instruments will be verified to have been calibrated throughout its ranges in known gamma fields. Calibration frequencies will be at least annually. These calibrations will be performed by a vendor or at one of NSP's nuclear generating plants utilizing sources which are traceable to a National Institute of Standards and Technology source.

Personnel radiation monitoring devices will not be required for personnel involved in normal plant operation or maintenance. Whenever maintenance is performed where radiation contamination is suspected or the radiation dose guidelines of 10 CFR Part 20, Section 20.1502 could be exceeded, appropriate monitoring devices will be issued to workers.

<u>NRC Form 313, Item 11 - "Waste Management"</u>

Presently there is less than 0.041 Curies of radioactive material distributed throughout the fossil plant. All of this material is the result of deposits accumulated during reactor operation. Essentially all of this activity is entrapped within the oxide scales and even though corrosive and erosive actions have resulted in the distribution of small amounts throughout much of the new fossil system, the major portion of this material remains where originally deposited.

The radioactive wastes generated during maintenance of the fossil plant will consist of contaminated dry trash such as paper, rags and metals. It is expected that any activity will mainly be Co-60. The solid dry waste will be collected and packaged in containers meeting Federal DOT specifications. These containers will be stored within the plant in a restricted and locked area until sufficient quantities are accumulated to warrant offsite shipment for burial, in accordance with 10 CFR Part 71.

An extensive radiological monitoring program was in effect during decommissioning operations of the Reactor Building and the Fuel Handling Building. Radiological measurements were taken of samples of ambient air, ground water, surface water, drinking water, bottom river sludge, raw milk, fish, plants, and soil. From the results of the analysis of these samples, no detectable isotopes of plant origin were found.

The small amount of radioactive material calculated to remain in the fossil plant systems precludes the possibility of significant airborne release of radioactive material to the environment. No monitoring of routine plant airborne releases is therefore required and no additional environmental monitoring for the effects of plant airborne releases is necessary.

Liquid effluent from the plant may contain trace amounts of Co-60. This would occur only during draindown of the fossil system which is done approximately once per year. The liquid is discharged to settling ponds and not directly to the Big Sioux River. The radiological surveillance program has included extensive water sampling since June, 1972. Baseline water sample surveys were performed prior to then. The sample program has consistently shown that normal Co-60 levels did not exceed 0.1% and that no samples exceed 1% of the levels specified in 10 CFR Part 20, Appendix B, Table II. Calculations and records show that less than 1 microcurie/year of radioactivity has been released in liquid effluents since 1972. Based on this data, no monitoring of routine plant liquid releases is therefore required and no additional environmental monitoring for the effects of plant liquid releases is necessary. Procedural guidance for special liquid sampling will be maintained at the site.

Air surveys and water samples taken for a period of six years during SAFSTOR resulted in levels at or near minimum detectable activities. This indicates that during normal plant operation there will be no liquid effluents in excess of exempt concentrations and no airborne levels above background.

Fossil plant surveys for radiation and contamination levels and previous exposure records show that the possibility of external personnel exposure due to the radiation from the fossil system is extremely low.

Therefore during normal operation, appropriate surveys will be made, as necessary and in accordance with procedures, for entrances into components of the fossil system where the radiological hazard is unknown or where a significant radiological hazard is known to exist. These abnormal operations represent the only potential for internal personnel exposure or release of significant effluents. Compliance with 10 CFR Part 20, Section 20.1501 will be achieved by surveys during these abnormal operations.

NRC Form 313, Item 12 - "Licensee Fees"

We expect this review will be done at full cost as it is related to decommissioning, reclamation or site restoration activities in accordance with the 10 CFR Part 170, Section 170.31, Table Item 14. Therefore, no check is attached for the amendment fee. If this is not the case, please notify us and we will send a license amendment fee.

RESUME

MYRON A DAVIS

EXPERIENCE;

NORTHERN STATES POWER CO. March 1964 to Present

Nuclear Engineering and Construction

November 1988 I was given the responsibility of setting up the radiation protection program for the Pathfinder Project.

My present responsibilities are:

Supervisor Radiation Protection for the Pathfinder Decommissioning Project; which includes radiation safety, exposure control, radioactive material control, radwaste shipping, environmental monitoring,

Monticello Nuclear

February 1974 transferred to Monticello Nuclear Plant as Radiation Protection Specialist.

My assignments at Monticello Nuclear have been:
Radiation protection work, plant chemistry, emergency planning coordinator, department purchasing coordinator and radioactive material shipping coordinator; which includes the processing and shipment of Radioactive Materials, Part 71 review on purchase orders and shipping procedure review and revision.
Development and coordination of Volume Reduction program. Development and coordination of the plant emergency plan. Routine plant radioactive and cold chemistry monitoring, plant radiation surveys, exposure control and instrument calibration and repair.

Pathfinder plant

Radiation & Chemical Technician. March 1964 to March 1972

This included all the radiological and chemical analysis and radioactive material shipping.

Chemical & Instrument Technician. March 1972 to February 1974

After pathfinder was decommissioned my work assignment was changed to include plant instrumentation along with my chemistry work.

SOUTH DAKOTA AIR NATIONAL GUARD.

May 1960 to August 1969 Airframe Repairman. Technical Sergeant supervising the repair of aircraft, airframe and Fiberglas components.

GAGE BROTHERS CONCRETE PRODUCTS CO.

October 1959 to March 1964 Chief draftsman and field supervisor. Drawing field prints for concrete items. This included layouts and calculations of reinforcing and prestress cables. Field supervisor for the erection of products.

EDUCATION;

I attended South Dakota State University from September 1956 to June 1959 with general studies in Engineering.

OTHER QUALIFICATIONS

I am a member of the National Registry of Radiation Protection Technologists. I have been involved with EPRI in the ASME Radwaste workshop for many years and have been a discussion group leader for 3 years. I am a member of the Monticello Lions club in which I have held many offices including president. I have been a director of the Monticello Hospital board and on our church council for 6 years.

ATTACHMENT 4

Pathfinder Final Survey Report

FINAL SURVEY REPORT
FOR THE
PATHFINDER ATOMIC PLANT

Prepared By
Chem-Nuclear Systems, Inc.
Columbia, South Carolina 29210
May 1992

Prepared For
Northern States Power Company

TABLE OF CONTENTS

TABLES

FIGURES

FIGURES
Continued

FIGURES
Continued

1.0 BACKGROUND

1.1 Reason for Decommissioning

The Northern States Power (NSP) Pathfinder Atomic Plant located northeast of Sioux Falls, South Dakota was decommissioned and placed in Safe Storage (SAFSTOR) in 1971. NSP decided to proceed with final decommissioning of the nuclear portions of the plant due to rising low-level waste disposal costs, uncertainty in the direction of future regulatory changes, and the eventual need to perform this work. NSP has decommissioned the nuclear facilities at the Pathfinder site to allow demolition of the Reactor Building (RB) and release of the Fuel Handling Building (FHB) for non-nuclear use.

1.2 Scope

The scope of this decommissioning was to obtain final clearance of the RB, FHB, and the Fuel Transfer Vault (FTV) for unrestricted use. Other areas of the facilities are not included in this decommissioning.

1.3 Management Approach

NSP developed a ten step Decommissioning Plan (ref. 1) to accomplish the decommissioning of the Pathfinder Plant. The primary objectives of this plan are to meet the requirements of the United States Nuclear Regulatory Commission (NRC) Regulatory Guide 1.86 (ref. 2) for the RB and FHB, demolish the RB and restore the RB area, and achieve unrestricted access for the FHB, FTV, and the Temporary Loading and Storage Building commonly referred to as the Rad Waste Storage building (RWS). The steps in the plan are:

1) Provision for temporary plant services and construction of RWS required for decommissioning
2) Area cleanup and disposal of SAFSTOR decommissioning wastes
3) Asbestos removal and disposal
4) Piping, equipment and recirculation pump removal
5) Reactor Building containment opening and reclosure
6) Reactor vessel removal
7) Bioshield activated/contaminated concrete removal
8) Decontamination of remaining contaminated areas
9) Final survey
10) RB Demolition

NSP submitted the Decommissioning Plan on July 18, 1989 and received NRC approval to proceed on June 28, 1990 with License Amendment #10 . This Final Survey Report documents actions taken through completion of step nine, the Final Survey. Following NRC acceptance of this Final Survey Report and issuance of a License Amendment the RB demolition will be allowed.

464271

Quality Assurance (QA) was an important element of the Pathfinder Project throughout the decommissioning process including the final survey. The project Decommissioning Plan included a limited QA plan patterned after the 18 QA criteria of 10 CFR Part 50 Appendix B for nuclear power plants.

During the early stages of the project, Pathfinder decommissioning procedures were developed and implemented to control the QA aspects of the project. These procedures established requirements for the design, performance, documentation, and retention of records for the decommissioning project.

2.0 SITE DESCRIPTION - PATHFINDER ATOMIC POWER PLANT

2.1 Facility Type and Location

The Pathfinder Atomic Power Plant is located 5.5 miles northeast of Sioux Falls, South Dakota. The nuclear steam supply system (NSSS) was a 66 MWe boiling water nuclear reactor designed by Allis-Chalmers Manufacturing Company of Milwaukee, Wisconsin.

The Pioneer Service and Engineering Company of Chicago, Illinois, provided architectural and engineering services for the construction project. The NSSS consisted of a boiling water reactor with a center superheat section and three recirculation loops. The total heat output was approximately 203 MWt.

2.2 Ownership

The Pathfinder Atomic Power Plant is owned and was operated by Northern States Power Company (NSP) of Minneapolis, Minnesota.

2.3 Facility Description

The Pathfinder Site contains the decommissioned nuclear facilities and a building housing a gas/oil fired boiler as shown in Figure 2-1 in Appendix B. The main non-decommissioned structures within the secured area are: the Security Office, the Cooling Tower, the Water Treatment Building, the Administration Building, the Turbine Building, the Boiler Building, and the Warehouse. The structures within the scope of this decommissioning are: RB, FHB, and FTV. The RWS is a temporary structure erected for use during this decommissioning project. The plant now uses the turbine and cooling tower, originally built for the nuclear plant, with the gas/oil fired boiler. The plant is now used as a peaking plant.

Fuel Handling Building

The FHB is adjacent to the RB as shown in Figure 2-2 in Appendix B. The FHB contained the spent fuel pool and most of the liquid waste processing equipment. The Basement Floor, Figure 2-3 in Appendix B, contained the purification coolers, the spent resin tank (extending up through the Mezzanine), concentrated waste storage tank, waste demineralizer, waste surge tank, and the low solids holdup tank (extending up through the Mezzanine). The Mezzanine Floor (elevation 1310'), Figure 2-4 in Appendix B, held the feedwater filters, reclaimed water storage tank, and the high solids holdup tank. The Operating Floor (elevation 1327'), Figure 2-5 in Appendix B, provided access to the spent fuel pool and to the lower floors of the FHB.

Reactor Building

Access to the RB was through a lockable personnel airlock at the Operating Floor elevation of the Turbine Building.

The Operating Floor of the RB, Figure 2-9 in Appendix B, houses the overhead polar crane, which was welded in place, and one switchgear rack. The reactor shield pool was accessible from the Operating Floor. There are three levels below the Operating Floor (el. 1327') in the RB. These are designated as the Equipment Floor (el. 1313'), Plug Floor (el. 1297'), and Pump Floor (el. 1270'-6"). Most of the reactor support equipment, such as the gland seal booster pumps, the shutdown cooler, and access to the steam pipe chase were located on the Equipment Floor, Figure 2-8 in Appendix B. Equipment access to the three individual recirculation pump compartments was accomplished by removing the concrete floor plugs at the Plug Floor elevation, Figure 2-7 in Appendix B. In addition to a monorail hoist for handling the recirculation pumps, this elevation contained various instrumentation. The recirculation pumps were located on the Pump Floor, the lowest level of the RB, Figure 2-6 in Appendix B. Each recirculation pump was located in a separate compartment with a pipe chase connecting each pump chamber to the area under the reactor vessel. The steam line piping penetration was housed in a separate chamber.

Fuel Transfer Vault

The FTV, Figure 2-10 in Appendix B, connected the reactor shield pool in the RB with the spent fuel pool in the FHB and contained the Fuel Transfer Tube.

Temporary Loading and Storage Building

The RWS is a 60-foot wide by 70-foot long metal building on a poured concrete slab (see Figure 2-11 in Appendix B). It was erected for this Decommissioning Project to provide a dry, weather-protected equipment laydown and waste container storage area. The storage area included storage of empty radwaste containers and full, decontaminated radwaste storage containers waiting offsite shipment. The RWS was a radioactive materials area and therefore is included in the scope of the Final Survey.

3.0 OPERATING HISTORY

3.1 Licensing

Northern States Power Company was granted license DPR-11 by the Atomic Energy Commission (AEC) for the operation of the Pathfinder Atomic Generating Plant in 1964. Low power testing occurred under this license from March, 1964 until September, 1967. Equipment failures during testing and economic factors resulted in a decision to place the reactor in a SAFSTOR mode. Following the completion of the SAFSTOR decommissioning program, the facility operating license was surrendered and the current by-product material possession license # 22-08799-02 was issued on August 9, 1972 under the provisions of Title 10, Part 30 of the Code of Federal Regulations. License 22-08799-02 permits possession for storage of the radioactive by-product materials produced during nuclear operations. The Part 30 license has been renewed as required.

3.2 Operations

The significant history of the Pathfinder reactor prior to the decommissioning consists of four phases. The first three phases cover the initial start-up program consisting of a series of tests designed to demonstrate the physics performance of the reactor and the performance of the integrated plant operation. These tests were sequenced in order of increasing reactor power level, i.e., all tests at a given power level were performed before the power was raised to the next level. Phase IV consisted of the SAFSTOR decommissioning.

PHASE I - 200kWt OR LESS - MARCH 1964 TO FEBRUARY 1966

Phase I experiments were performed at low power and ambient conditions to establish the reference core. Critical control rod configurations, core power distributions, and reactivity coefficients were measured for the reference core.

Between March 24, 1964 (date of initial criticality) and November 9, 1964, boiler fuel core criticality tests were performed. On November 9, 1964, the superheater fuel was loaded and on November 16, 1964, initial criticality for the full core was achieved. Reactor and integrated systems performance tests during Phase I continued through February 1966.

During Phase I, the radioactivity generated by the reactor was minimal. No fuel element failures occurred, and radioactivity levels in the reactor water were kept very low (ranging from 5×10^{-8} to 1.1×10^{-5} μCi/mℓ and averaging 2.3×10^{-7} μCi/mℓ). No significant airborne or smearable contamination problems were encountered. No abnormal exposures to personnel occurred. Gaseous radwastes released on an unidentified basis during Phase I amounted to 2.5 x 10^9 μCi of noble gases and 8.3 x 10^4 μCi of particulates. The concentrations released were below maximum permissible concentration (MPC) levels. The noble gases and particulates were believed to be composed mainly of naturally-occurring radionuclides of the uranium and thorium chains originating from concrete and construction materials. Periodic analysis showed that all activity indicated by the inline monitors was background or naturally-occurring particulates. No halogen radionuclides were released.

PHASE II - 5 MWt OR LESS - MARCH 6 TO MAY 19, 1966

The objective of the Phase II testing was to raise the reactor power level from essentially zero power to a level at which the onset of boiling in the flooded superheater was expected, and to determine the superheater radiative cooling ability, perform reactor systems tests and calibrate the nuclear instruments. During Phase II, the integrated reactor thermal power achieved was 4.68 MWD. The superheater fuel burnup for this period was equivalent to 6.05 MWD/MTU, and the boiler fuel burnup was 0.655 MWD/MTU.

The radioactivity levels in the reactor water substantially increased during this period, ranging from 1.5 x 10^{-7} to 9.2 x 10^{-4} μCi/mℓ and averaging 1.7 x 10^{-4} μCi/mℓ. No halogen activity was observed in the reactor water, indicating that no fuel element failures had occurred. Gaseous radwastes released during Phase II were at background or naturally-occurring levels and amounted to 3.0 x 10^8 μCi of noble gases and 6.5 x 10^3 μCi of particulates.

No significant airborne or smearable contamination problems were encountered during Phase II, and no abnormal exposures occurred.

PHASE III - FULL POWER OR LESS - MAY 19, 1966 TO SEPTEMBER 16, 1967

The objective of this phase was to reach full power in a safe manner. During Phase III, power was increased in five steps, starting from some power near 5 MWt and going to full power. At each power level numerous tests were performed, including power calibration, radiation testing, superheater steam operation, xenon reactivity, fluid dynamics effects, and a variety of systems testing.

Phase III lasted for a period of 17 months, ending on September 16, 1967, when the plant was shut down due to a condenser tube failure. Subsequent inspections showed that the steam separators had begun to disintegrate near the nozzles and activated pieces of translocated metal were found in various locations within the reactor pressure vessel and the recirculation pumps. Because of this hardware failure problem and economic reasons, the decision was made to not continue operation.

The Phase III testing had been quite successful, and between May 19, 1966, and September 16, 1967, the reactor produced 16,621 MWD and logged 4,595 critical hours. The total boiler fuel burnup was approximately 2,330 MWD/MTU.

During this period, the radioactivity levels in the reactor water increased to an average concentration of 7.4×10^{-2} μCi/mℓ of gross beta activity, with levels reaching as high as 2 to 3 μCi/mℓ. No fission products were observed in the primary system, indicating no fuel element failures. Radioactive corrosion products began to deposit in various piping loops to the point where some shielding of hot spots was required. High dose rate areas included the purification line in the FHB, the air ejector, feed water heaters, the main steam line, pool clean-up equipment, seal water filters, chloride analyzer filters, spent resin tanks, the purification cooler system, and various pumps. The radionuclides reported to be present in fresh primary samples included ^{64}Cu, ^{51}Cr, ^{56}Mn, ^{65}Zn, ^{59}Fe, and ^{60}Co. Samples older than 10 days contained 99% ^{65}Zn, with traces of ^{51}Cr, ^{59}Fe, and ^{60}Co being present. The ^{65}Zn activity undoubtedly originated from zinc corrosion products dissolving from the admiralty brass condenser and being neutron activated during recycling of the reactor water through the pressure vessel.

Total gaseous radwaste emissions amounted to 9,330 Ci of noble gases, and 259 mCi of particulates. Again, the gaseous discharges were presumed to be mainly from naturally-occurring radionuclides.

Operation of the plant during this period produced only one significant radiation incident. On September 16, 1967, a condenser tube leak occurred which resulted in cross contamination of the cooling tower water with the primary system water. Airborne contamination was also released in the RB, although not of a serious magnitude.

A considerable effort was spent in cleaning up the reactor systems affected by the condenser tube leak. In addition, a major inspection of the reactor revealed the serious deterioration of the steam separators. The reactor fuel, control rods, and vessel internal components were temporarily removed for inspection. Due to the deterioration of the steam separators, the reactor was never restarted and the plant was converted to a gas/oil-fired unit which has been used only during periods of peak power demand.

PHASE IV - SAFSTOR DECOMMISSIONING

In August 1968, NSP announced plans for repowering the unit with boilers which could be fired with either oil or natural gas. Then, in 1970, after first removing the nuclear fuel, the nuclear steam supply and associated systems, along with the nuclear related facilities, were decommissioned and placed in a safe storage (SAFSTOR) configuration. Both the repowering and the decommissioning work involved partial dismantling of some equipment and piping. In general, all contaminated piping outside the RB and FHB was removed or decontaminated to reduce contamination levels. The third and fourth feedwater heaters were also removed and disposed of.

During the SAFSTOR decommissioning program, the nuclear steam supply system was dismantled to the extent necessary to render it inoperable and incapable of being restored to service. This included filling the reactor vessel with gravel. The reactor internals were left in place. Reactor support systems were also partially dismantled at the time of decommissioning. The reactor vessel was drained and connected to a vacuum to remove water from it. All process systems and piping in the RB and in the lower two levels of the FHB were also drained. Areas of the RB were decontaminated to minimize the amount of removable surface radioactivity. Similar decontamination efforts were undertaken in the lower two floors of the FHB. Sections of piping and components removed during the partial dismantling which were not shipped offsite for disposal were placed in the RB and the lower elevations of the FHB for storage.

Some of the dismantled equipment was also placed in the spent fuel pool in the FHB. Both the RB and the lower two levels of the FHB were then sealed to prevent uncontrolled access. The spent fuel pool was sealed with a concrete cap. Controlled and monitored access to the decommissioned facilities was then permitted only for inspection of the decommissioned nuclear facilities.

3.3 Waste Disposal

SAFSTOR DECOMMISSIONING

Radioactive wastes produced during dismantling activities consisted of contaminated equipment and piping, spent resins, filter cartridges, contaminated liquid wastes, contaminated tools, and debris, plus miscellaneous decontamination materials. Two hundred eighty-five drums of solids, consisting of construction debris, filter cartridges, and other contaminated materials, and 114 drums of spent resin were shipped offsite for disposal. Equipment and piping too big to be drummed was stored on the lower levels of the RB. Contaminated piping and hardware were also stored in the spent fuel pool.

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4.0 DECOMMISSIONING ACTIVITIES

4.1 Objectives

The objective of the current decommissioning project is to dismantle and decontaminate the FHB, RB and FTV to a level appropriate for unrestricted use. The remainder of the operational fossil powered plant is not in the scope of this decommissioning project.

4.2 Results of Previous Characterizations

In 1980, Battelle's Pacific Northwest Laboratory (PNL) undertook a special investigation of the SAFSTOR decommissioned nuclear facilities at the Pathfinder plant sponsored by the Department of Energy. The purpose of the investigation was to characterize the condition of the equipment placed in extended safe storage. The investigation included a calculation to estimate the radionuclide inventory remaining in the decommissioned process equipment and piping. No effort was made during the study to determine the radionuclide by-product material inventory remaining in the reactor vessel and internals. Nor was it possible, under the scope of that study, to determine the inventory of radioactive by-products in the concrete biological shield around the reactor or the floors and walls of the decommissioned facilities, though the primary radionuclides were identified.

The radionuclide inventory at the Pathfinder plant (exclusive of the reactor vessel and internals and concrete) as of 1980 was published in a topical report summarizing the results of the study performed by PNL. Table 4-1 in Appendix C presents the radionuclide inventory reported by PNL and the calculated inventory decay corrected as of January 1990. As reported by PNL, 35% of the ^{60}Co inventory resides in the primary coolant piping, and 30% in the spent fuel storage pool. In the spent fuel storage pool, most of the ^{60}Co was found to be adsorbed into the stainless steel spent fuel storage racks. The ^{55}Fe inventory paralleled that observed for ^{60}Co. Over 57% of the ^{63}Ni and over 65% of the ^{59}Ni resides in the reactor's primary coolant piping. The main steam line and the reactor purification lines were also important repositories for ^{59}Ni and ^{63}Ni. Traces of ^{137}Cs, ^{238}Pu, ^{239}Pu, ^{240}Pu, and ^{241}Am were found in the reactor water purification and the radwaste processing systems.

The PNL report (ref. 3) stated that small amounts of radionuclides were present as contamination products within the walls and floors of the decommissioned nuclear facilities at Pathfinder. An accurate estimate of the residual radionuclide inventory in the contaminated concrete could not be made since the radionuclide distributions in these surfaces were found to be extremely variable. The PNL report states, "Residual contamination was very patchy, and within just a few feet, surface radioactivity could vary by up to two orders of magnitude". PNL also observed that some of this contamination was confined to the surface. Removal of any enamel paint or epoxy coating that may be on a contaminated surface usually removed the majority of the radioactivity. From the concrete core samples taken during the PNL study, the radioactive contamination was found to be confined to the topmost 1 cm of all but two of the contaminated locations. The two locations showing relatively higher levels of contamination more than 1 cm below the surface were in the reactor containment building on the floor below the reactor recirculation pumps and reactor vessel.

In 1985, entry was also made into the spent fuel pool which was used to store dismantled radioactive equipment. The general level of radiation within the pool above the stored wastes varied from 0.5 to 1.5 mR/hr. The highest reading of 1,000 mR/hr was found on contact with an under water vacuum cleaner stored in the pool. The radiation level on top of the concrete cap above the spent fuel pool was less than 0.15 mR/hr.

A neutron activation analysis of the reactor vessel and internals was performed by TLG Engineering, Inc. in 1989 (ref. 4). The analysis estimated the radionuclide inventory of the reactor vessel and its internals. The results are shown in Table 4-2 in Appendix C.

NSP drilled and obtained concrete core samples from the biological shield in 1989. The core samples were sent to Battelle-Pacific Northwest Laboratories for detailed radionuclide analysis. All of the concrete and steel samples contained extremely low concentrations of radionuclides. The concrete cores which were closest to the vessel contained the highest radionuclide concentrations. The most abundant gamma isotope was ^{152}Eu, which peaked at a level of 1.74×10^{-4} µCi/g. ^{60}Co was the next most abundant radionuclide, being a factor of 2 to 6 times lower that ^{152}Eu. The ^{60}Co is however an important contributor to the gamma dose rate from the concrete, albeit very small. The two gamma emitting natural radionuclides, ^{228}Ac and ^{235}U, were also detected in the concrete samples. The ^{228}Ac is a daughter of primordial ^{232}Th, and the ^{235}U is a natural isotope of uranium. The concentrations of these isotopes were rather constant throughout the concrete cores. The steel rebars contained only very small amounts of ^{60}Co as the only gamma emitter which was detectable. The most abundant radionuclides in the steel were ^{63}Ni and ^{55}Fe both of which have very low energy emissions and would not be detectable. This data was used for planning for the removal of activated bio-shield concrete.

In March of 1989, a special inspection was made of the decommissioned nuclear facilities to determine current general area levels of radiation and surface contamination. Most areas were found to have very low levels of both surface contamination and radiation.

In the RB, the general area radiation levels were approximately 0.01 to 0.07 mR/hr. Near some equipment, the radiation levels ranged between 0.8 and 5.0 mR/hr, with a reading on the reactor head of 1.4 mR/hr.

Measurements of the radiation levels on contact with the reactor vessel insulation (5"-6" thick) were also lower than anticipated. The highest activity was located near the base of the reactor vessel cylinder above the recirculation piping penetrations. At this elevation, a band of higher levels was observed to range up to 600 mR/hr at isolated hot spots around the girth of the vessel.

Radiation levels in the FHB were mostly less than 0.15 mR/hr. In the FHB basement, a contact reading of 320 mR/hr was obtained on the demineralizer prefilter housings.

Smears taken during the 1989 radiation survey also showed only very low levels of removable surface contamination. Except as noted below, all areas showed less than 100 dpm/100 cm^2. A few higher concentrations were found on the reactor head, the fuel transfer tube in the reactor shield pool, the shield pool cleanup suction line, and on a floor drain below the reactor vessel and the suction and discharge valves of the recirculation pumps. The highest smearable concentration of about 320,000 dpm/100 cm^2 was found in the shield pool cleanup suction line. Contamination levels on the vessel head ranged up to 8,100 dpm/100 cm^2, and to 21,100 dpm/100 cm^2 on the fuel transfer tube. Four floor drains in the basement of the RB showed contamination levels of up to 3,000 dpm/100 cm^2. Smears from the FHB showed only levels below 100 dpm/100 cm^2.

4.3 Decommissioning Procedures

Procedures were created to control the work performed in the decommissioning of the RB, the FHB, and the FTV. The decommissioning consisted of the removal of the following:

- Reactor Vessel
- Piping and Equipment
- Concrete
- Asbestos
- Liquids
- Hazardous Wastes

The estimated low-level waste volume was 35,000 cubic feet. The volume of material disposed of as a result of the decommissioning activities is shown in Table 4-3.

TABLE 4-3 DECOMMISSIONING WASTES

Volume (ft^3)	Type	Disposition
5,480	Trash, building rubble	Burial at US Ecology LLW Site
3,990	Reactor Vessel	Burial at US Ecology LLW Site
3,430	Asbestos	Burial at US Ecology LLW Site
2,750	Bioshield	Decontamination Contractor
18,800	Piping, equipment, concrete sections	Decontamination Contractor

4.3.1 Reactor Vessel

The reactor vessel, filled with gravel during the SAFSTOR decommissioning, was pumped full of grout to hold the internals and to stabilize the gravel. The grout also encapsulated loose contamination (if any was present) and provided for additional stability of the waste form. The vessel was prepared as its own Type A transportation container. Steel plate for shielding was welded to the exterior of the vessel as required to meet 49 CFR 173.441 radiation levels. The outside of the vessel was decontaminated to meet 49 CFR 173.443 contamination limits and all openings to the vessel were welded shut to preclude any leakage of contamination, thereby producing a certified Type A package. The vessel was shipped via rail to the US Ecology burial site in Richland Washington.

4.3.2 Piping and Equipment

Routine construction activities using thermal and mechanical cutting methods were used to remove piping and equipment. Prior to large scale removal of the piping and equipment, the low points in the system were checked for the presence of liquids. Any liquids found were removed prior to cutting activities. Floor drains and piping embedded in concrete were assumed to be contaminated and were removed by concrete cutting and by using large core drills. Contaminated piping and equipment was packaged as LSA material in strong tight containers. The services of a decontamination contractor were used to reduce the volume being buried. Piping and equipment was sent to the contractor for decontamination and salvage.

4.3.3 Concrete

Concrete surfaces that were above the release limit were chipped to remove the contaminated layer. The contaminated concrete rubble and dust were packaged with piping and equipment in strong tight containers. During the removal of the concrete, local containment was used to control the dust that was created. For industrial safety the personnel wore a particulate type face mask.

The reactor cavity was the location where the largest amount of concrete had to be removed to meet the release limits. The inner section of the bio-shield was completely removed (see Figure 4-1 in Appendix B). This section of the bio-shield was cut into large pieces (approximately 20,000 pounds each) and shipped via a sea van to the decontamination contractor. The center section of the bio-shield had a significant amount of concrete and rebar removed around the neutron ports.

4.3.4 Asbestos

Due to the difficulty in surveying the asbestos, all of the asbestos in the RB and the FHB was assumed to be contaminated and was disposed of at the U.S. Ecology Richland, Washington disposal facility. The asbestos was packaged in strong tight containers and labeled as containing asbestos. All asbestos removal was done in accordance with EPA, State and local guidelines.

4.3.5 Liquids

During initial decommissioning activities all low point drains were opened. Approximately 400 - 500 gallons of water were collected. Later, during concrete removal activities the liquids generated during cutting and core drilling were also collected, totaling approximately 1,500 gallons.

These liquids were evaporated to separate out the water and the contamination. The liquids were sampled and analyzed before and during the evaporation process to assure concentrations of the liquids were below MPC. No airborne problems occurred. The dry, solid residues, which were found to be contaminated, were disposed of as LSA material.

4.3.6 Hazardous Wastes

Lead and mercury were two hazardous wastes that were found during the decommissioning. Special procedures were written to remove both of these hazardous materials from locations in the FHB and the RB. The lead was originally used as shielding throughout the plant and consisted of stacks of lead blocks on the plug floor of the RB and around a pump chase in the sump. Lead shot was also used for shielding an old Continuous Air Monitor found in the RB. Later on in the project a large quantity of lead was found around six (6) neutron ports in the Reactor Vessel cavity.

The type of lead in the FHB consisted of shot placed around instrument radiation monitors and around a Reactor Water Purification line. Lead sheets were also found around two (2) Condensate/Feedwater Filter Housings. A final source of lead was part of a cover around an empty source cask left in the FHB during SAFSTOR. All of the lead was decontaminated and disposed of as salvage.

The mercury that was found was not contaminated and was disposed of through the existing NSP system for hazardous waste disposal. The mercury was located throughout the RB and FHB in Mercoid controls, level switches, and flow transmitters.

4.4 Quality Assurance

An onsite NSP QA representative was assigned full time to the project. This position reported to an offsite NSP QA Supervisor. The responsibilities of QA involved the reviews of technical specifications and decommissioning procedures including verification of the satisfactory implementation of instrument calibrations, radiation protection, radwaste controls, security controls, material procurement, record controls, and environmental monitoring.

Throughout the decommissioning project over 100 surveillances were performed of daily activities of the Pathfinder staff and work force. These surveillances were performed mainly by the onsite QA representative with occasional assistance from the offsite NSP QA auditors experienced in radiation protection and the packaging and transportation of radioactive waste.

In support of the surveillance program, three audits were performed by offsite NSP QA auditors. Two of these audits were team efforts with qualified radiation protection specialists from NSP's operating nuclear plants.

QA also performed supplier audits and surveillances of the architect/engineer, the engineering consultant, the reactor vessel heavy lift contractor, the reactor vessel package steel fabricator, and the radwaste processor. Other major contractors involved in the initial reactor vessel lift and grouting of the reactor vessel came under onsite work controls.

5.0 FINAL SURVEY PROGRAM

The final survey was designed to demonstrate that the decontaminated surfaces of the RB, FHB, FTV, and RWS meet the requirements of NRC Reg. Guide 1.86. The main elements of the survey included; determination of local background, gridding of building surfaces into one square meter grids, assignment of areas into survey units of no larger than 100 m^2, scanning and direct readings of the surface for beta-gamma contamination, smears of the surface for removable contamination, and gamma flux measurements at one meter from surfaces. Previous surveys by PNL and NSP had identified ^{60}Co as the primary contaminate and found no detectable alpha contamination. Limited alpha surveys were performed to confirm the lack of alpha contamination. The final survey design included reliance on surface scans of major portions of the facility versus a statistical selection of fixed measurement locations per previous guidance, i.e. NUREG/CR-2082 (ref. 5). This survey design resulted from repeated discussions, reviews, and comments from the NRC on draft survey plans. The Pathfinder Decommissioning Project Final Survey Plan (ref. 6) received NRC approval on January 21, 1992.

5.1 Sampling Parameters

In conjunction with the physical gridding and marking of structures, a detailed set of building drawings was prepared with a grid overlay matching the actual grid layout. Figure 5-1 in Appendix B shows the layout drawing of survey unit 1. The alphanumeric designators refer to the survey areas included in the survey unit. The survey area grid layouts used by the HP technicians to direct the survey are also shown. Grid points (intersections) were clearly marked using paint, indelible marker or other method of permanent identification. Survey units were established consisting of between 30 and 100 survey blocks. Survey units comprise contiguous survey blocks of like probability of contamination. Survey grid and survey unit designations appear on the detailed drawings. Survey blocks are approximately one square meter in area, exclusive of irregularities, appurtenances and attachments.

Areas with a high probability of contamination were designated as "lower surface areas" and were defined as those areas comprised of floors, structures extending not more than two meters above floors, and wall surfaces not more than two meters above floors. Additional areas above the two meter level were also designated as "lower surface areas" (high probability areas) by the Supervisor, Radiation Protection (SRP) based upon the potential for contamination from previous activities.

Area with a low probability of contamination were designated as " upper surface areas" and were defined as wall surfaces and areas greater than two meters above the floor, overheads, and ceiling structures, unless otherwise designated by the SRP.

NSP set action levels of 80% and 25% of the Reg. Guide 1.86 limit during the scanning of survey blocks in "lower" and "upper" surface areas respectively. Any scan reading which exceeded these levels triggered additional direct contamination measurements in the area exceeding the action level. Areas determined to exceed the Reg. Guide 1.86 limits were decontaminated and resurveyed.

Items or areas within a survey unit which could not be surveyed by the standard techniques were designated as "special surveys". Typical items included pipe penetrations, trenches remaining after removal of pipes from below floor slabs, anchor bolt holes, conduit, ductwork, and complex equipment, i.e. motors, ventilation fans, etc.

These types of items, structures, or components were difficult to grid due to their complexity, unusual configuration or location and required special survey techniques. Special surveys, directed by the SRP, were performed as follows:

- Conduit, pipe runs, cable trays, and duct work were scanned along a portion of the length. Direct survey readings and smear surveys were taken at selected points along the length with emphasis on horizontal surfaces and accessible openings.

- Penetrations, instrument ports, and the FHB stack were scanned internally at accessible openings, especially at the inlet and outlet. Direct survey readings and smear surveys were also taken in these areas.

- Ventilation systems consisting of the plenum area and fan blades were scanned internally at accessible surfaces. Direct survey readings and smear surveys were also taken in these areas.

- I-beams and structural supports were scanned along a portion of the length. Direct readings and smear surveys were taken at selected points along the length with emphasis on horizontal surfaces.

- Expansion joints and cracks were scanned along a portion of the length. Direct readings and smear surveys were taken at selected points along the length.

- Small holes in walls such as anchor bolt holes received direct measurement at the surface and smear surveys inside the openings.

- Screened air vents and gratings were scanned at the opening. Direct survey readings and smear surveys were taken at selected points around the surface.

- Stairways received scans and/or direct survey readings at selected locations along the length. Smear surveys were also taken at the locations of direct readings.

- The FHB crane and RB polar crane were scanned at various selected areas. Smear surveys were taken at selected locations around the crane structure including the cable drum.

- The FHB and RB HVAC systems were scanned internally/externally at various selected areas around the vent housing, duct work, and filters. Direct survey readings and smear surveys were also taken at these areas.

5.2 Major Contaminates

Pacific Northwest Laboratory conducted an extensive sampling and measurements program at Pathfinder in July 1980. The intent of the program was to determine the quantities and composition of radionuclides remaining in the plant and the immediate environs. Samples of piping, hardware, concrete, and soils were measured to determine the concentrations of the long-lived radionuclides present. Several radionuclides were found on piping and hardware systems. The most abundant was ^{60}Co followed by ^{63}Ni, ^{55}Fe, and ^{59}Ni. The radionuclides found in concrete (see Table 5-1) were predominately ^{60}Co followed by ^{137}Cs, ^{134}Cs, ^{152}Eu, and ^{154}Eu. Since the decommissioning activities removed all the process piping and hardware, the final survey monitored the concrete structure for compliance with the decommissioning criteria. The final survey techniques focused on detection of the beta-gamma emissions characteristic of ^{60}Co and ^{137}Cs.

TABLE 5-1 RADIONUCLIDE CONCENTRATIONS IN CONCRETE; 0-1 cm (pCi/g) (ref. 3)

Radionuclides	^{60}Co	^{134}Cs	^{137}Cs	^{152}Eu	^{154}Eu
Average	46.75	0.12	17.8	0.07	0.023
Maximum	225.14	2.06	369.1	0.63	0.11

5.3 Decontamination Limits

The limits of USNRC Regulatory Guide 1.86 Table I were applied to the RB and FHB at Pathfinder. The applicable limits from R.G. 1.86 (based on the residual radionuclides) are:

Removable	beta-gamma	1,000 dpm/100cm^2
	alpha	20 dpm/100cm^2
Average	beta-gamma	5,000 dpm/100cm^2
	alpha	100 dpm/100cm^2
Maximum	beta-gamma	15,000 dpm/100cm^2
	alpha	300 dpm/100cm^2

A maximum gamma exposure rate specified in guidance from the NRC was also applied. This level was:

Gamma exposure 5 μR/hr above background at one meter from the surface.

5.4 Equipment and Procedures

5.4.1 Instruments

The survey instruments used in the performance of the final survey are listed Table 5-2.

TABLE 5-2 SURVEY INSTRUMENTS

Instrument	Type	Radiation Detected	MDA (dpm/100 cm^2)
Ludlum Floor Monitor (FM) Model 239-1F	Gas Proportional	α, β, γ	229 (β, γ)
Ludlum Hand Held Monitor (HH) Model 43-68	Gas Proportional	α, β, γ	101 (α) 505 (β, γ)
Pancake Survey Monitor (PM) Model 44-9	GM	β, γ	1417 (β, γ)
Ludlum Micro-R Meter (MM) Model 19	Scintillator	γ	N/A
Tennelec LB 5100 Series II	Gas Proportional	α, β	18.3 (α) 30.0 (β)

Note: A Ludlum Model 2221 Scaler/Ratemeter was used with the portable detectors listed above.

5.4.2 Instrument Techniques

Three techniques were used to measure the residual radioactivity at Pathfinder. These techniques were: scanning, direct readings, and smear surveys. Scanning was performed by holding the detector ~1 cm from the surface and moving the probe 2 to 3 inches per second over the surface being monitored. Scans were primarily performed to detect contamination using the handheld and floor monitors with occasional use of the pancake detector. NSP established "trigger levels" for scans of 80% of the limit in a "lower" surface area, i.e. 4000 dpm/100 cm^2, or 25% of the limit in an "upper" surface area, i.e. 1250 dpm/100 cm^2 (if the MDA exceeded 1250 dpm/100 cm^2 the MDA was used as the trigger). Any scan reading exceeding the trigger level prompted a more detailed evaluation of the area. Direct contamination readings were made at fixed points by holding the detector ~1 cm from the surface for one minute and recording the integrated count. Direct contamination measurements were made with the handheld, floor, and pancake monitors. Direct gamma flux readings were made at fixed points by holding the micro-R meter one meter from the surface and recording the exposure rate. Smear surveys were performed at fixed points by rubbing a smear paper over an area of 100 cm^2 and analyzing the smear paper for collected activity with the Tennelec alpha-beta counter.

5.4.3 Background

The three criteria for selection of background structures were 1) located in the vicinity of Pathfinder, 2) not suspected of contamination, and 3) similar building materials and construction. Six non-contaminated structures were identified in the vicinity of the Pathfinder RB and FHB which had similar materials of construction, i.e. concrete and aggregate from the same supplier and similar geometry, i.e. poured concrete walls both above and below grade. The six selected structures were: the Minnehaha Courthouse, the Patrick Henry School, the Brandon Lutheran Church, the Brandon Elementary School, the Pathfinder Water Treatment Building, and the Pathfinder Screenhouse (see Figure 5-2 in Appendix B). At each of the structures, contamination measurements were made with the Floor Monitor (FM), Hand Held (HH), and Pancake Monitor (PM). The measurements were made on walls, floors, and in corners. Gamma measurements were also made with a micro-R meter (MM) at the same locations and outside at one meter above the ground at one, two, and three meters from the exterior wall. Measurements were also made on the roofs and exterior walls.

5.4.4 Procedures

In addition to the standard NSP radiation protection and survey procedures, several specific procedures were developed for the final survey process. These specific procedures are listed below. A brief summary of their contents can be found in Appendix A.

RPP R.03.03 Ludlum 239-1F Floor, Hand Held Monitors and GM Probe Functional Check and Operating Procedure

RPP R.06.11 Background Determination for the Final Survey

PDSP-13 Final Survey of Buildings and Structures

PDSP-15 Background Assessment and μR Meter Correlation Procedure

PDSP-16 Final Survey Data Entry Procedure

5.5 Organization/Training

The management staff of the Pathfinder Decommissioning Project were responsible for assuring that the final survey design, procedures, and activities were performed in a satisfactory manner.

The Decommissioning Project Manager had the overall control and responsibility for the final survey and received close support from the Supervisor Radiation Protection (SRP). The SRP had primary responsibility for overseeing the activities at the site to ensure that surveys were performed and documented properly.

Conduct of all phases of the final survey were performed under the control of qualified and trained personnel in accordance with established Pathfinder procedures. These personnel were contract Radiation Protection Specialists (CRPS) with a great deal of experience in applied radiation protection, especially large outage jobs with more hazards than normal radiological conditions. Prior to their employment at Pathfinder, many of these personnel had attended one or more site specific courses in radiation protection theory at an operating nuclear plant. Each Senior CRPS employed at Pathfinder met or exceeded the minimum qualifications of ANSI/ANS 3.1-1981. Each CRPS that did not meet these industry wide requirements was classified as a Junior CRPS and was required to work under the direction of the Supervisor Radiation Protection or a Senior CRPS.

Additional training was provided to radiation protection personnel performing the final survey by the SRP and the onsite QA representative. The training consisted of a review of survey methods, survey locations, survey instruments, survey documentation and release criteria as described in the final survey plan and implementing procedures.

5.6 Quality Assurance - Final Survey

QA was an integral part of the final survey design and participated in the development of the final survey procedures.

The final survey was performed in accordance with approved procedures specifying the release limits of Regulatory Guide 1.86 for fixed and removable contamination. The data collected during the final survey was well documented and verified to be accurate by QA personnel and the Pathfinder Staff. A computer data base program was also created to store the large quantity of measurements taken during the final survey. The data was then entered into a computer program for processing and to provide evidence that survey results were satisfactory. The transfer of the final survey field data into the computer data base was monitored by QA personnel for accuracy and completeness. The computer program, used to process the survey data from the data base and to verify acceptance of the final survey results, was independently validated by QA personnel.

During final surveying of the FHB, the RB, the FTV, the RWS and exterior locations around the buildings, a number of onsite surveillances were performed to assure satisfactory implementation of the Final Survey Plan and procedures.

The specific areas verified by surveillances included personnel training, background determinations, survey grid placement, instrument calibrations and functional checks, survey measurements, observation of final survey techniques, survey results and data collection and processing.

A QA audit of the final survey was performed during the final survey process. The offsite audit team included qualified radiation protection specialists from NSP's operating nuclear plants. The auditors performed radiation and contamination surveys at various, selected locations throughout the Fuel Handling Building which had previously been surveyed by the final survey teams. The audit surveys validated the results of the final surveys in the selected areas. There were no inconsistencies identified.

6.0 SURVEY RESULTS

6.1 Background Determination

The results of background measurements that were taken at the six off site locations (see Figure 5-2 in Appendix B) were examined for anomalies. Two μR/hr readings were deleted from the data taken in the Water Treatment Building due to well water contaminates accumulated on the Well Water Pressure Tank (60 μR/hr on bottom). Five high HH readings were deleted from the Minnehaha Courthouse data due to apparent contribution from the adjacent incinerator. The remaining data was plotted on log probability paper to evaluate consistency with a log-normal distribution (see Figures 6-1 to 6-4 in Appendix B). All data sets met the log-normal criterion except 1) the μR/hr data which had to be separated into interior (MM-INT) and exterior (MM-EXT) data sets to meet the criterion and 2) the PM data for which the data from the Brandon Elementary School and the Brandon Lutheran Church had to be eliminated to meet the log-normal criterion (the measurement results were unacceptably greater than the rest).

The "best estimate" of background (B) for each instrument was determined for the remaining data using the equation shown below from NUREG/CR-2082. The results are shown in Table 6-1.

$$B = e^{\left(\overline{\log x} + 1.28\sqrt{\frac{n-1}{n}}\, s\right)}$$

Where:

B	=	the best estimate of background (cpm/probe),
$\overline{\log x}$	=	the mean of the natural logs of the measurements,
n	=	the number of measurements, and
s	=	the standard deviation of the measurements

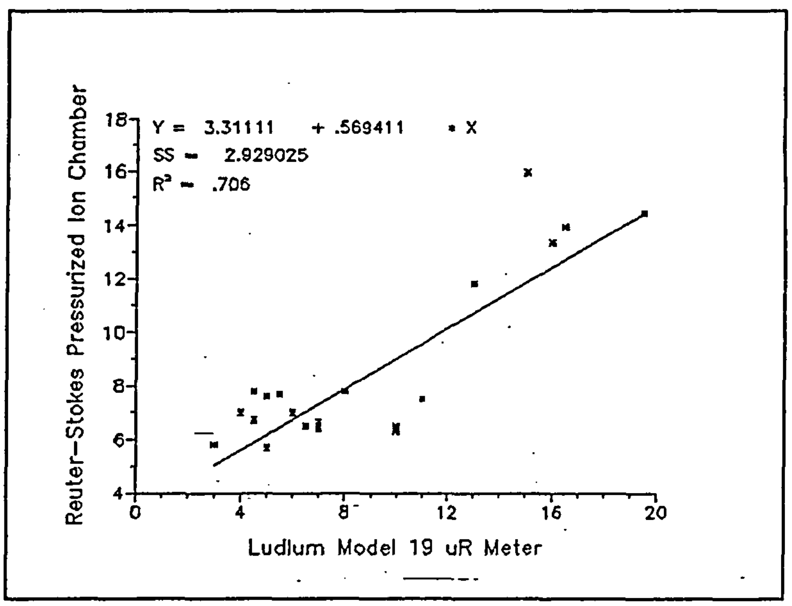
TABLE 6-1 BEST ESTIMATE OF BACKGROUND

INSTRUMENT	# OF DATA POINTS	BACKGROUND	LN-NORMAL DISTRIBUTION
FM	50	1574 cpm/probe	YES
PM	40	52 cpm/probe	YES
HH (β, γ)	75	446 cpm/probe	YES
MM-INT	71	8 μR/hr	YES
MM-EXT	40	14 μR/hr	YES

6.2 Micro R Meter Correlation

Gamma measurements were taken at 23 locations with both the Ludlum Model 19 Micro-R Meter and the Reuter-Stokes Pressurized Ion Chamber. The results were plotted along with a linear regression line, (see Figure 6-5). The linear regression coefficient was used to correct the Ludlum measurements to "true" µR/hr.

FIGURE 6-5 MICRO-R METER CORRELATION



6.3 Survey Units

Survey units were identified in the FHB, RB, FTV, and RWS. Table 6-2 in Appendix C identifies the number of survey units, surface area of the survey units, and number of grid points surveyed. The locations of survey units by building and floor are shown in Figures 6-6 through 6-24 in Appendix B.

The data sheets produced by the surveyors were accumulated in packages by building, floor, and survey unit. The quantity of data precludes direct inclusion of the raw data in this report. The results of the data manipulations and evaluations are discussed and reported in Sections 6.5, 6.6, and 6.7. To allow efficient manipulation of the data, the data was entered in a computer data base. The grid survey results are contained in one file and the special survey results in another.

6.4 Additional Decontamination

The majority of direct contamination measurements taken for the final survey were found to be less than the project trigger point setting that was established below the USNRC release guideline of 5000 dpm/100 cm^2 for average beta-gamma surface contamination.

All areas found during the final survey which exceeded project trigger point levels for beta-gamma activity were decontaminated and resurveyed. Deconamination of these areas was attempted even when the areas did not exceed the release guidelines. Decontamination was generally accomplished by a simple wipe down of the surface or removal of a thin layer of the concrete surface. Most levels were reduced to below the trigger point level and no areas exceeded the USNRC release guidelines.

A number of survey areas were found that exceeded the trigger point levels for beta-gamma activity. These areas are identified in Tables 6-3 through 6-6 in Appendix C and provide survey results before and after final decontamination and final release surveys.

Table 6-3	Lists maximum contamination levels found by scans of gridded areas.
Table 6-4	Lists maximum contamination levels found by taking direct contact readings at grid intersections.
Table 6-5	Lists maximum contamination levels found by scans of special survey areas.
Table 6-6	Lists maximum contamination levels found by taking direct contact readings of special survey areas.

During the final survey four (4) major areas were found where measurements exceeded the decontamination limits of Section 5.3. These ares required considerable decontamination efforts to remove contamination over large areas. The following is a brief description of each area and the actions taken to reduce the levels to acceptable readings.

6.4.1 Spent Fuel Pool Subfloor

During the final survey, readings in excess of 12 μR/hr (at contact) were found around the drain line. The drain line was removed with a core drill. During its removal, a subfloor was found under the original floor. The subfloor actually drained any water to the sump from leaks through the spent fuel pool liner.

In order to check for possible contamination of the subfloor, holes were drilled through the original floor and samples were analyzed for ^{60}Co. When contamination was found, it was necessary to remove the original floor to gain access to the contaminated area. The original floor was removed using a concrete saw. Once removed, detailed surveys of the area were made and the contaminated concrete was removed (see Figure 6-25 in Appendix B). All readings were below project trigger point levels following decontamination work.

6.4.2 Reactor Cavity and Reactor Cavity Floor

During the final survey, readings as high as 17 μR/hr were found on areas of the walls and floor of the Reactor Cavity. Areas on the walls where the neutron detectors had been located had to have the guide tube for these detectors removed along with the adjoining concrete to a depth of twenty (20) inches and up to two mats of rebar. On the floor of the cavity the embedded base plates for the vessel support column, the first mat of rebar, and concrete to a depth of nine (9) inches had to be removed. On the walls of the cavity in the area below the bioshield the first mat of rebar and concrete to a depth of six (6) inches also had to be removed. These areas are shown in Figure 6-26 in Appendix B.

6.4.3 Fuel Transfer Vault

During the final survey the drain at the bottom of the fuel transfer vault was found to be above the trigger limit. When the drain cover was removed to check for contamination it was found that the drain pipe had broken away from the drain bowl. A chipping hammer was used to remove the drain bowl and to create a hole large enough to collect soil samples from the area below and around the drain. The soil samples were contaminated and a larger hole was chipped through the floor of the vault. A total of eight (8) 55-gallon drums of contaminated soil and several feet of drain pipe was removed from this area (see Figure 6-27 in Appendix B). The remaining section of buried pipe and surrounding soil was surveyed and found to be clean.

6.4.4 Reactor Building Equipment Hatch

The area in front of the equipment hatch consisted of a recessed area with a removable steel deck at the same level as the Reactor Building Operating Floor. A drain line was located at the bottom of this recessed area. This drain line had been tied into the reactor building drain system.

During the final survey, elevated contact μR/hr readings were found in the recessed area. Contaminated liquids may have backed up from the drain, followed the edge of the wall and contaminated the area below. Core drills were used to locate the extent of the contamination and also to remove any contamination found (see Figure 6-28 in Appendix B). Following completion of this work no elevated readings were found.

6.5 Raw Data Evaluation

The raw data from the survey was entered into a computerized data base. All data reduction and comparisons of reduced data to release criteria was performed on the data using software[1] designed to manipulate data in a data base and perform statistical calculations. Programs were written to analyze the data for compliance with the various requirements, i.e. number of data points required by the survey plan and compliance with the release criteria. The results of these analyses are presented below.

Direct contamination levels (A_n) at each survey point were determined by: 1) converting instrument readings in cpm to activity in dpm using the instrument efficiency, 2) correcting from activity per probe area to activity per 100 cm^2 by multiplying by 100 divided by the probe area in cm^2 (A_g), and 3) subtracting the local area background in dpm/100 cm2 for that instrument (A_b). (Background readings were converted to dpm before subtraction because the efficiency of the gas proportional detectors changed over the period of the survey with changes in the ambient air temperature.)

$$A(dpm/100cm^2) = \frac{cpm}{eff} * \frac{100}{probe\ area}$$

$$A_n = A_g - A_b$$

[1]) Base SAS Software, SAS Institute, Cary, NC

Where A = activity, A_n = net activity, A_g = gross activity, A_b = background equivalent activity, cpm = detector counts per minute, and eff = efficiency

Removable contamination was determined by counting the smear samples for alpha and beta contamination (C), subtracting the instrument background (B), and converting the resulting counts to dpm using the appropriate instrument efficiency (eff) and counting time (t) for the gas proportional counter.

$$A\ (dpm/100\ cm^2) = \frac{(C-B)}{eff*t}$$

Where A = activity, C = gross counts, B = background counts, eff = efficiency, and t = counting time

Gamma flux levels (μR/hr) were determined by: 1) correcting the raw data to "true" μR/hr by applying the correlation factor (CF) previously determined (PDSP 15), and 2) subtracting the corrected area background (b) from each corrected gross reading (g) to obtain the net reading (n).

$$\frac{\mu R'}{hr}(n) = [\frac{\mu R}{hr}(g) * CF] - [\frac{\mu R}{hr}(b) * CF]$$

Minimum detectable activity (MDA) for surface contamination was determined for each instrument using the equation below.

$$MDA = \frac{2.71+4.65\sqrt{B*t}}{eff*t*\frac{probe\ area}{100}}$$

where B = background counts, t = counting time, and eff = detector efficiency

6.6 Statistical Evaluation

The corrected values for direct contamination, removable contamination, and gamma flux were accumulated for each survey unit. The means and standard deviations for the data for each measurement type for the survey unit were calculated. These values were used to calculate the test statistic shown below per the USEPA guidance (ref 8).

$$\mu = \bar{x} + t_{1-\alpha,df}\frac{s}{\sqrt{n}}$$

where μ = test statistic, $\bar{x}$ = the mean, s = standard deviation, t = Student's t, $1-\alpha$ = 0.95, df = n-1, and n = the number of data points

The test statistic was compared to the compliance limit for that measurement type from Section 5.3 and, if less than the limit, the survey unit was judged acceptable.

6.7 Results

The results of the statistical evaluation of the data for each survey unit and each special survey are shown in Table 6-7 and Table 6-8, respectively (in Appendix C). The values in Tables 6-7 and 6-8 are the results of the test statistic calculation for each type of measurement in a survey unit except the maximum contamination values which are the maximum values for direct contamination measured in a survey unit.

The results in Table 6-7 and Table 6-8 were produced using the data analysis method discussed in the Final Survey Plan and described in Sections 6.4 and 6.5. Alternative methods for analyzing the data are presented in Appendix D.

In addition, maximum values for direct contamination at a single point and for the mean in a survey unit, for µR/hr at a point, and for removable contamination for a point are reported for the FHB, RB, and RWS and are shown in Table 6-9.

TABLE 6-9 MAXIMUM RESULTS*

Building	Direct Contamination Sample Point (dpm/100 cm²)	Mean Contamination per Survey Unit (dpm/100 cm²)	µR/hr at Single Point	Removable Contamination at Single Point β (dpm/100 cm²)
FHB	2,889.88	1,341.13	1.7	84
RB	3,444.56	-340.38	3.42	65
RWS	-612.74	-834.89	-1.14	36

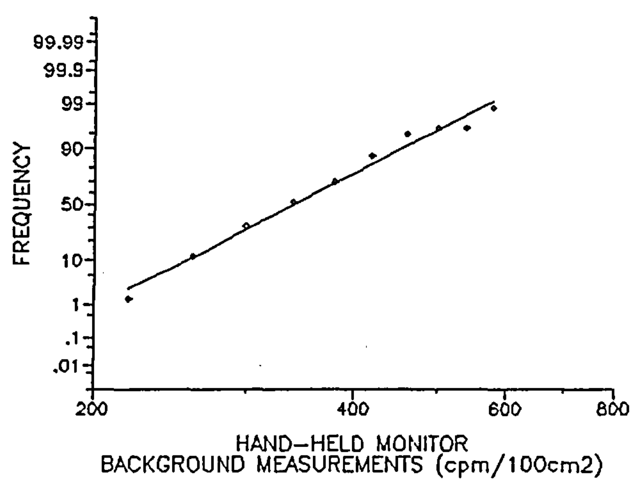
* All results are reported as net above local area background.

6.8 Alpha Monitoring

The PNL investigation indicated no alpha contamination in excess of free release limits and nearly no alpha contamination at all.

The original plan was to use an alpha scintillation detector with a rate meter for the alpha measurements. Due to the high MDA values for the scintillation detector, the hand-held proportional counter with scaler was substituted. Background alpha levels were determined at five of the six locations identified for background measurements; no measurements were made at the Brandon Middle School due to an access limitation. The data was analyzed as described in Section 6.1. The data from the Brandon Lutheran Church was deleted as not fitting the expected log-normal distribution. The log-probability plot of the alpha background measurements is shown in Figure 6-29.

FIGURE 6-29 LOG-PROBABILITY PLOT OF HAND-HELD MONITOR ALPHA BACKGROUND MEASUREMENTS



The best estimate of background (B) for the alpha instrument was determined by using the equation described in section 6.1. The results are shown in Table 6-10:

TABLE 6-10 BEST ESTIMATE OF BACKGROUND

Instrument	Number of Data Points	Background (B) cpm/probe	LN-Normal Distribution
HH (α)	40	11	Yes

Direct alpha surveys were performed at 163 locations in the FHB, RB, and RWS to confirm previous survey results indicating that no alpha contamination was detectable at the Pathfinder site. The locations for the surveys were selected by the SRP throughout the decontaminated area. The raw data was converted to net area concentrations (dpm/100cm^2) above background following the analytical methods described in Section 6.1. The "best estimate" of the local area background measurements was used as background. In addition, each smear taken for beta-gamma contamination was also counted for alpha contamination. The mean and standard deviation of the net area concentrations and the removable contamination concentrations were determined and are reported in Table 6-11 in Appendix C.

The results are consistent with the previous surveys and demonstrate the lack of alpha contamination.

7.0 CONCLUSION

The data presented in Section 6.0 demonstrate that the FHB, RB, FTV, and RWS meet the decontamination limits specified by the NRC. Nearly all the results are less than the "best estimate" of local background. The residual radioactivity in these structures is very near zero and certainly less than the limits of Regulatory Guide 1.86.

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8.0 REFERENCES

1. Pathfinder Decommissioning Plan, Northern States Power, July 1989.

2. Regulatory Guide 1.86, Termination of Operating Licenses for Nuclear Reactors, USAEC, June 1974.

3. Topical Report, Residual Radionuclide Distribution and Inventory at the Pathfinder Generating Plant, Pacific Northwest Laboratory, June 1982.

4. "Activation Analysis of the Pathfinder Reactor Vessel and Internal Structure", prepared by TLG Engineering, Inc. for Northern States Power Company, June 1989.

5. NUREG/CR-2082, Monitoring for Compliance with Decontamination Survey Criteria, US NRC, Washington, DC, June 1981.

6. Pathfinder Decommissioning Project Final Survey Plan, Northern States Power, December, 1991.

7. Safety Evaluation Report on Proposed Final Decommissioning of the Fuel Handling Building and Reactor Building at the Pathfinder Generating Plant, Northern States Power Company, June 1990

8. EPA 230/02-89-042. Methods for Evaluating The Attainment of Cleanup Standards. Volume 1: Soils and Solid Media, US EPA, Washington, DC, February 1989.

APPENDIX A

PROCEDURES

PROCEDURES

RPP R.03.03	Ludlum 239-1F Floor, Hand Held Monitors and GM Probe Functional Check and Operating Procedure.

This procedure provides instructions for the proper operation of the Ludlum Model 239-1F Floor monitor, Model 43-68 Hand Held monitor, and GM Pancake 44-9 probe with Model 2221 meter. Specific instructions are included for gas flow rates, operating voltages, preoperational background determination, and source measurement. A daily functional check includes measurement of a known source and determination that the net daily reading is within two standard deviations of the net preoperational reading. The efficiency of the instrument is determined weekly. Detector scan speed is specified as 2-3 inches per second.

RPP R.06.11 Background Determination for the Final Survey

This procedure provides instructions for the determination of the instrument readings above background that correspond to each of the decommissioning criteria of Reg. Guide 1.86.

PDSP-13 Final Survey of Buildings and Structures

This procedure describes the method of performing radiation measurements and establishes the number, size, and location of survey points for building and structure areas for the final survey. The procedure defines lower and upper surface areas, survey units, and survey blocks. Gridding of the survey area is required (actual and on building drawings) with grid blocks to be nominally 1m x 1m and a survey unit not to exceed 100 blocks. Lower surface areas are scanned over 100% of the surface of all blocks in the survey unit and upper areas scanned over at least 10% of the blocks in the survey unit. Whenever a lower area scan detects radioactivity >4000 dpm/100 cm^2 or an upper area scan >MDA or >1250 dpm/100cm^2 (whichever is greater) the region is identified and sufficient fixed measurements taken to determine the average contamination level for each 1 m^2 area. Areas exceeding 5000 dpm/100 cm^2 will be decontaminated. Fixed contamination readings, μR readings, and smear surveys are made at grid points in each survey unit at the following rates: 50% in lower areas, 30% in upper areas, or 30 (whichever is larger). The exterior building surfaces are monitored with the same techniques as the interior surfaces but at 30 or more locations. The ground around the RB and FHB is scanned at contact and 1 m measurements taken with the micro-R meter. Items and areas which could not be readily surveyed by the techniques described above were designated as "special surveys". Special surveys include FHB ventilation system, polar crane, penetrations, expansion joints, anchor bolt holes, conduit, ductwork, etc. Survey techniques include scanning, direct readings, and smear surveys. Direct readings for alpha contamination are made at more than 30 locations in the RB and FHB as selected by the SRP to confirm the lack of alpha contamination. The survey results are analyzed per EPA guidance, "Methods for Evaluating the Attainment of Cleanup Standards" to demonstrate compliance with the limits of Reg. Guide 1.86.

PDSP-15 Background Assessment and μR Meter Correlation Procedure

This procedure defines the method for determining background radiation levels that are used in the assessment of the radioactivity at Pathfinder. The procedure requires the identification of six structures near the Pathfinder RB and FHB with similar materials of construction and geometry. At each of these locations, measurements are made with each of the instrument types used in the final survey. For each type of measurement, the data are evaluated for fitting a log-normal distribution and a "best estimate" of the background is determined per NUREG/CR-2082. Gamma exposure rate measurements made with a NaI scintillation detector are converted to true μR/hr by correlation to ion-chamber readings. Simultaneous measurements are made with the NaI μR meter and the ion-chamber at various locations and exposure rates. The data are used to develop a correlation curve.

PDSP-16 Final Survey Data Entry Procedure

This procedure describes the requirements for data entry and verification of final survey radiation measurements in a computer database. This procedure is to assure the accurate transfer of data into the database. The data to be entered is reviewed by the Radiation Protection staff prior to data entry.

There are two databases created by this procedure. The first database is for initial entry, checking, and corrections. After data is input into this database a hardcopy printout is created which is signed by the person entering the data and an independent person verifying the data. The printout is then reviewed by the SRP. After the review and approval of the SRP the data is then transferred to the second database. This second database contains the verified final survey radiation measurements. The administrative control on the versions of the database are the same principles as the distribution of "Controlled Manuals". Backups of all the database files are made at the end of each workday.

APPENDIX B

FIGURES

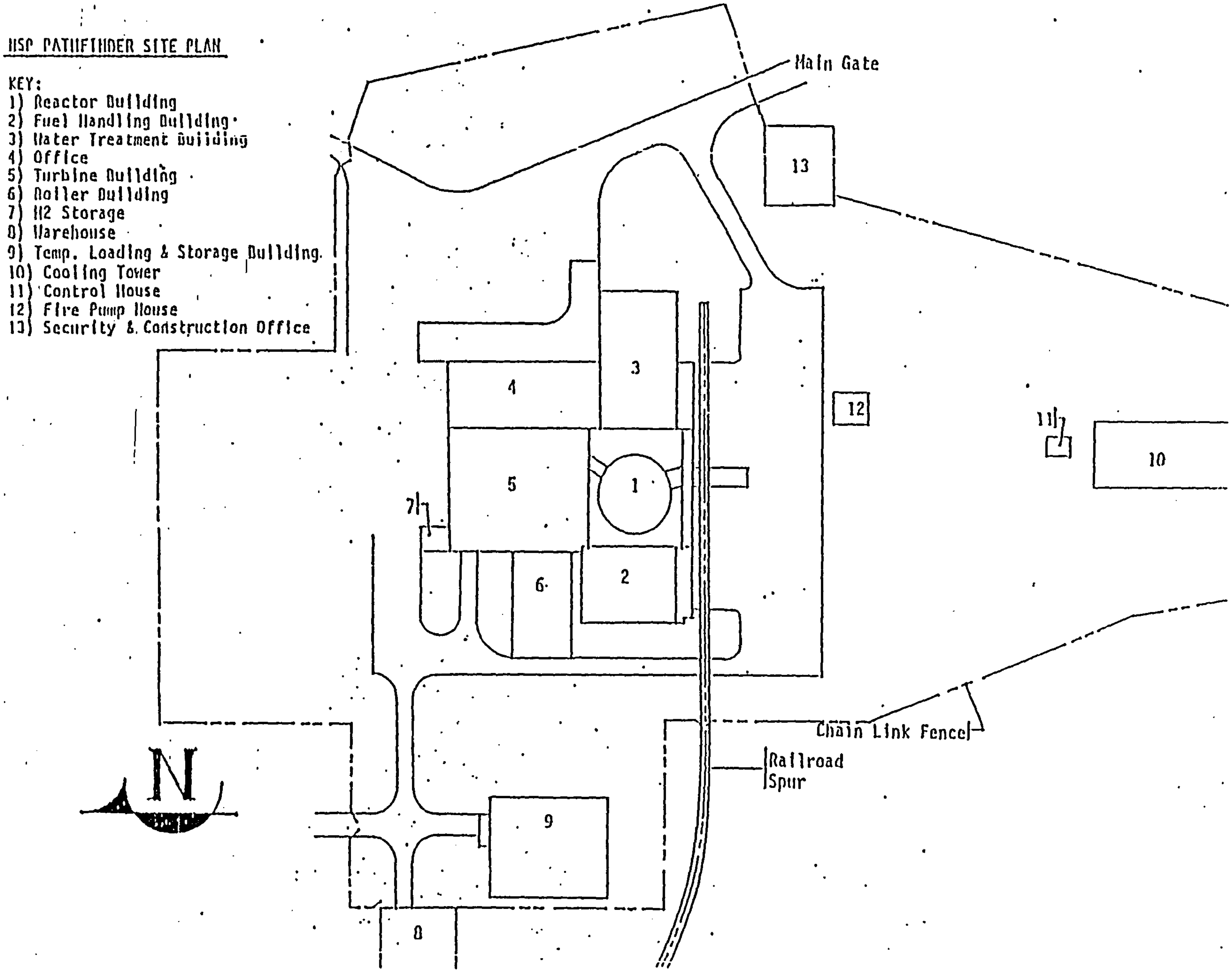
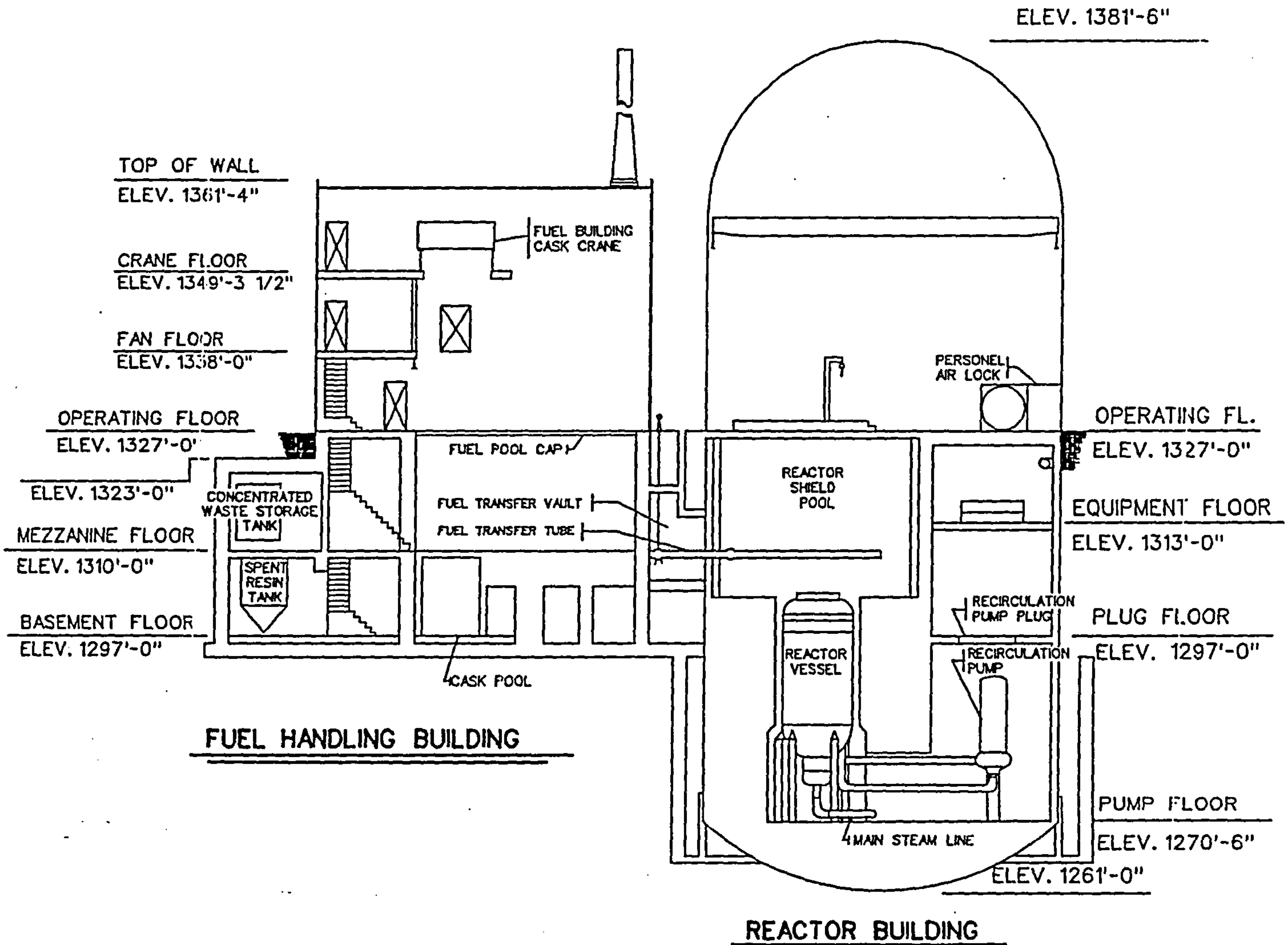


FIGURE 2-1

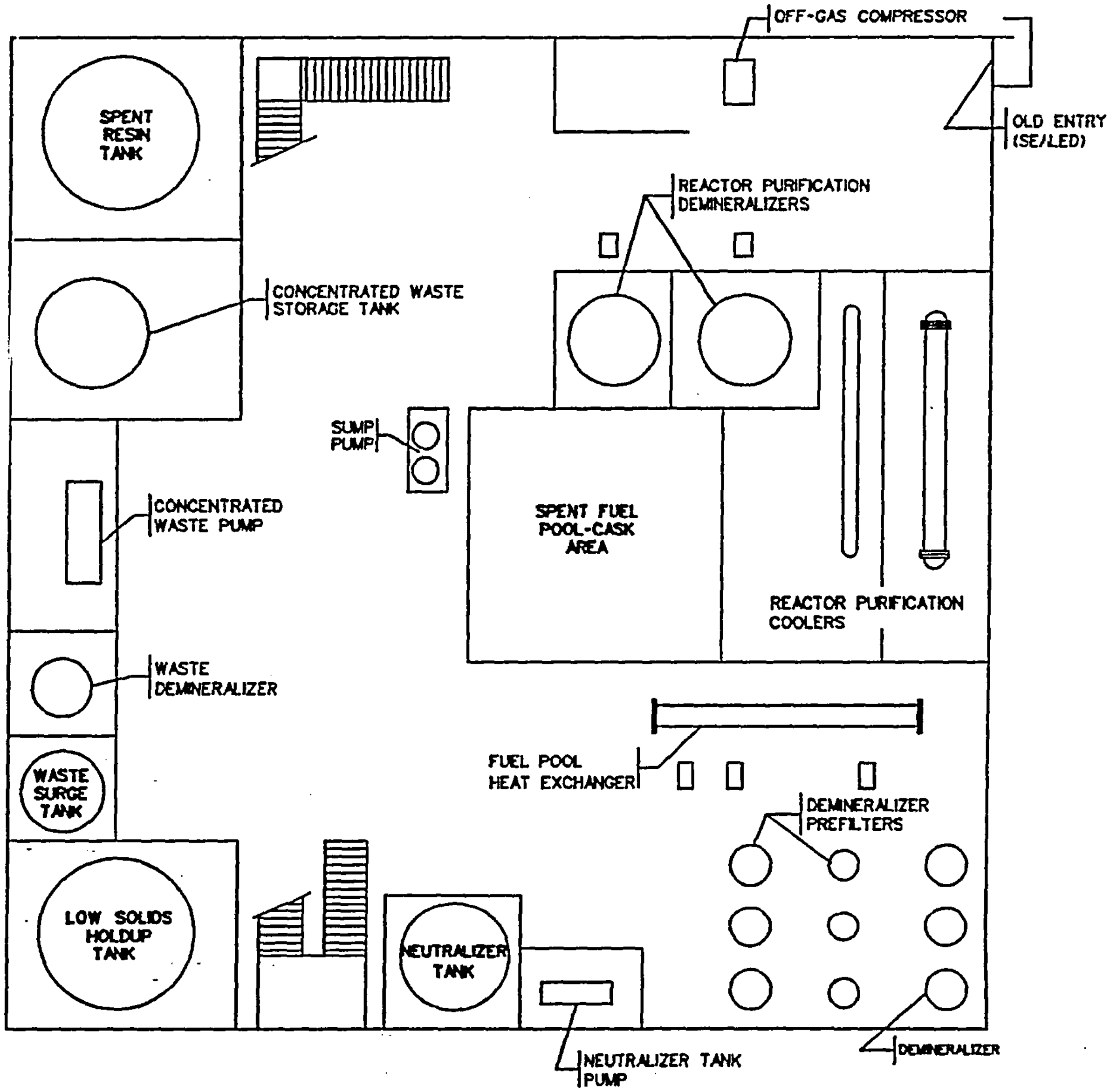
NSP PATHFINDER SITE PLAN

FIGURE 2-2 PATHFINDER PLANT ELEVATION VIEW



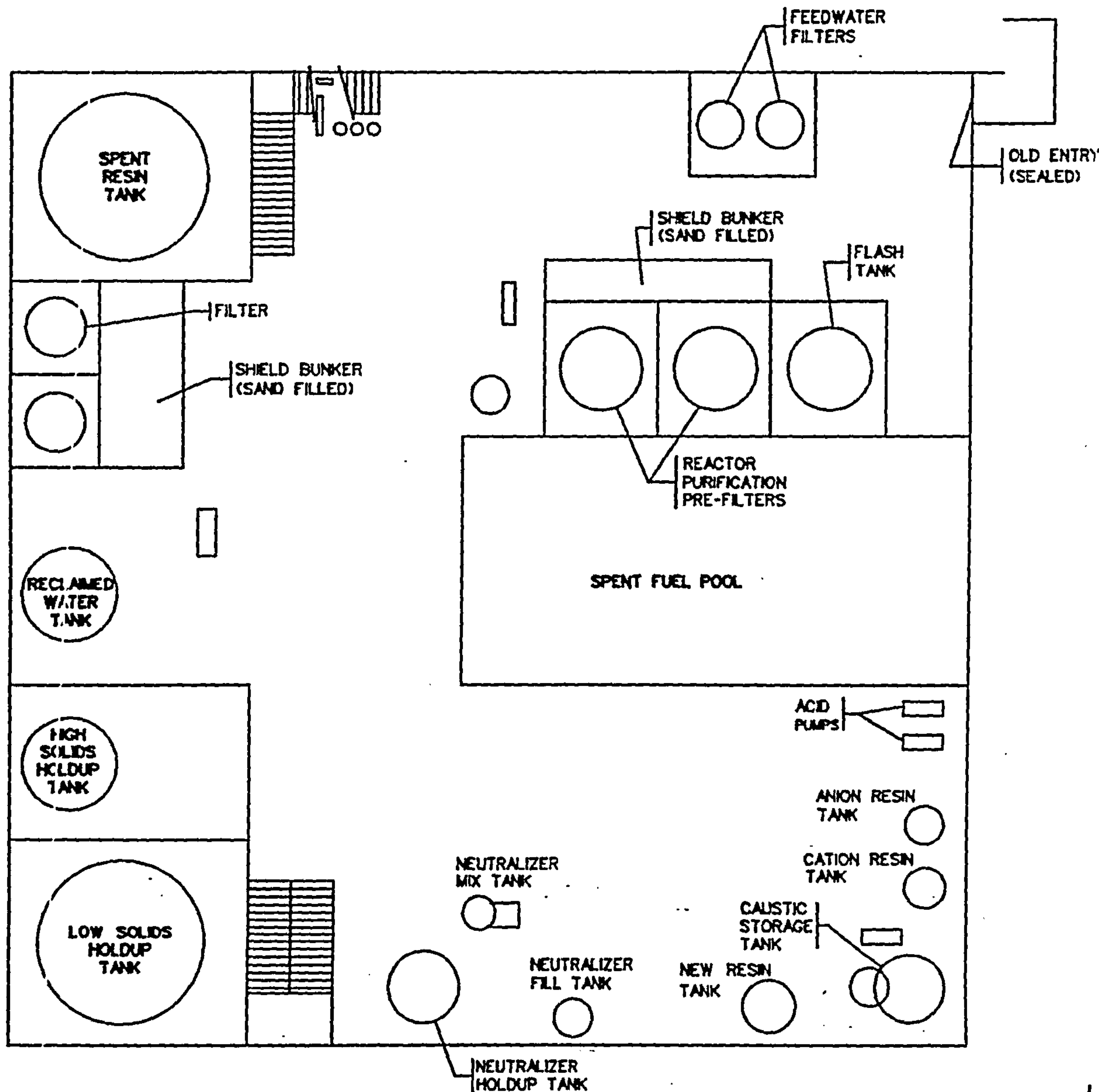
PATHFINDER
PLANT ELEVATION VIEW

FIGURE 2-3 PATHFINDER FUEL HANDLING BUILDING BASEMENT FLOOR



PATHFINDER
FUEL HANDLING BUILDING
BASEMENT FLOOR
ELEV. 1297'-0"

FIGURE 2-4 PATHFINDER FUEL HANDLING BUILDING MEZZANINE FLOOR



PATHFINDER
FUEL HANDLING BUILDING
MEZZANINE FLOOR
ELEV. 1310'-0"

FIGURE 2-5 PATHFINDER FUEL HANDLING BUILDING OPERATING FLOOR

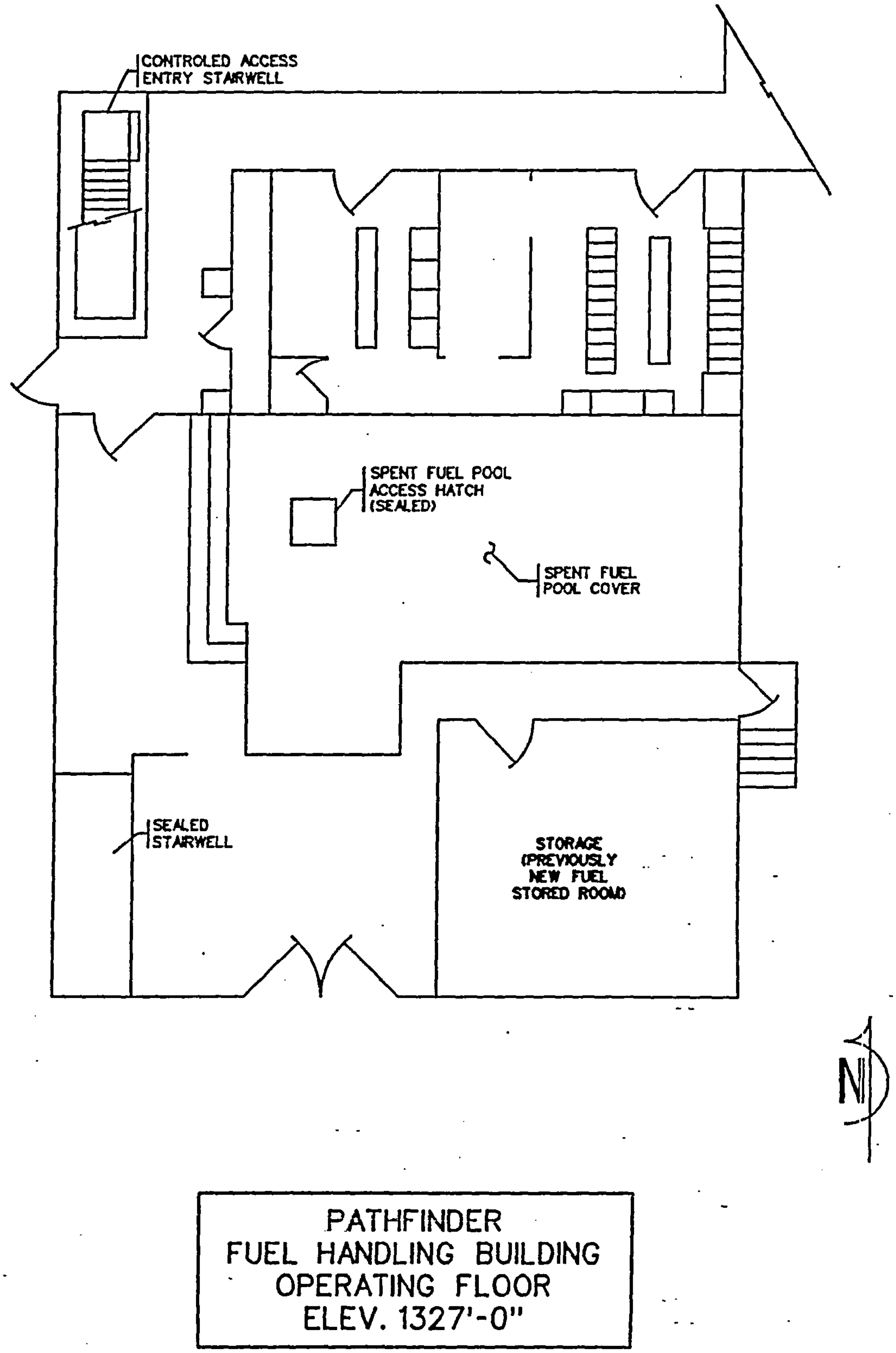
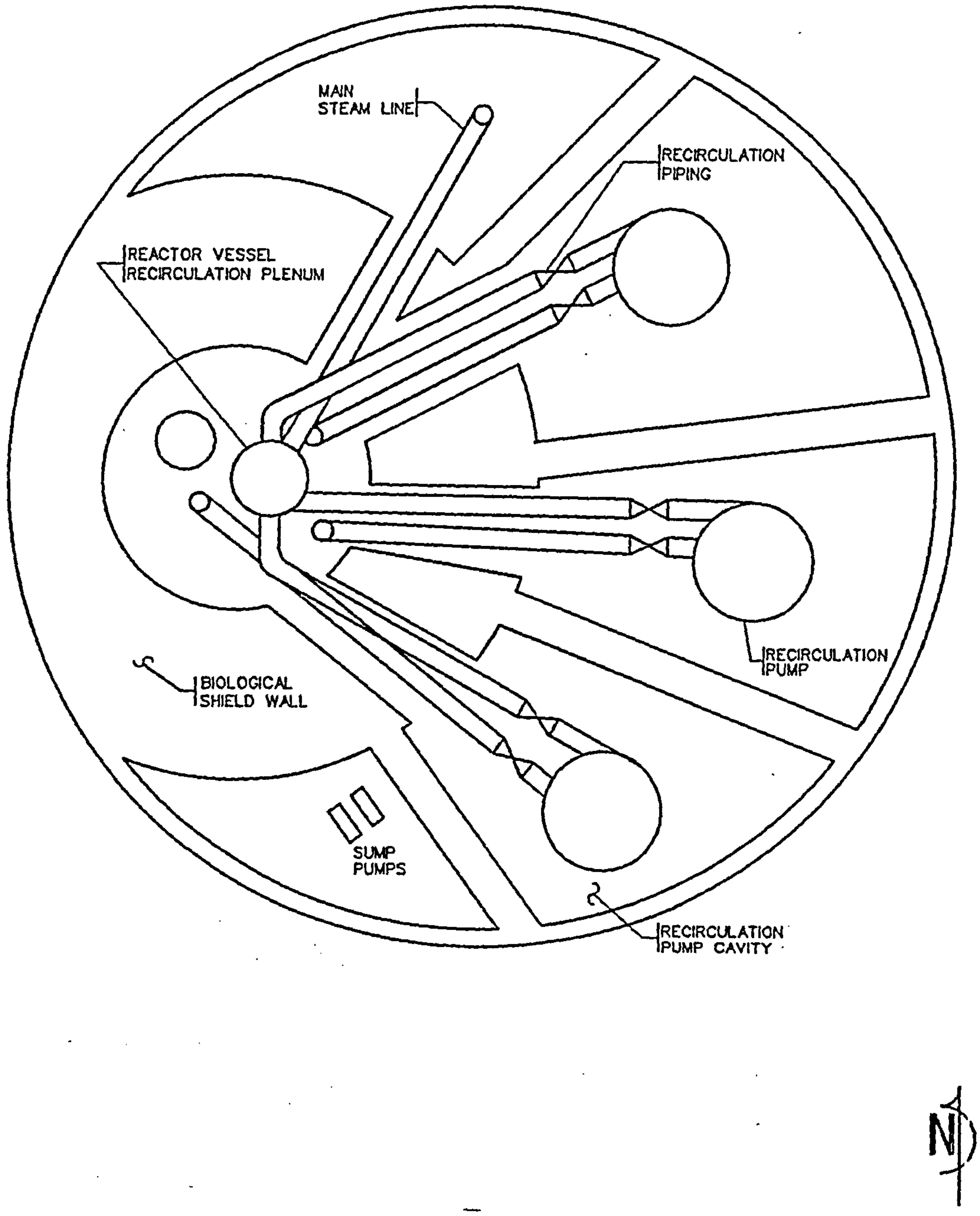
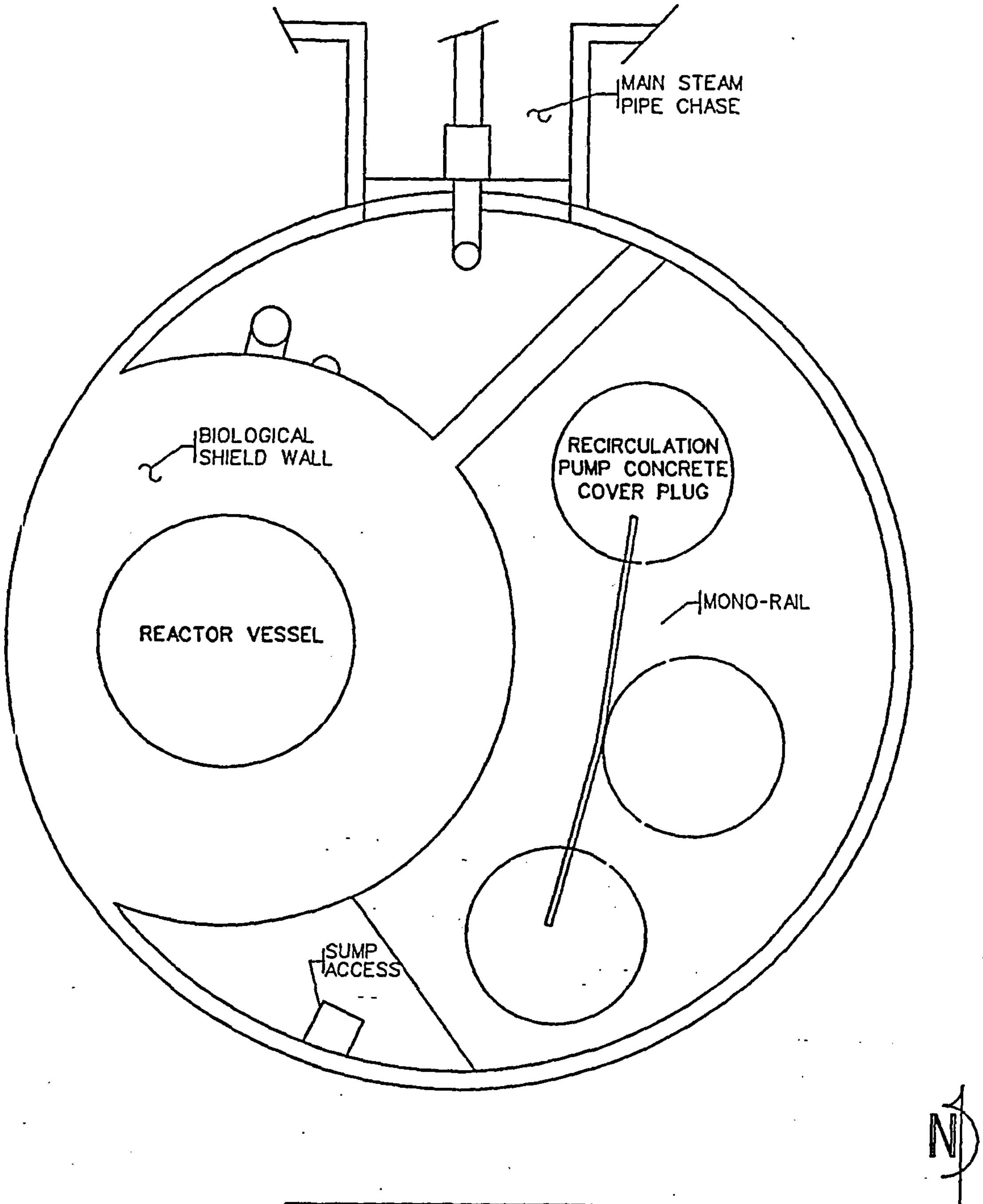


FIGURE 2-6 PATHFINDER REACTOR BUILDING PUMP FLOOR



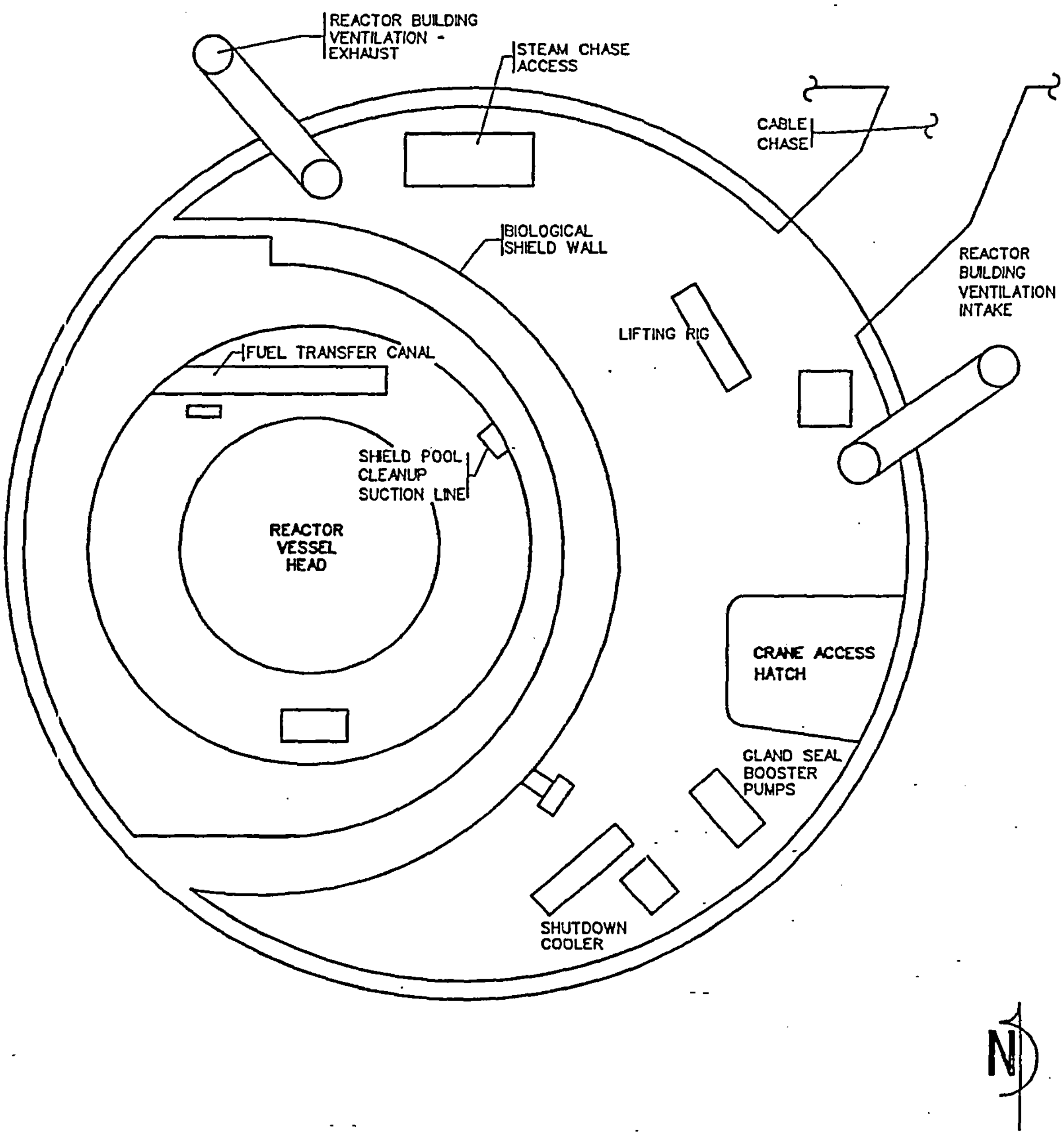
PATHFINDER
REACTOR BUILDING
PUMP FLOOR
ELEV. 1270'-6"

FIGURE 2-7 PATHFINDER REACTOR BUILDING PLUG FLOOR



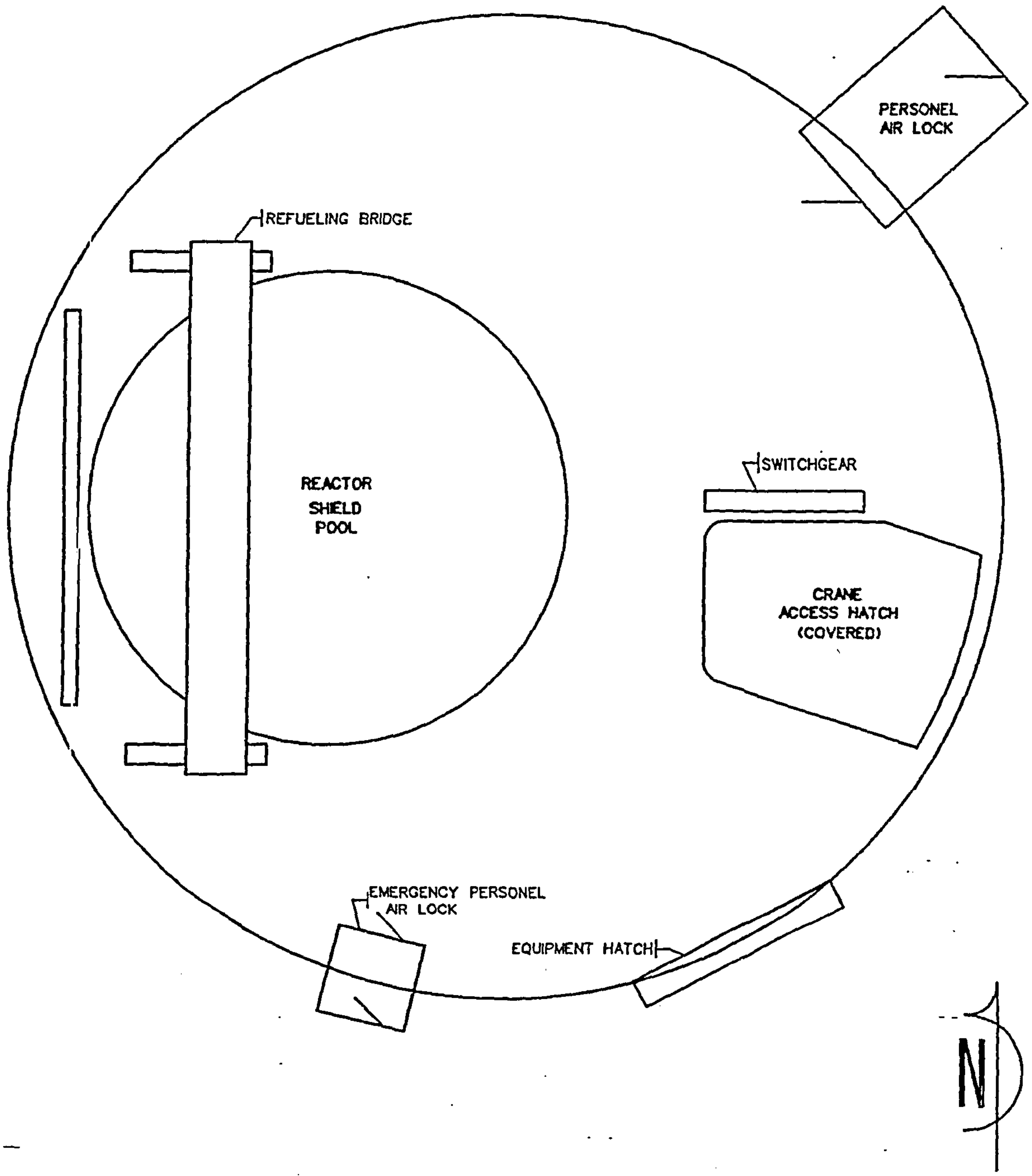
PATHFINDER
REACTOR BUILDING
PLUG FLOOR
ELEV. 1297'-0"

FIGURE 2-8 PATHFINDER REACTOR BUILDING EQUIPMENT FLOOR



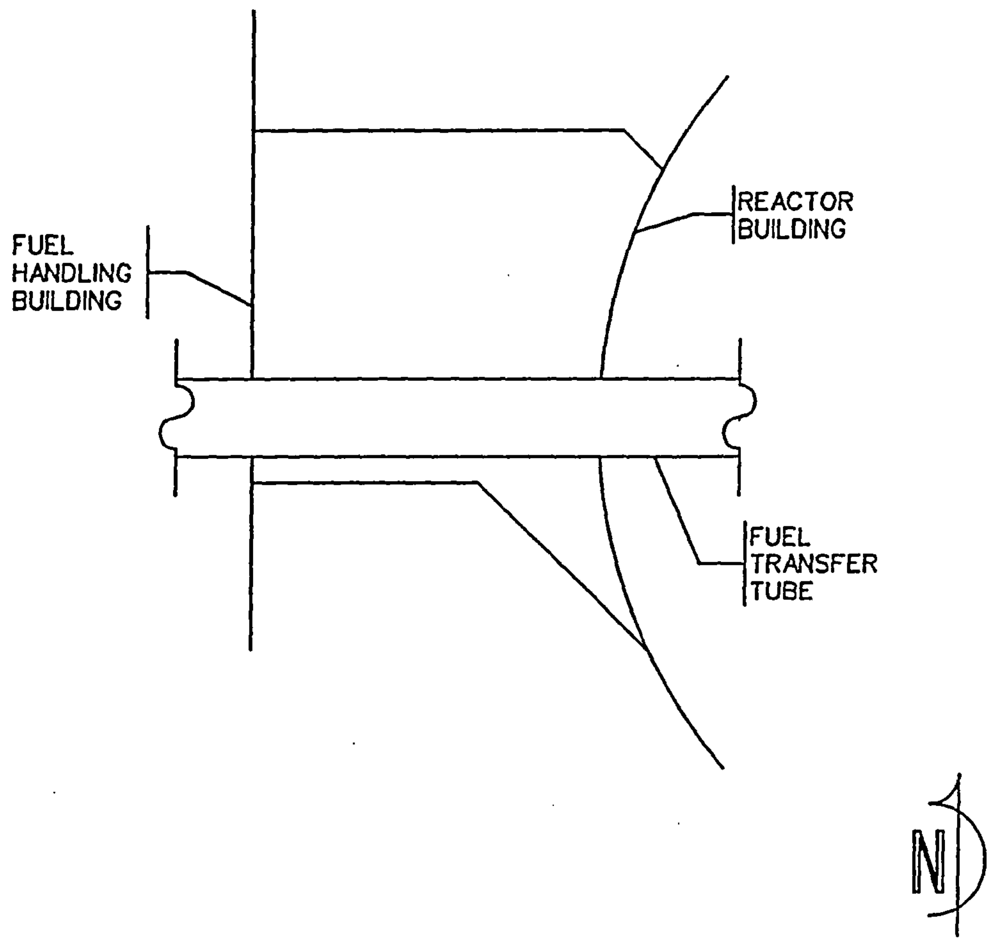
PATHFINDER REACTOR BUILDING EQUIPMENT FLOOR ELEV. 1313'-0"

FIGURE 2-9 PATHFINDER REACTOR BUILDING OPERATING FLOOR



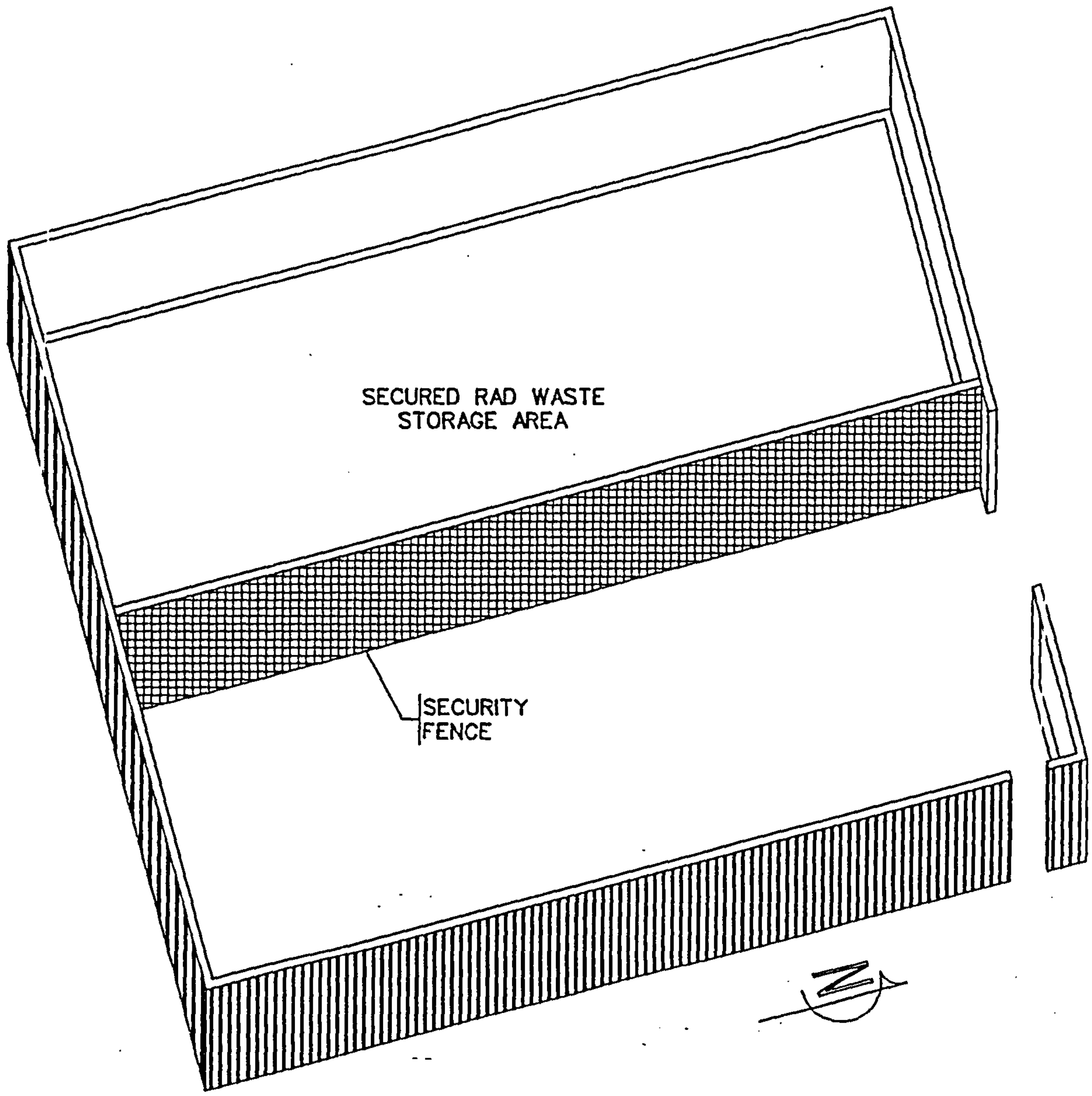
PATHFINDER
REACTOR BUILDING
OPERATING FLOOR
ELEV. 1327'-0"

FIGURE 2-10 PATHFINDER FUEL TRANSFER VAULT



PATHFINDER
FUEL TRANSFER VAULT
ELEV. 1306'-6"

FIGURE 2-11 PATHFINDER TEMPORARY LOADING & STORAGE



PATHFINDER
TEMP. LOADING & STORAGE
(RWS)
ELEV. 1323'-0"

FIGURE 4-1 PATHFINDER REACTOR BUILDING BIO-SHIELD CONCRETE REMOVAL

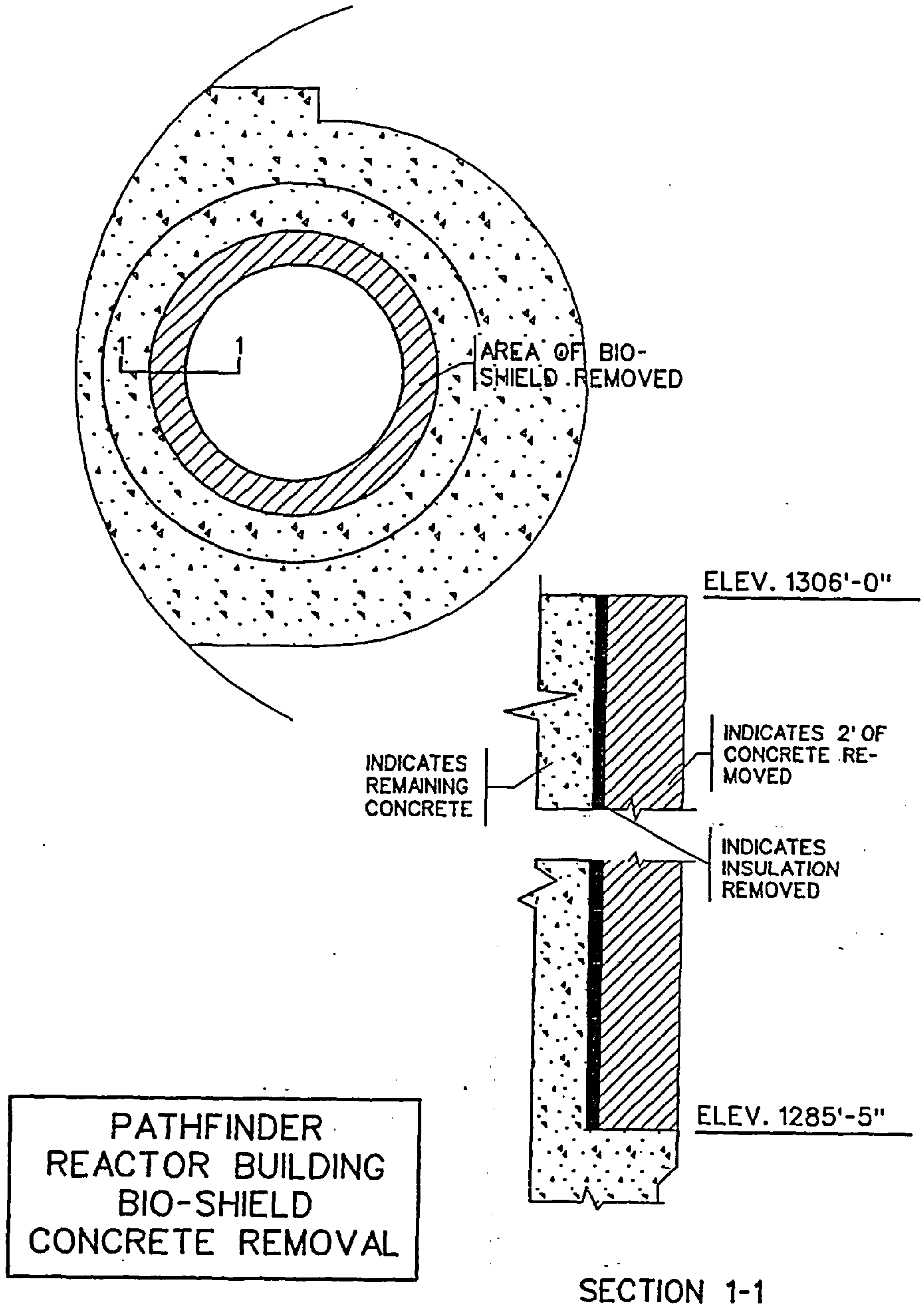
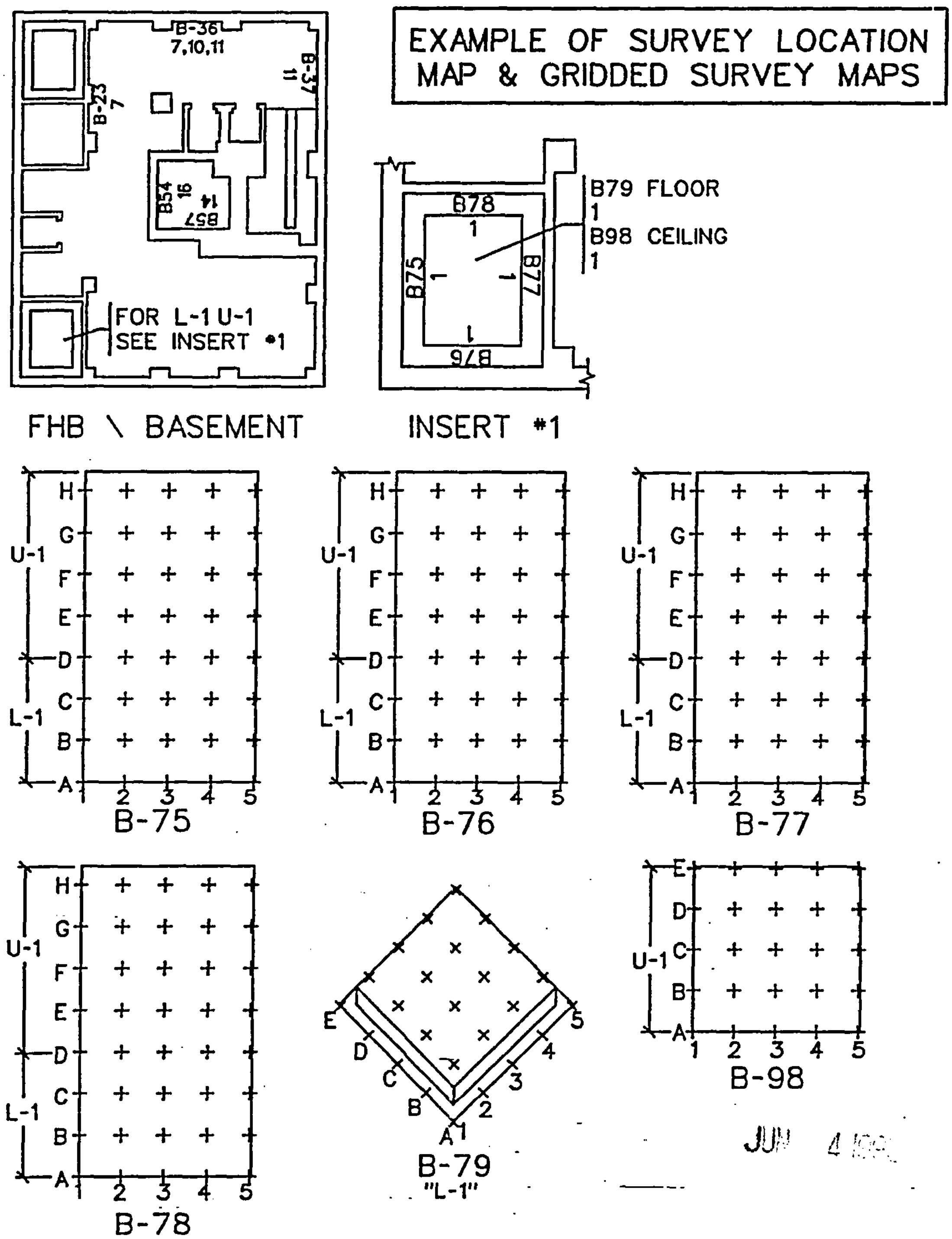


FIGURE 5-1 EXAMPLE OF SURVEY LOCATION MAP & GRIDDED SURVEY MAPS



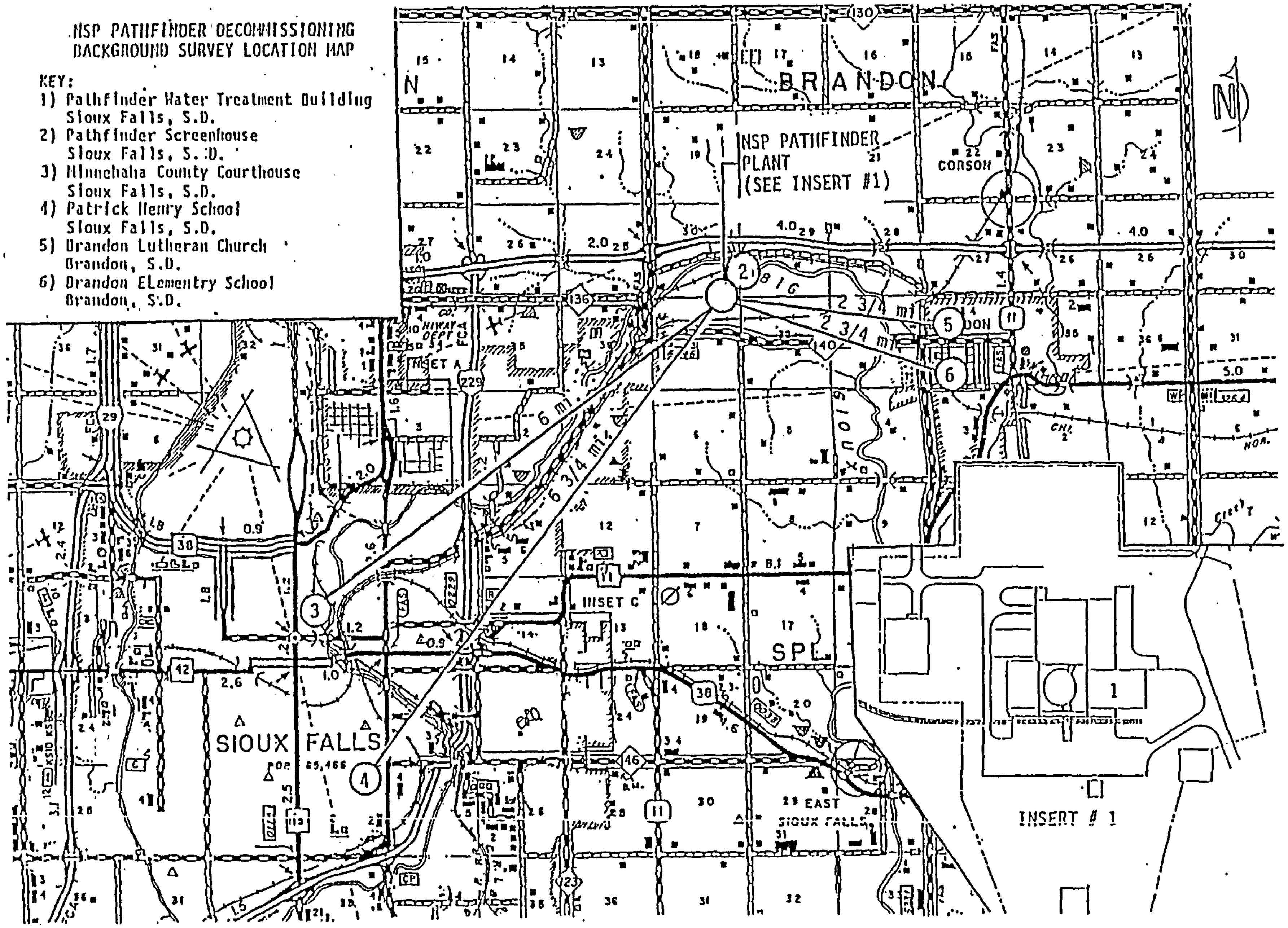


FIGURE 5-2 BACKGROUND SURVEY LOCATIONS

FIGURE 6-1 LOG-PROBABILITY PLOT OF FLOOR MONITOR BACKGROUND MEASUREMENTS

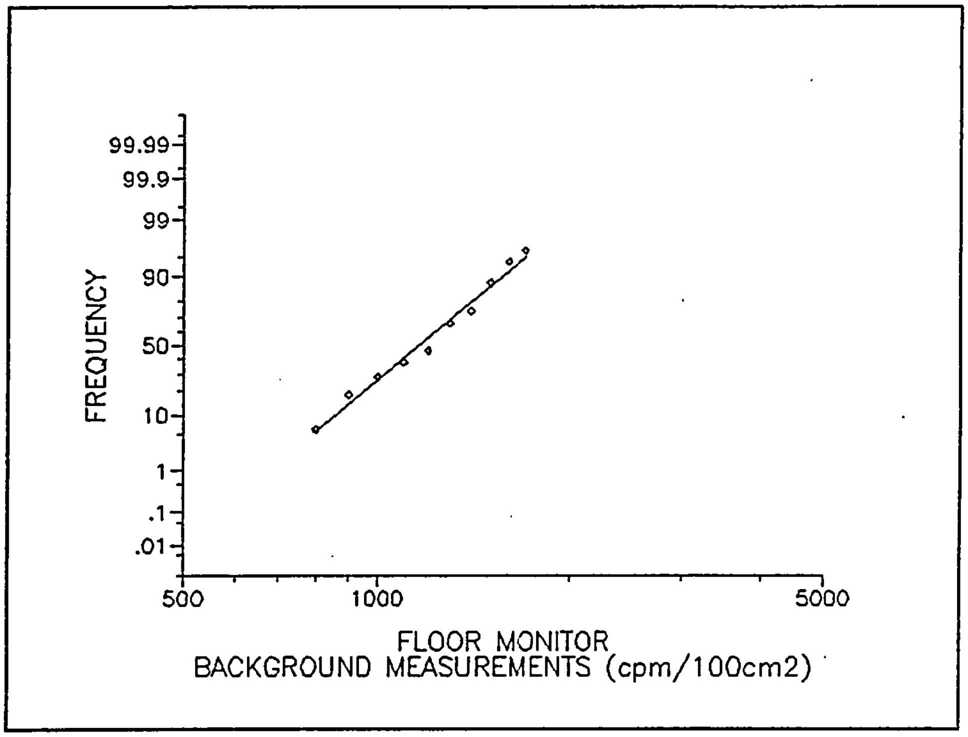


FIGURE 6-2 LOG-PROBABILITY PLOT OF PANCAKE MONITOR BACKGROUND MEASUREMENTS

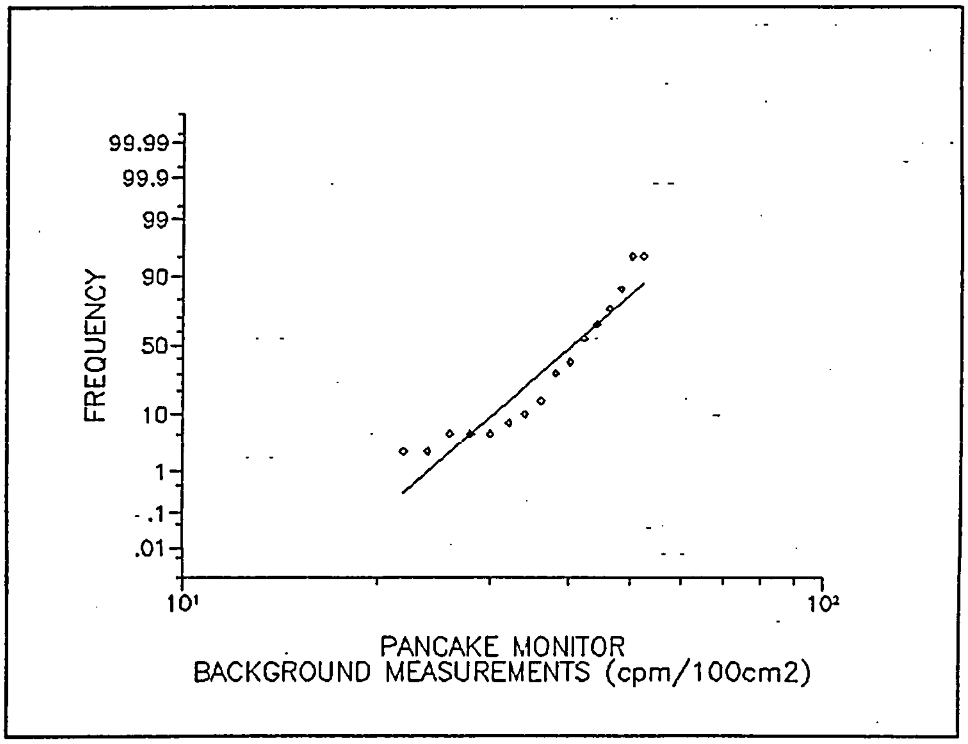


FIGURE 6-3 LOG-PROBABILITY PLOT OF HAND-HELD MONITOR BACKGROUND MEASUREMENTS

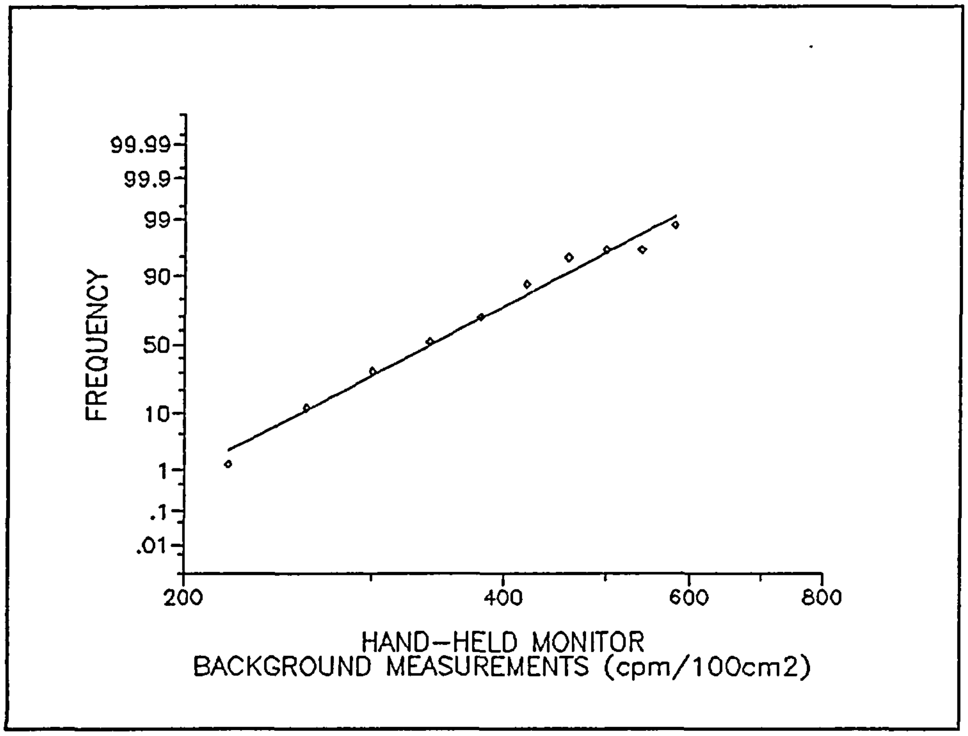


FIGURE 6-4 LOG-PROBABILITY PLOT OF μR METER BACKGROUND MEASUREMENTS

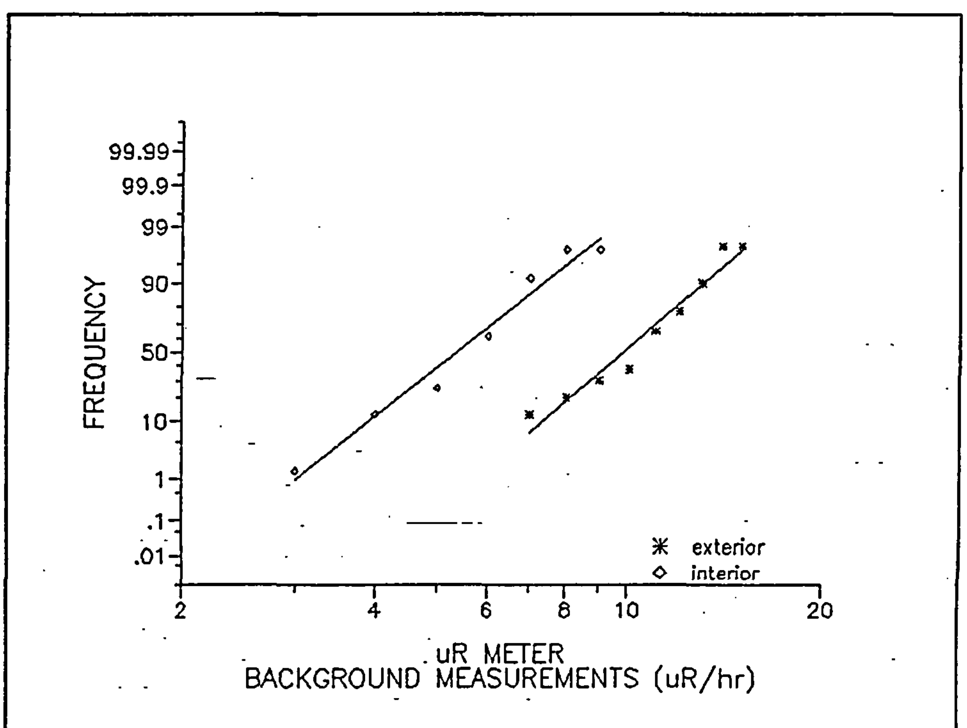


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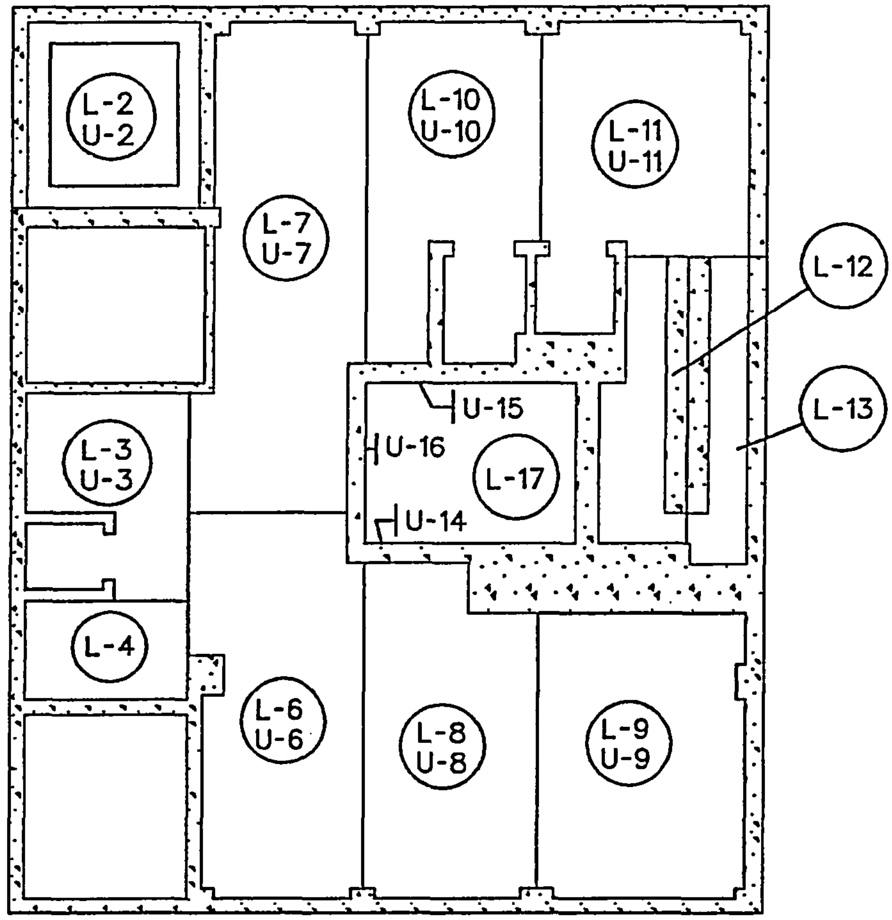
FIGURE 6-6 PATHFINDER FUEL HANDLING BUILDING BASEMENT SURVEY UNIT LOCATIONS

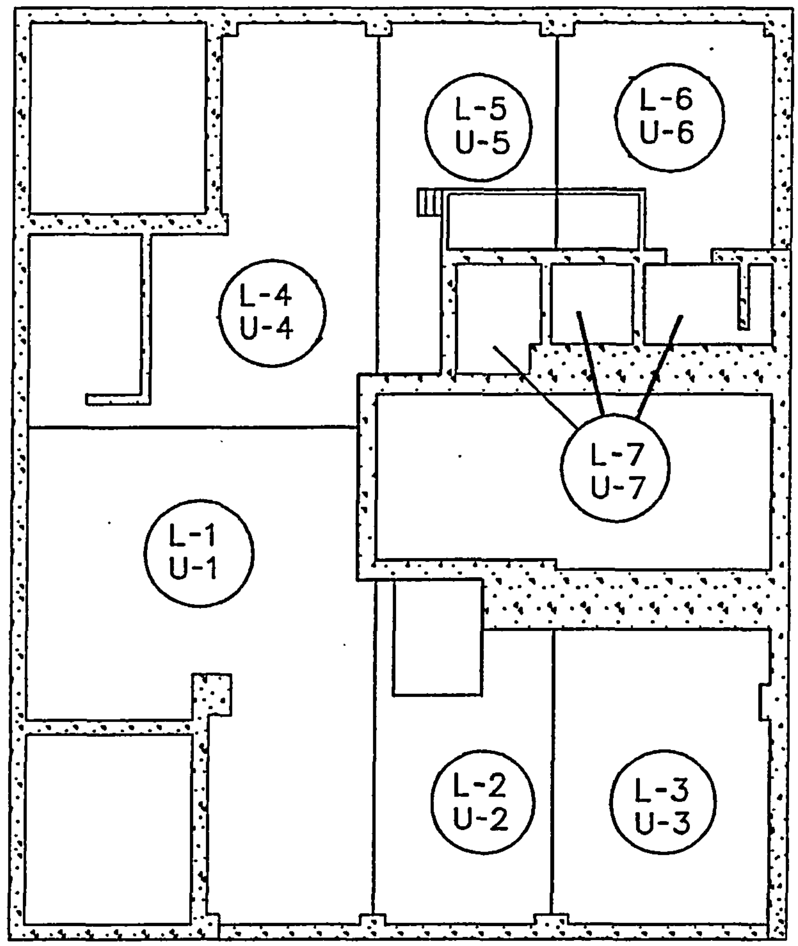


L-1 FLOOR & WALLS TO 3m LINE
U-1 WALLS FROM 3m LINE UP & CLG.
L-2 FLOOR & WALLS TO 3m LINE
U-2 WALLS FROM 3m LINE UP & CLG.
L-3 FLOOR & WALLS TO 2m LINE
U-3 WALLS FROM 2m LINE UP &CLG.
L-4 FLOOR, WALLS, & CLG.
L-6 FLOOR & WALLS TO 2m LINE
U-6 WALLS FROM 2m LINE UP & CLG.
L-7 FLOOR & WALLS TO 2m LINE
U-7 WALLS FROM 2m LINE UP & CLG.
L-8 FLOOR & WALLS TO 2m LINE
U-8 WALLS FROM 2m LINE UP & CLG.
L-9 FLOOR & WALLS TO 2m LINE
U-9 WALLS FROM 2m LINE UP & CLG.
L-10 FLOOR & WALLS TO 2m LINE
U-10 WALLS FROM 2m LINE UP & CLG.
L-11 FLOOR & WALLS TO 2m LINE
U-11 WALLS FROM 2m LINE UP & CLG.
L-12 FLOOR, WALLS, & CLG.
L-13 FLOOR, WALLS, & CLG.
U-14 WALL INDICATED
U-15 WALL INDICATED
U-16 WALL INDICATED
L-17 FLOOR AREA

N

PATHFINDER FHB BASEMENT
SURVEY UNIT LOCATIONS
ELEV. 1297'-0"

FIGURE 6-7 PATHFINDER FUEL HANDLING BUILDING MEZZANINE SURVEY UNIT LOCATIONS



L-1 FLOOR & WALLS to 2m LINE
U-1 WALLS FROM 2m LINE & CLG.
L-2 FLOOR & WALLS to 2m LINE
U-2 WALLS FROM 2m LINE & CLG.
L-3 FLOOR & WALLS to 2m LINE
U-3 WALLS FROM 2m LINE & CLG.
L-4 FLOOR & WALLS to 2m LINE
U-4 WALLS FROM 2m LINE & CLG.
L-5 FLOOR & WALLS to 2m LINE
U-5 WALLS FROM 2m LINE & CLG.
L-6 FLOOR & WALLS to 2m LINE
U-6 WALLS FROM 2m LINE & CLG.
L-7 FLOOR & WALLS to 2m LINE
U-7 WALLS FROM 2m LINE & CLG.

PATHFINDER FHB
MEZZANINE SURVEY UNIT
LOCATIONS ELEV. 1310'-0"

FIGURE 6-8 PATHFINDER FUEL HANDLING BUILDING OPERATING FLOOR SURVEY UNIT LOCATIONS

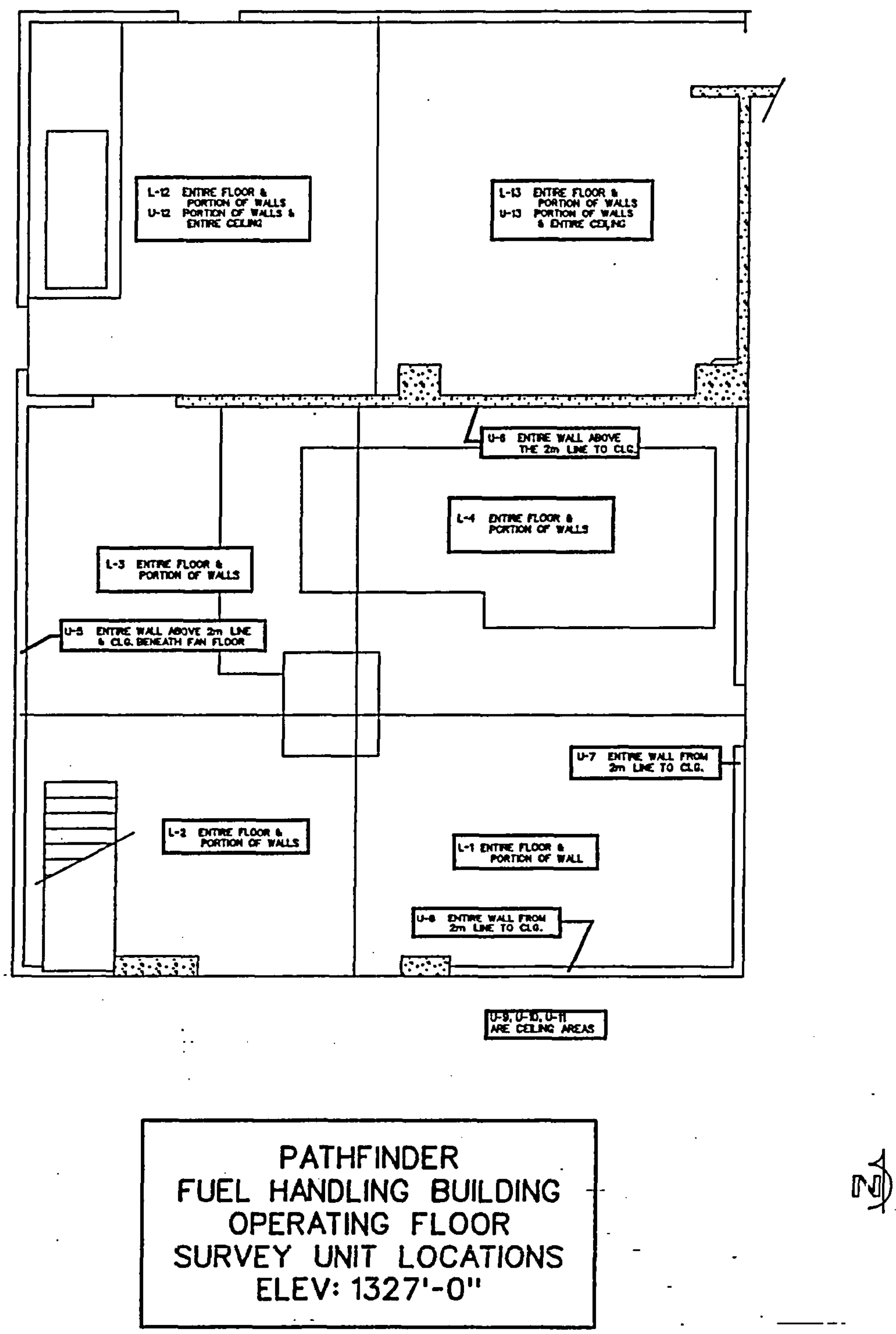
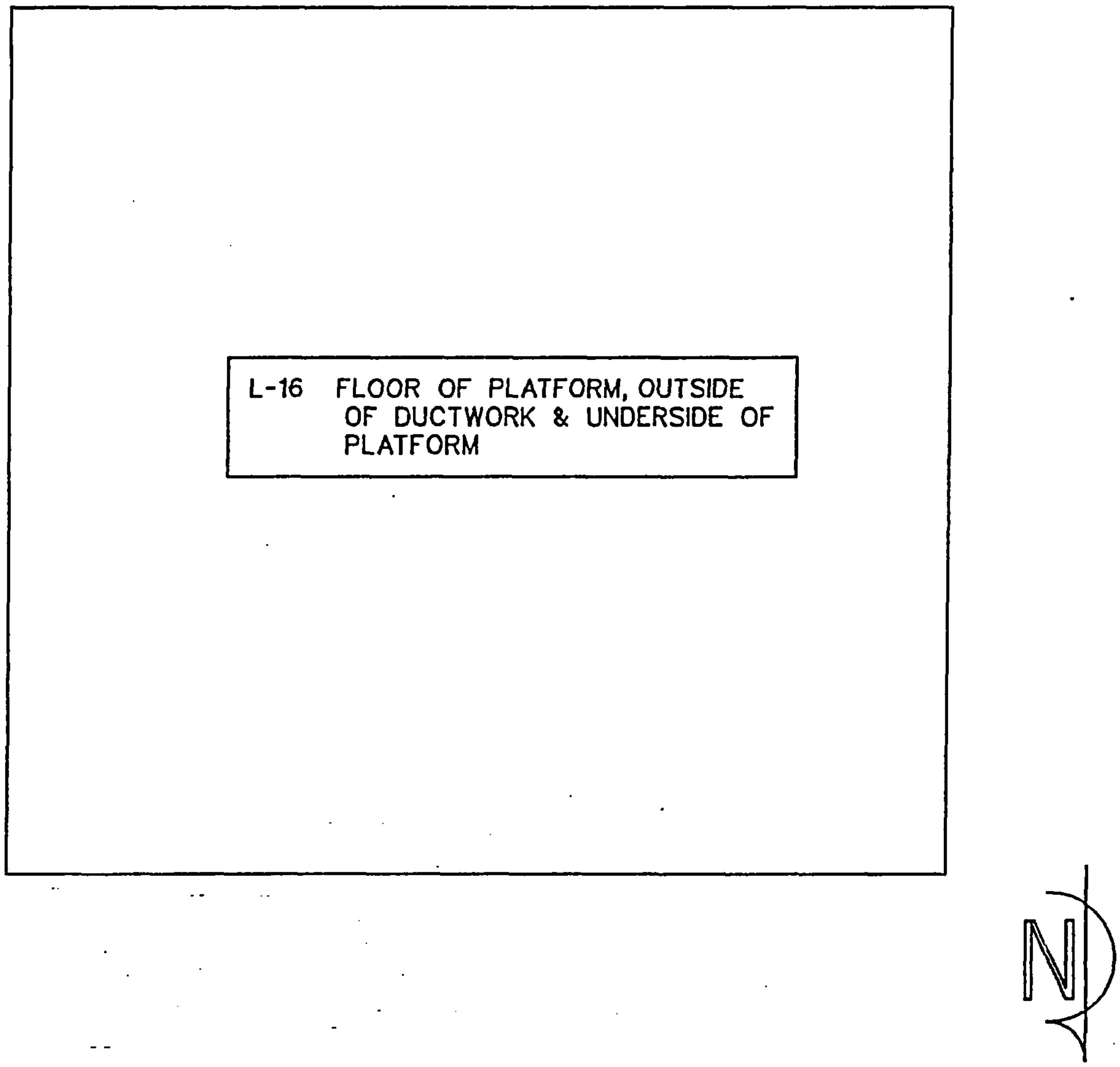


FIGURE 6-9 PATHFINDER FUEL HANDLING BUILDING HVAC PLATFORM SURVEY LOCATIONS



PATHFINDER
NEW FUEL STORAGE
ROOF & CEILING
SURVEY LOCATIONS

FIGURE 6-10 PATHFINDER FUEL HANDLING BUILDING FAN FLOOR SURVEY UNIT LOCATIONS

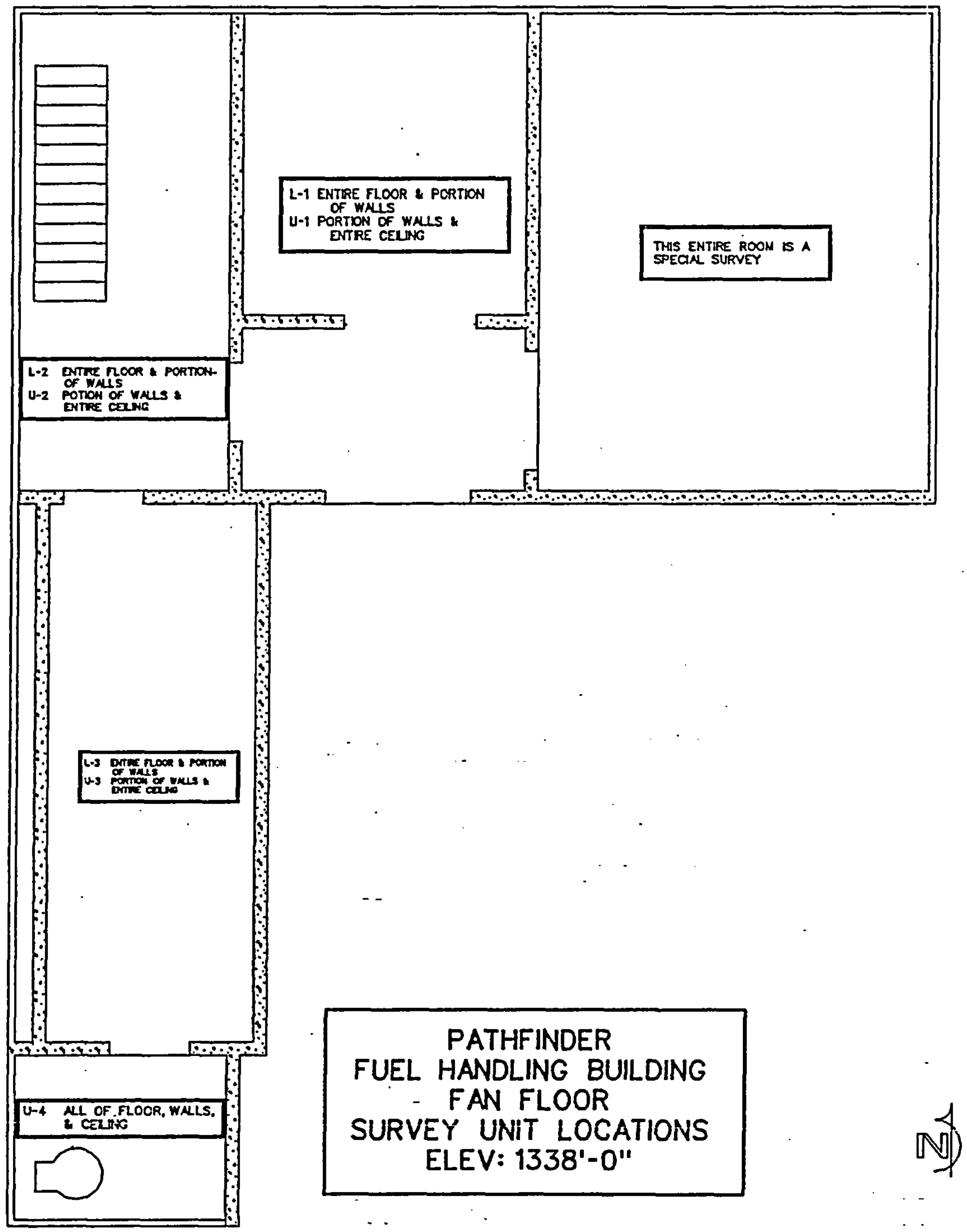
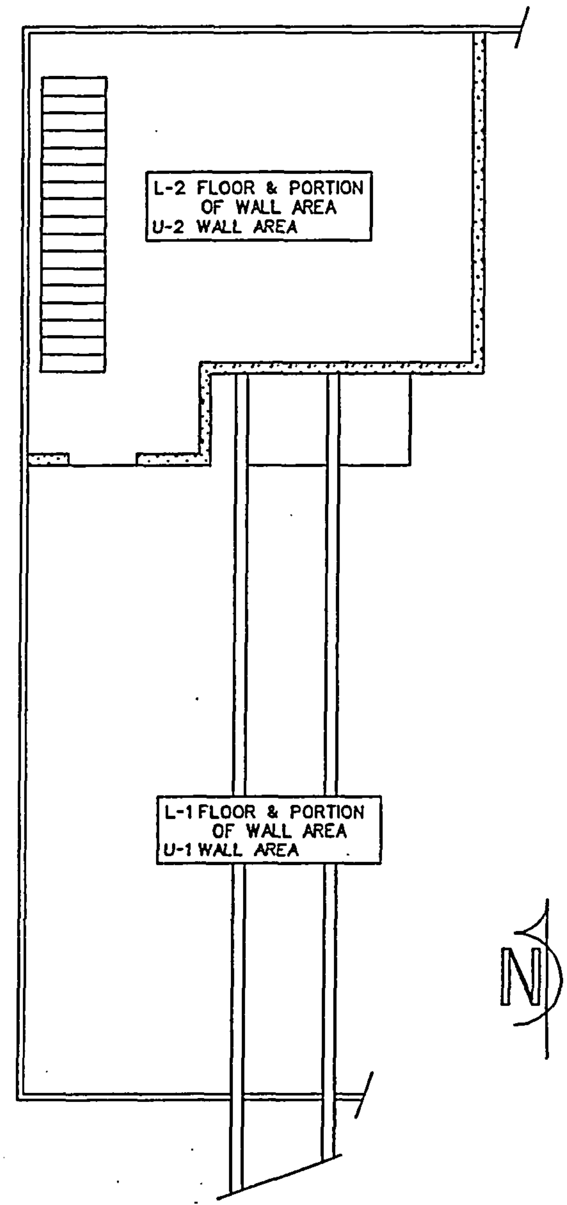


FIGURE 6-11 PATHFINDER FUEL HANDLING BUILDING CRANE FLOOR



PATHFINDER
FUEL HANDLING BUILDING
CRANE FLOOR
ELEV: 1349'-3 1/2"

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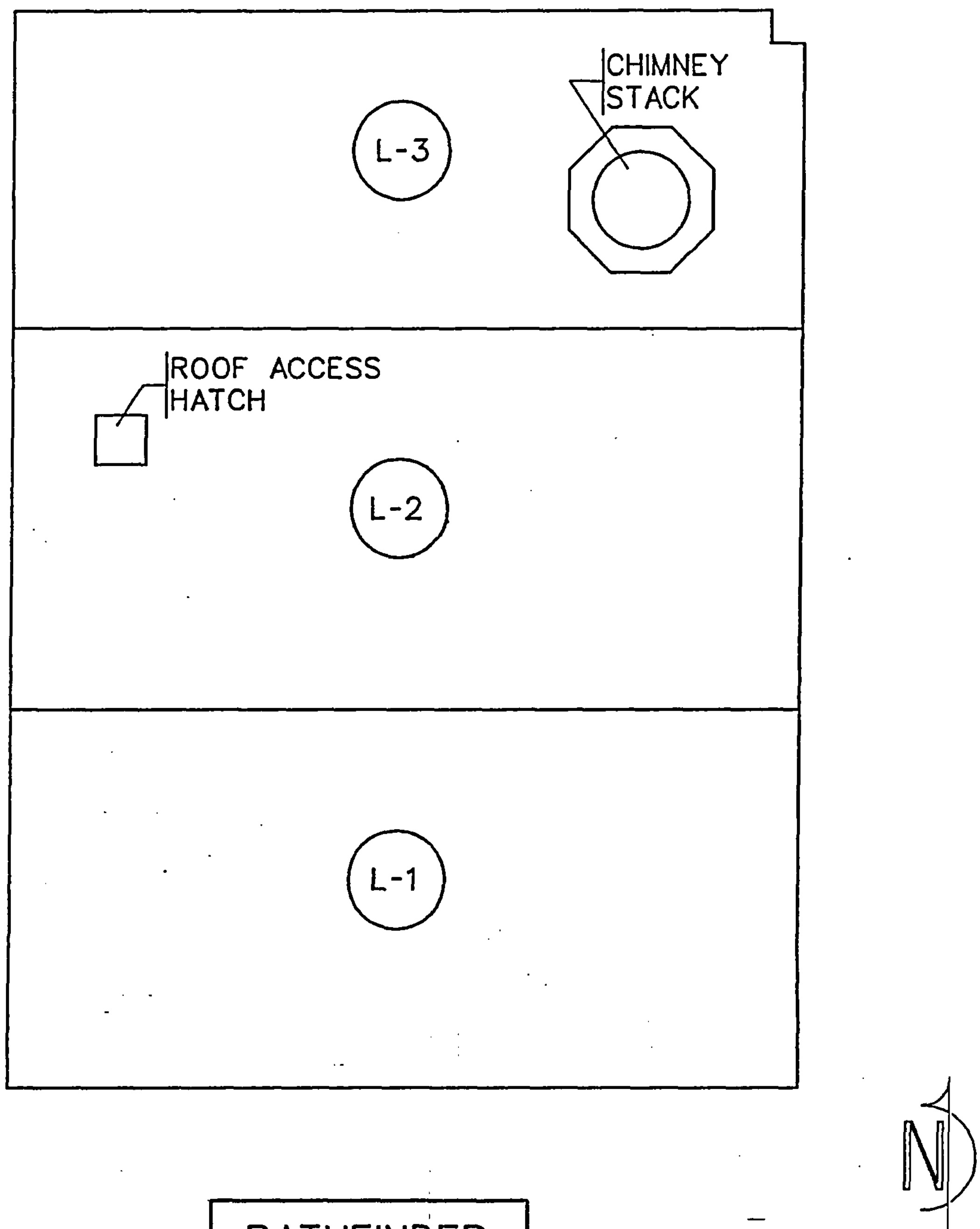
FIGURE 6-12 PATHFINDER FUEL HANDLING BUILDING ROOF SURVEY UNIT LOCATIONS



PATHFINDER
FHB - ROOF
SURVEY UNIT
LOCATIONS

FIGURE 6-13 PATHFINDER FUEL HANDLING BUILDING ACCESS HALLWAY SURVEY UNIT LOCATIONS

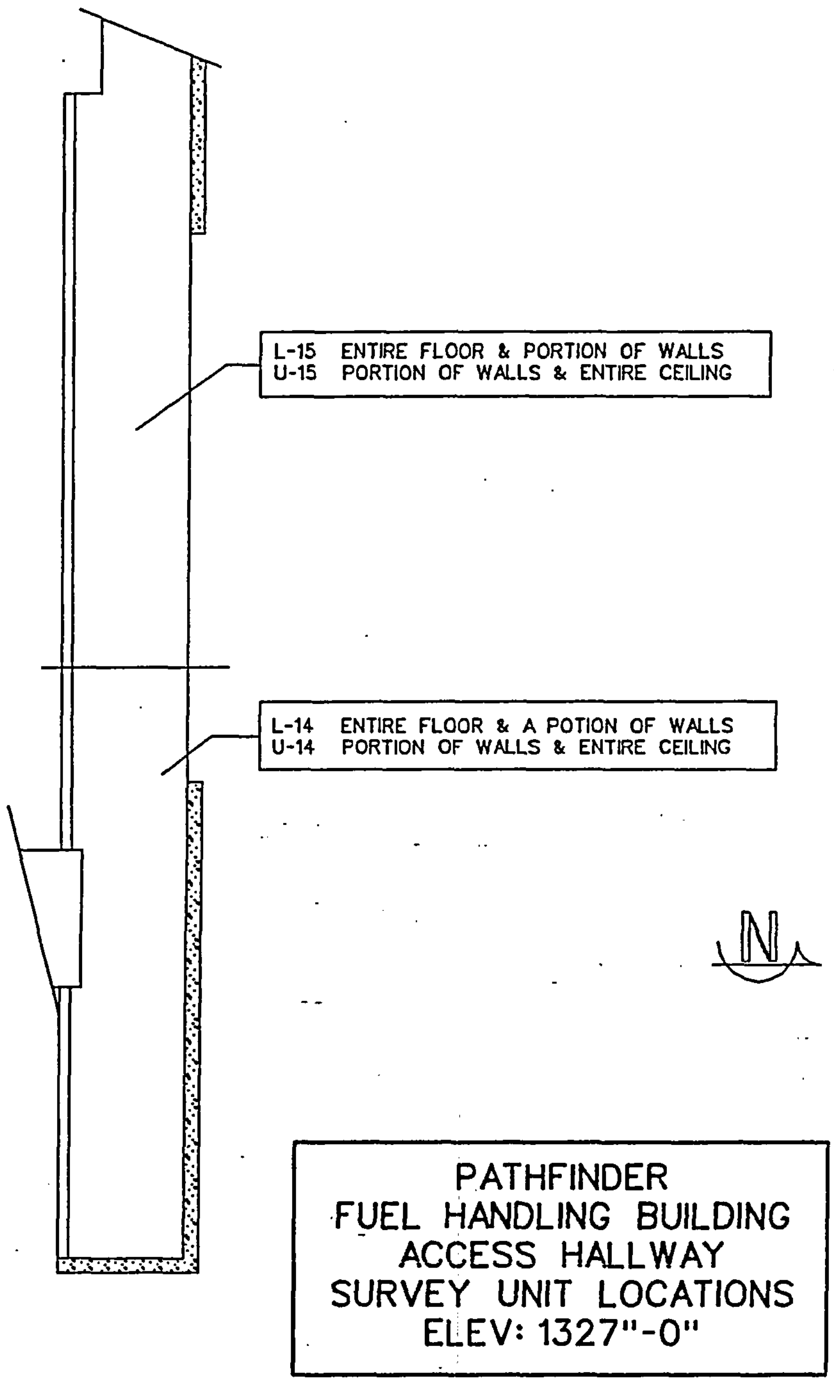
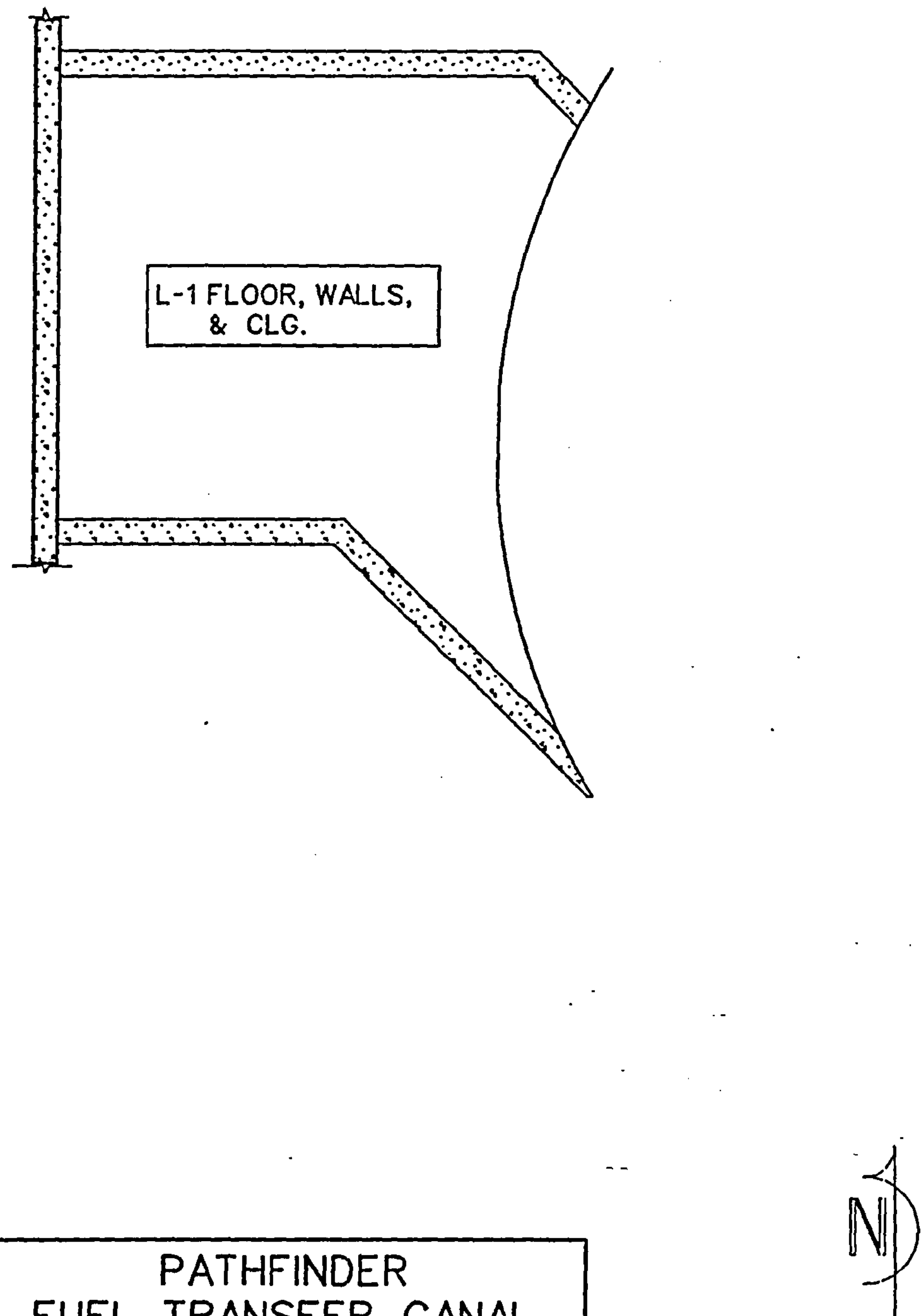
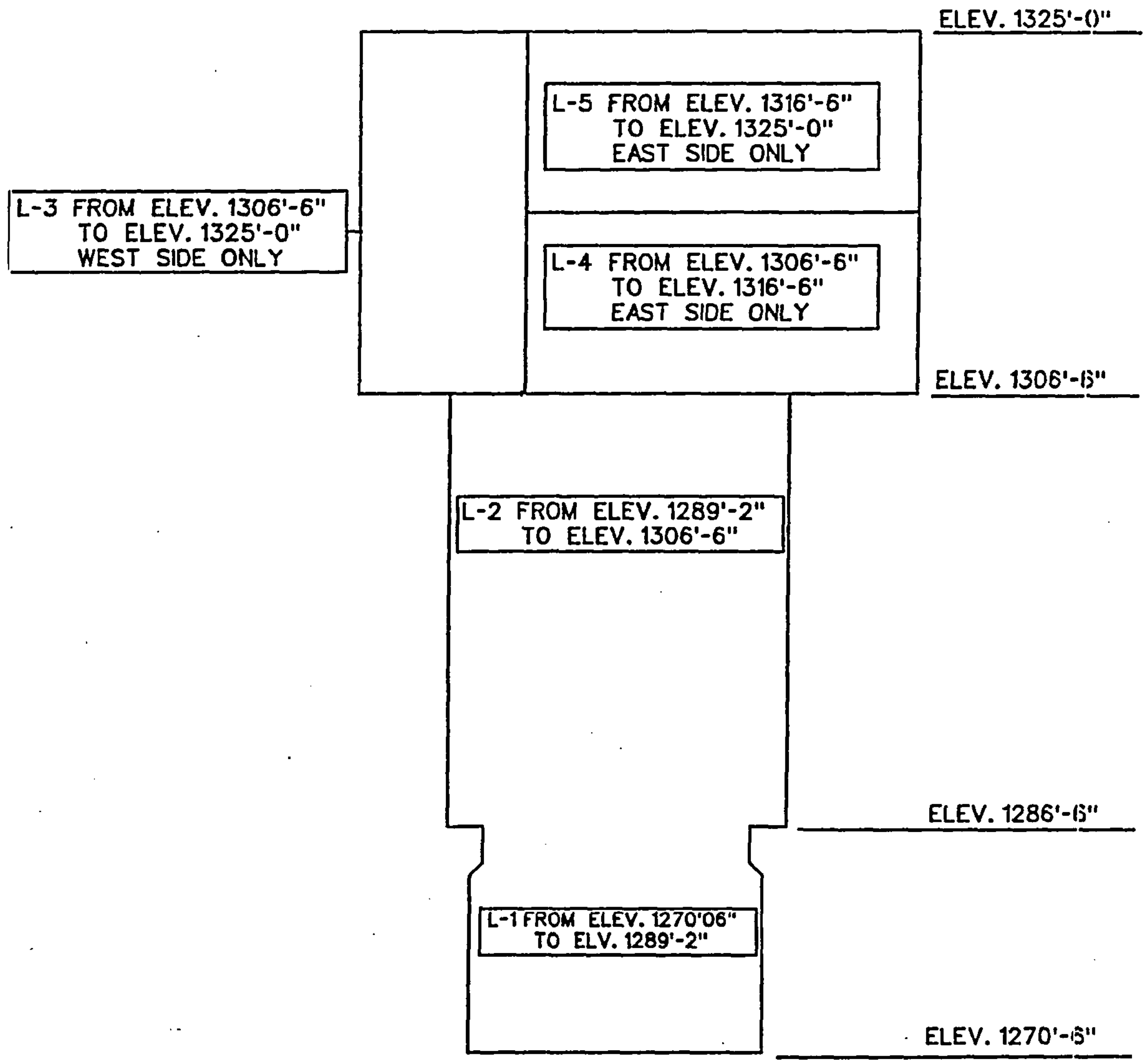


FIGURE 6-14 PATHFINDER FUEL TRANSFER CANAL SURVEY UNIT LOCATIONS



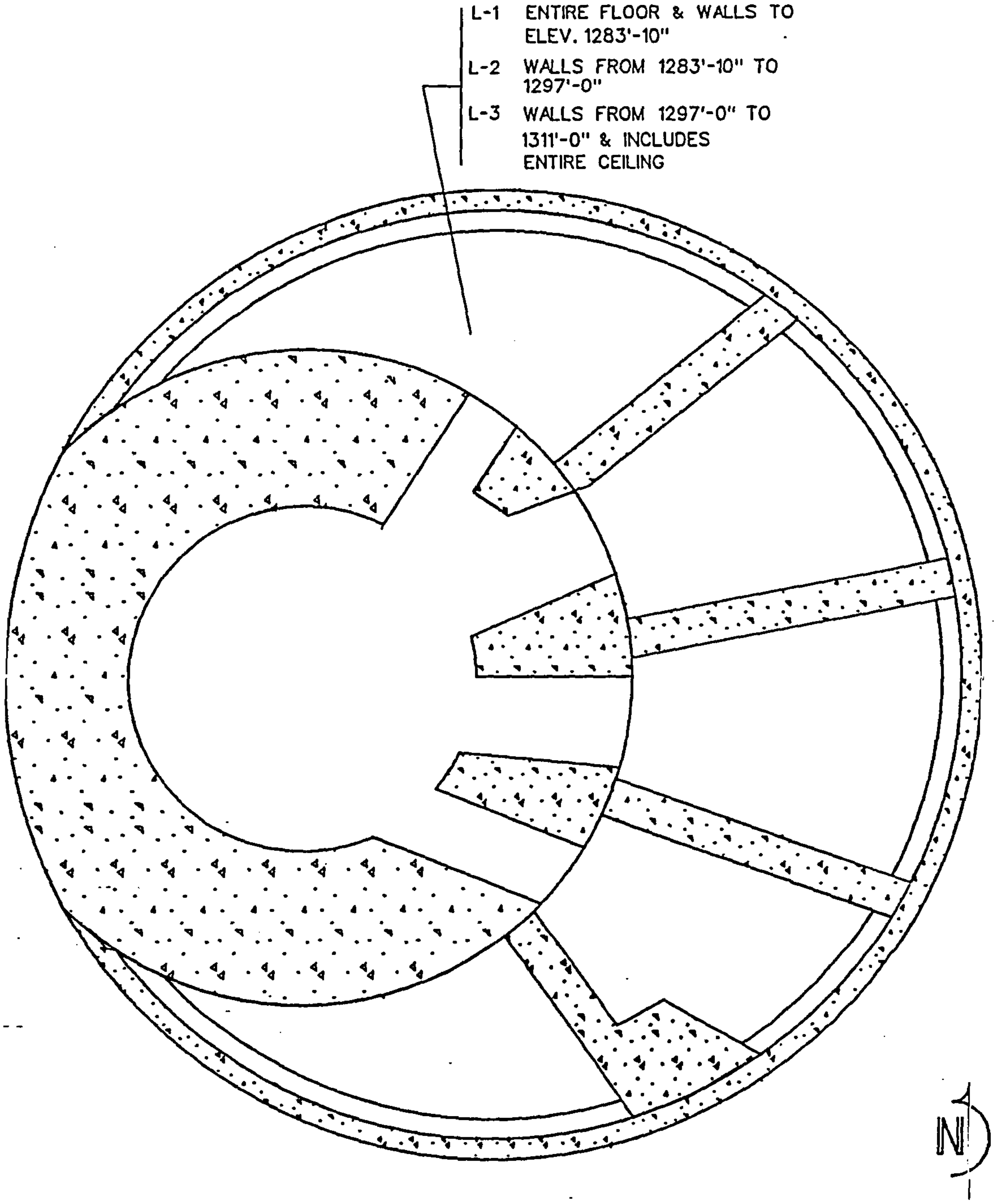
PATHFINDER
FUEL TRANSFER CANAL
SURVEY UNIT LOCATIONS

FIGURE 6-15 PATHFINDER REACTOR BUILDING CAVITY & SHIELD POOL SURVEY UNIT LOCATIONS



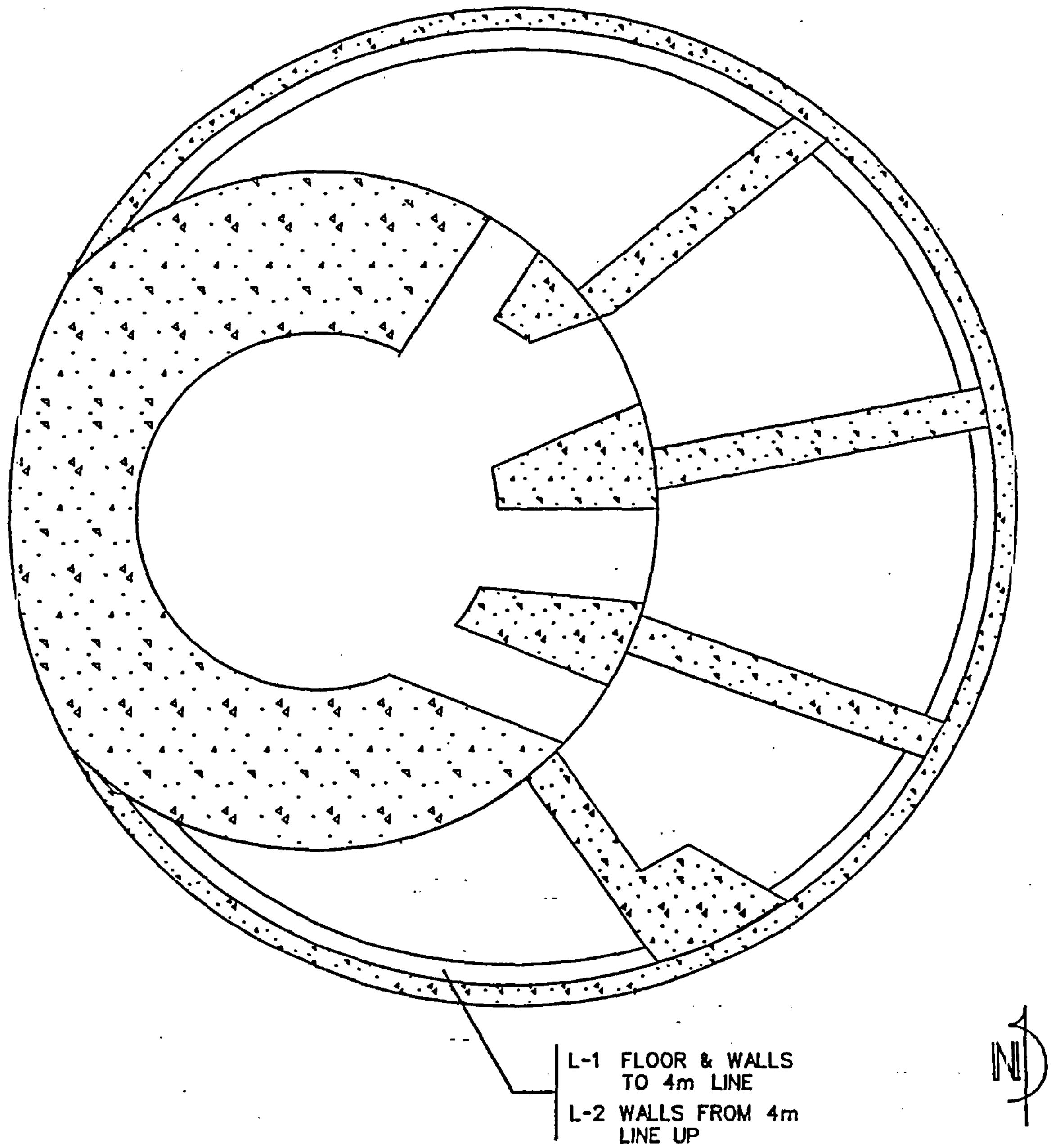
PATHFINDER
REACTOR BUILDING
CAVITY & SHIELD POOL
SURVEY UNIT LOCATIONS

FIGURE 6-16 PATHFINDER REACTOR BUILDING STEAM CHASE SURVEY UNIT LOCATIONS



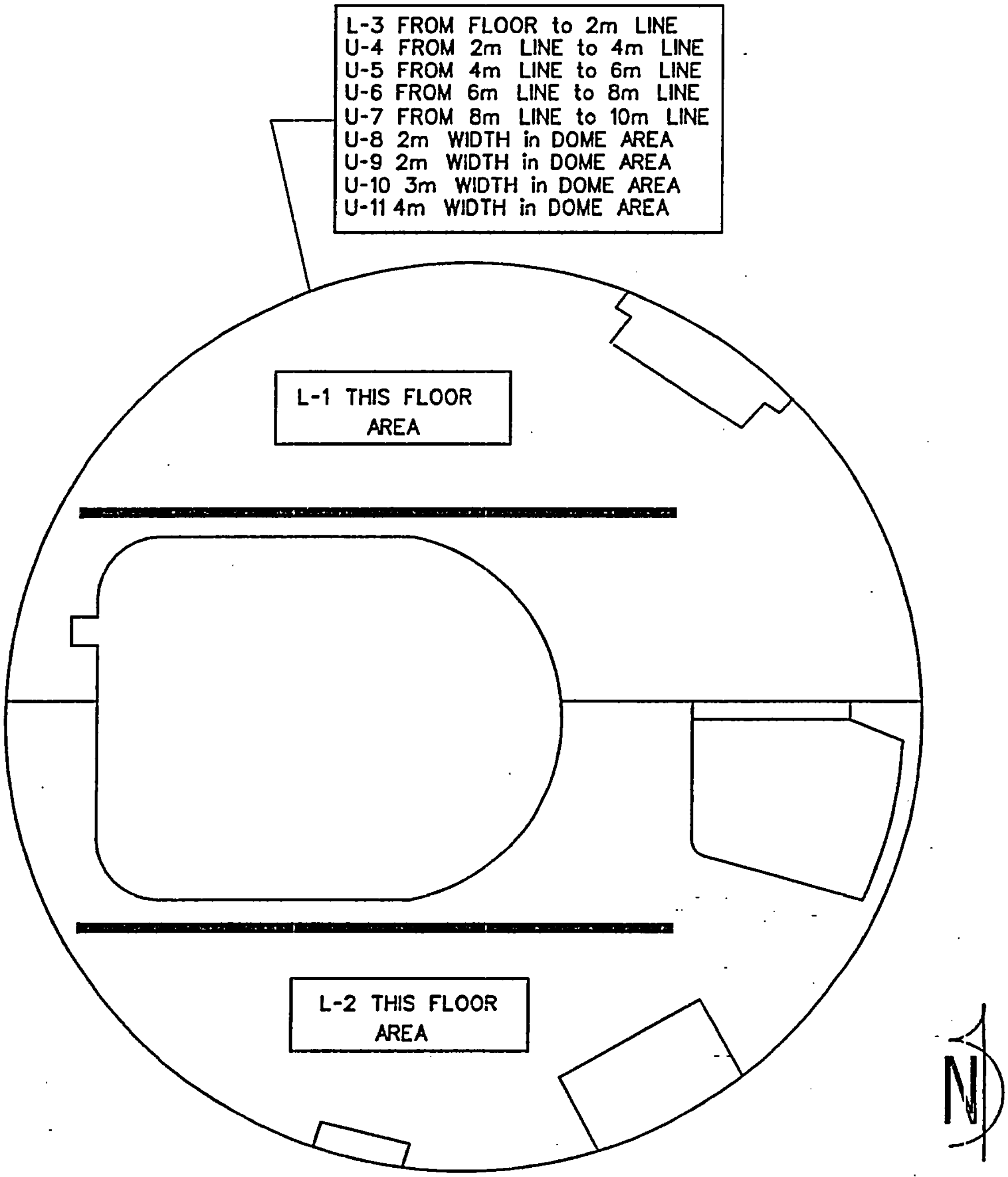
PATHFINDER REACTOR BUILDING STEAM CHASE SURVEY UNIT LOCATIONS. ELEV. 1270'-6"

FIGURE 6-17 PATHFINDER REACTOR BUILDING SUMP CHASE SURVEY UNIT LOCATIONS



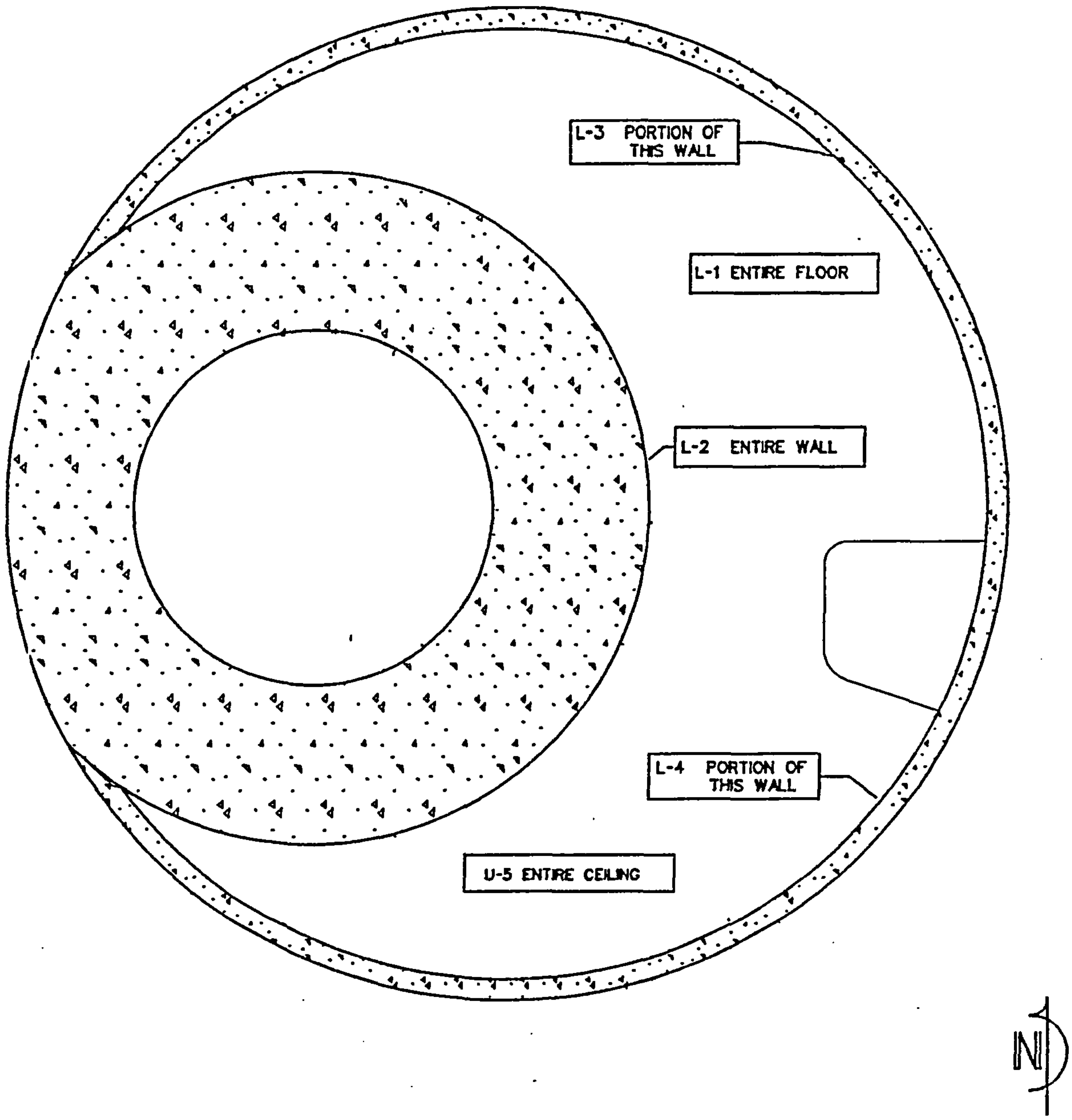
PATHFINDER REACTOR BUILDING
SUMP CHASE SURVEY UNIT
LOCATIONS. ELEV. 1270'-6"

FIGURE 6-18 PATHFINDER REACTOR BUILDING OPERATING FLOOR SURVEY UNIT LOCATIONS



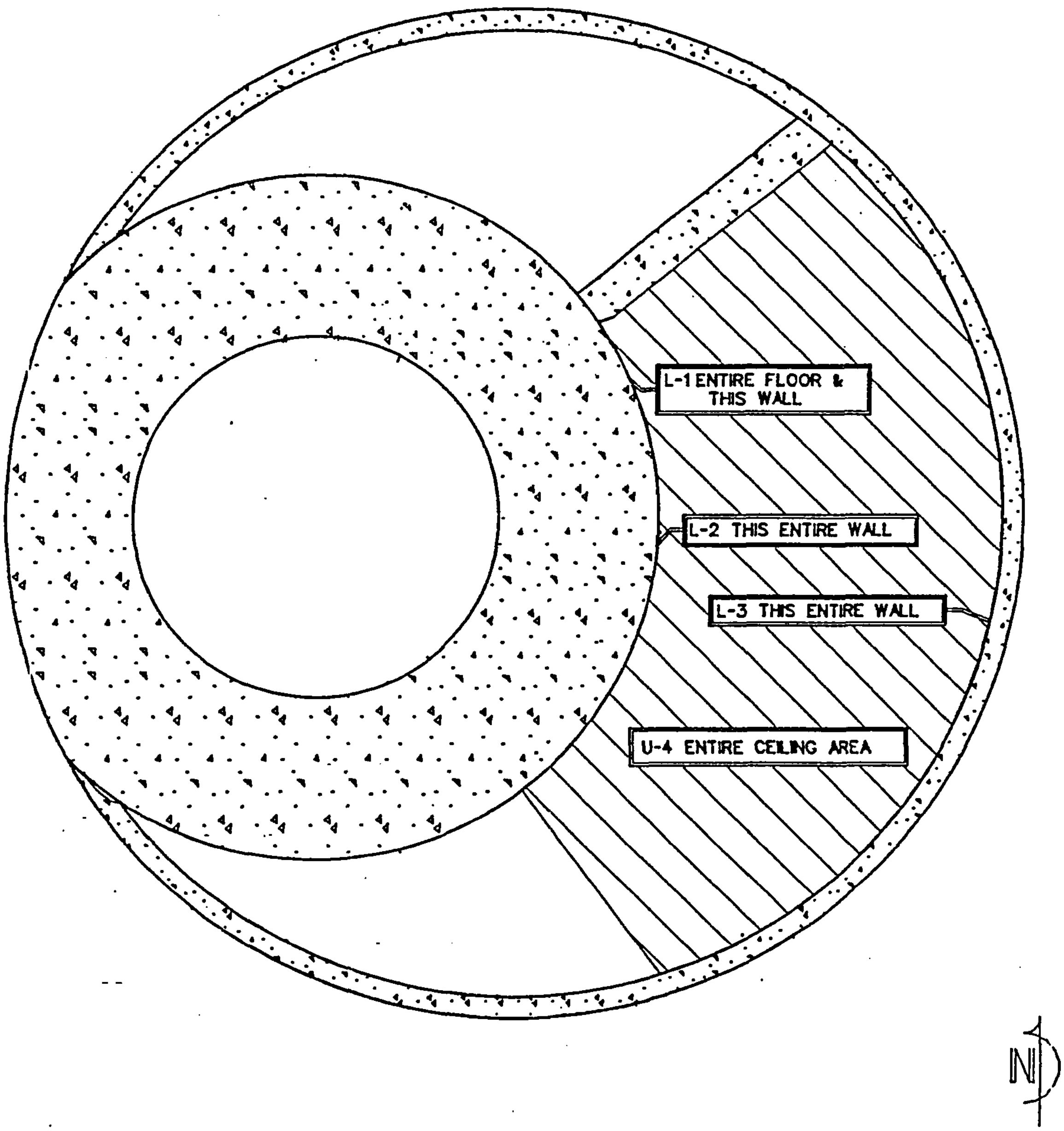
PATHFINDER REACTOR BUILDING
OPERATING FLOOR
SURVEY UNIT LOCATIONS

FIGURE 6-19 PATHFINDER REACTOR BUILDING EQUIPMENT FLOOR SURVEY UNIT LOCATIONS



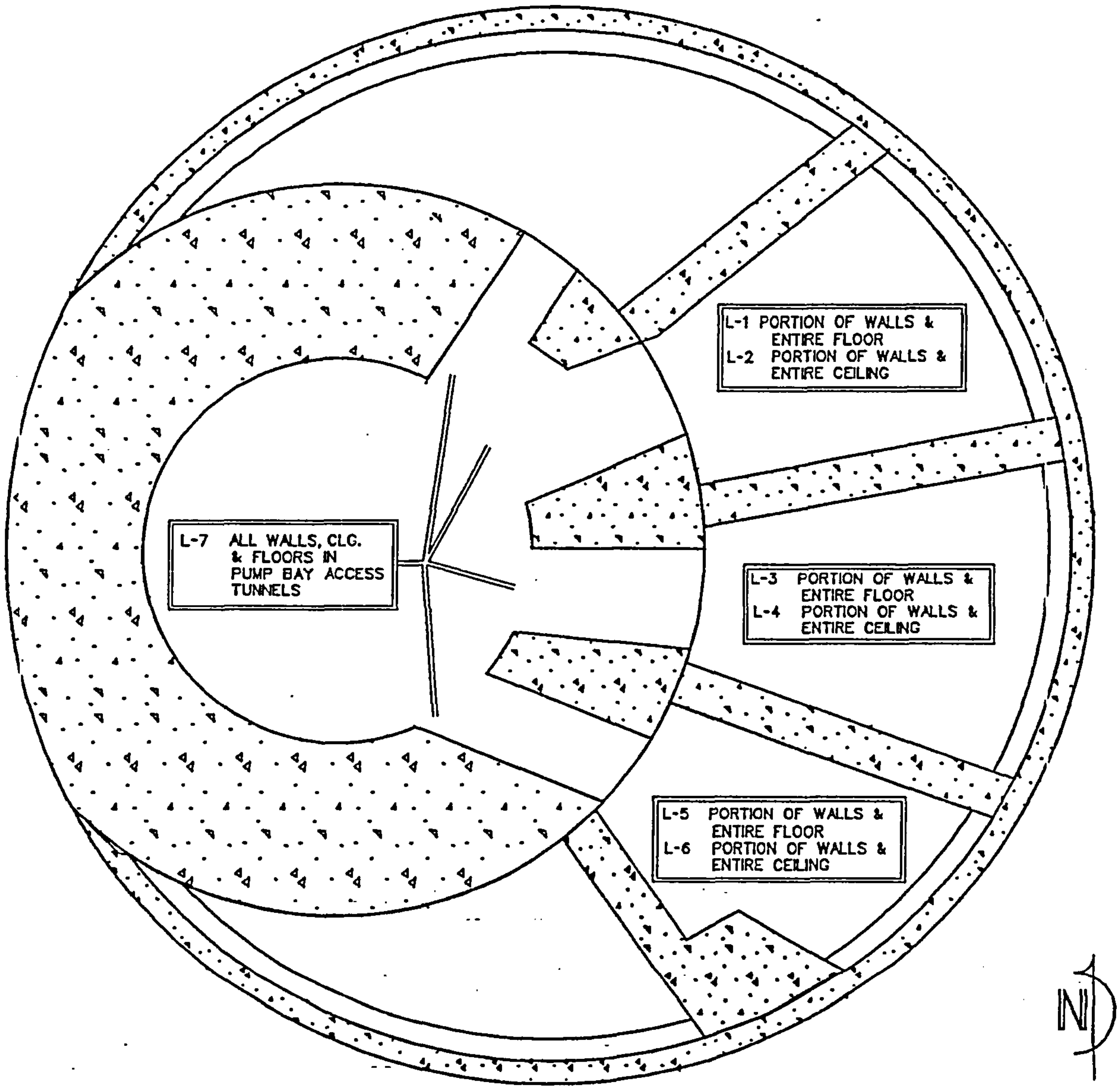
PATHFINDER REACTOR BUILDING
EQUIPMENT FLOOR
SURVEY UNIT LOCATIONS
ELEV. 1313'-0"

FIGURE 6-20 PATHFINDER REACTOR BUILDING PLUG FLOOR SURVEY UNIT LOCATIONS



PATHFINDER REACTOR BUILDING PLUG FLOOR SURVEY UNIT LOCATIONS. ELEV. 1297'-0"

FIGURE 6-21 PATHFINDER REACTOR BUILDING PUMP FLOOR SURVEY UNIT LOCATIONS



PATHFINDER
REACTOR BUILDING
PUMP FLOOR
SURVEY UNIT LOCATIONS
ELEV: 1270'-6"

FIGURE 6-22 PATHFINDER TEMP, LOADING & STORAGE BUILDING SURVEY UNIT LOCATIONS

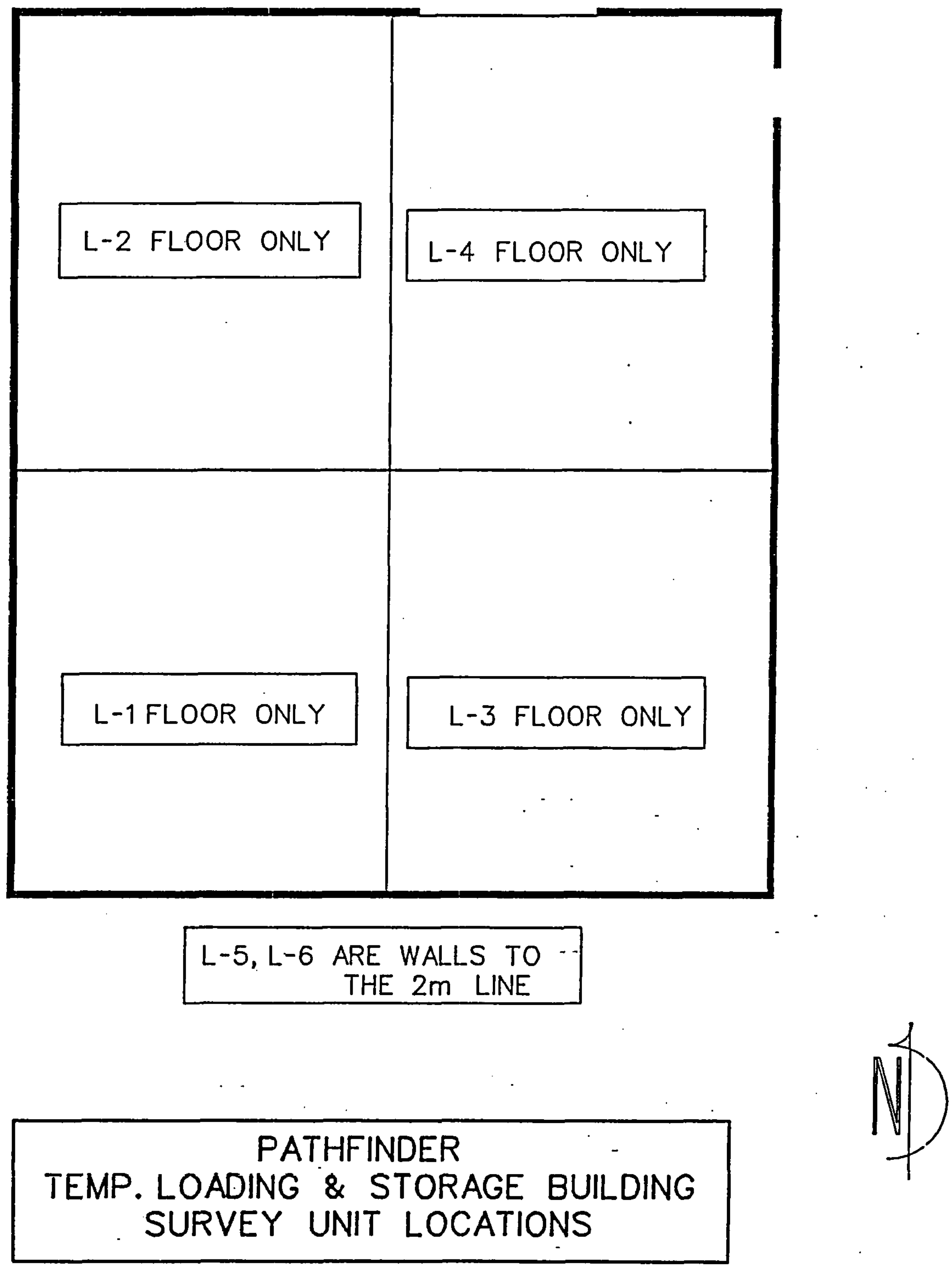
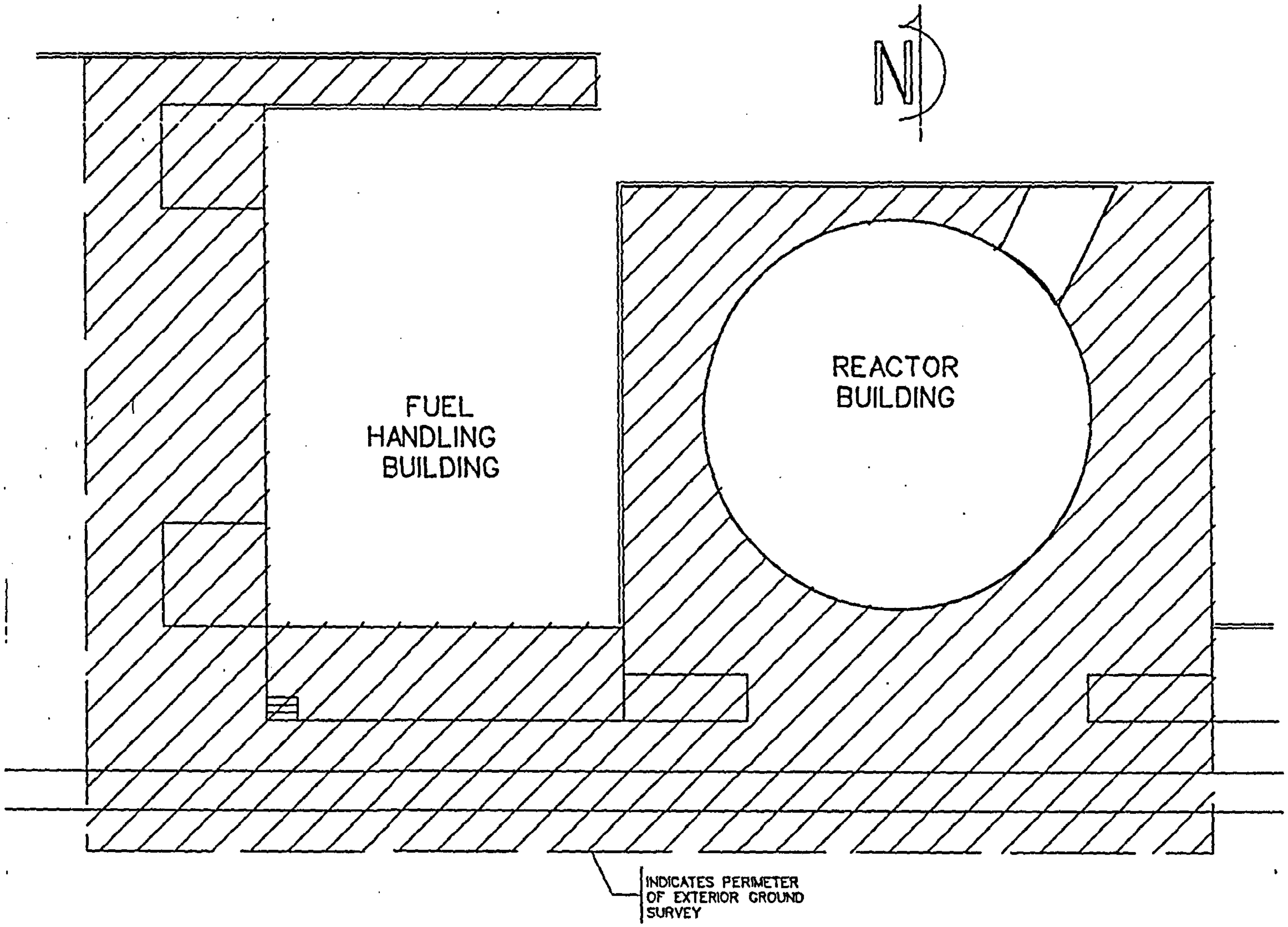
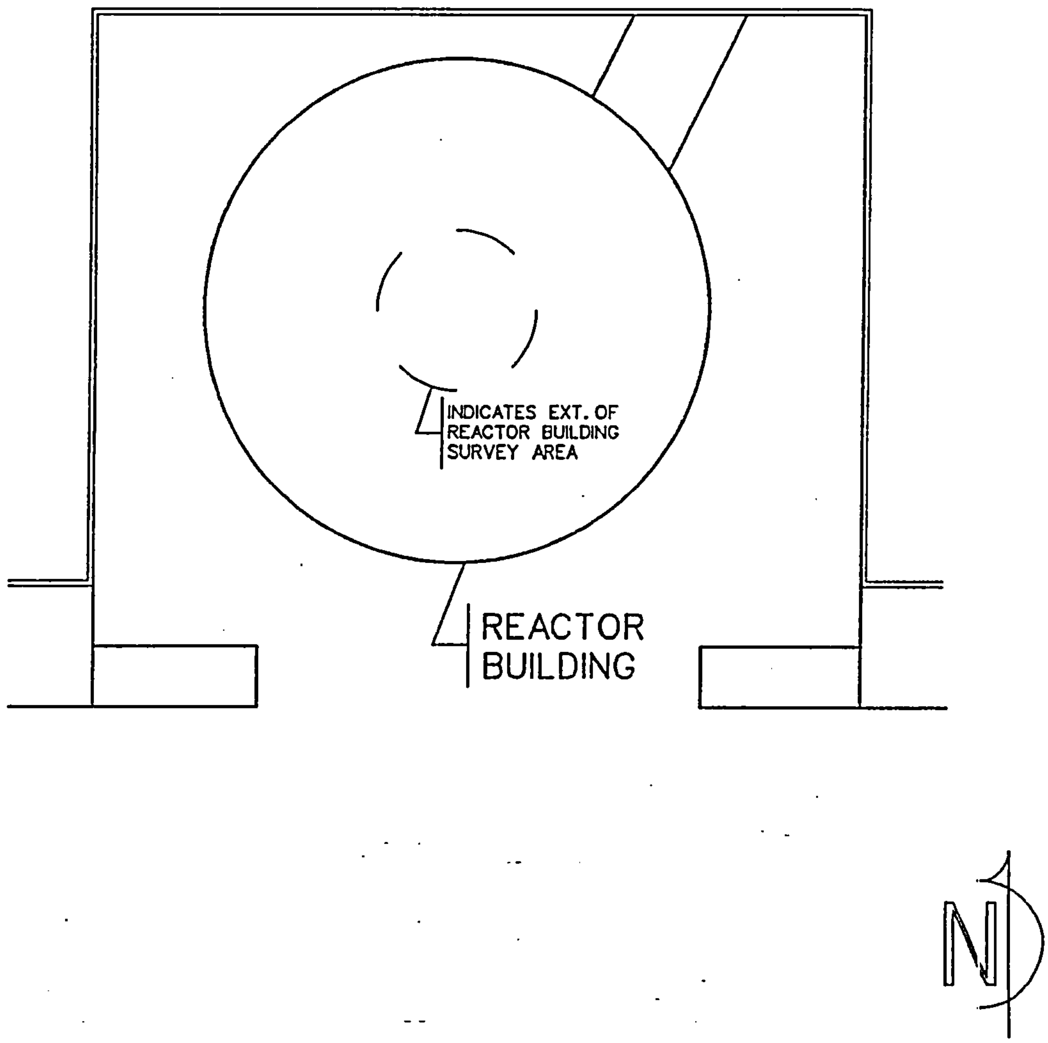


FIGURE 6-23 PATHFINDER GROUND SURVEY UNIT LOCATIONS



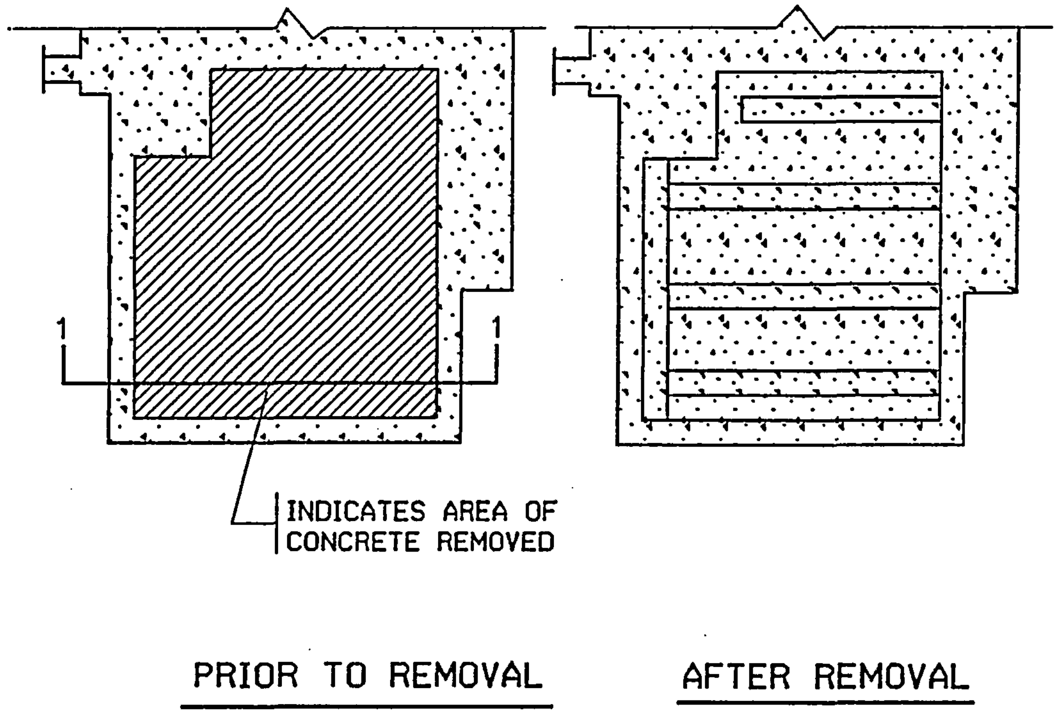
PATHFINDER EXTERIOR
SURVEY LOCATION
ELEV. 11324'-0"

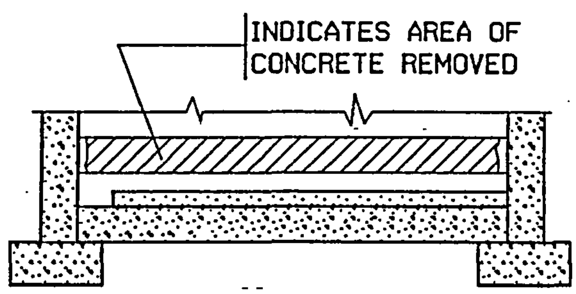
FIGURE 6-24 PATHFINDER REACTOR BUILDING DOME OUTSIDE SURVEY UNIT LOCATIONS



PATHFINDER
EXTERIOR REACTOR BUILDING
SURVEY UNIT LOCATION

FIGURE 6-25 PATHFINDER FUEL HANDLING BUILDING SPENT FUEL SUBFLOOR CONTAMINATION REMOVAL

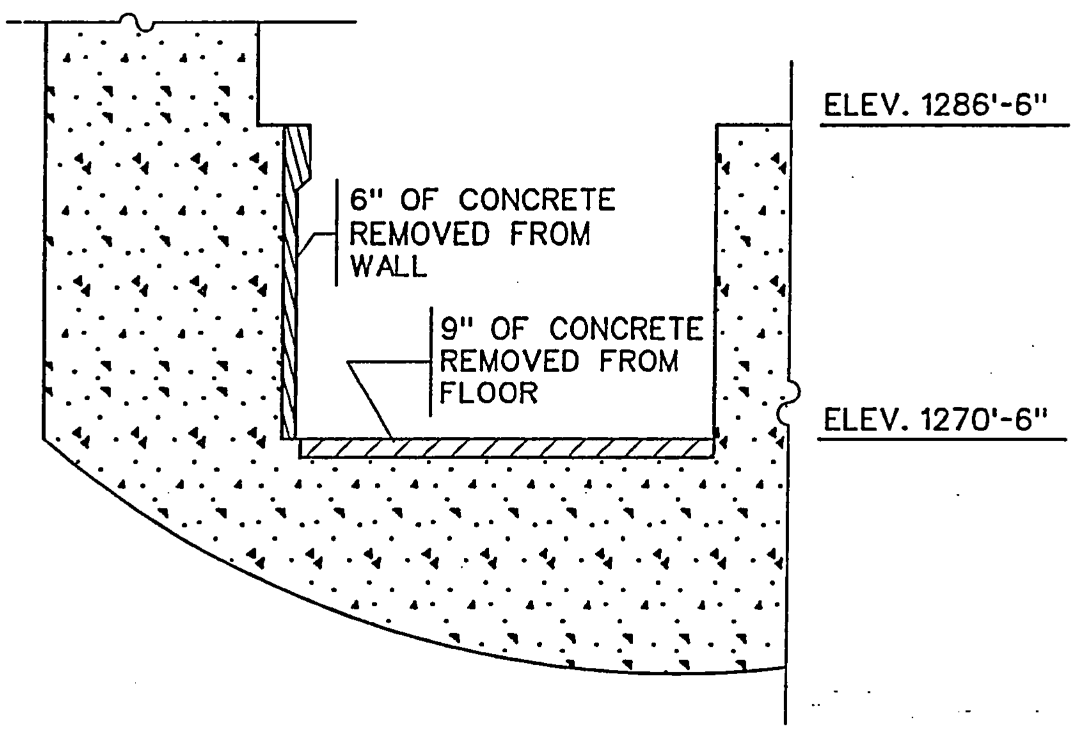




SECTION 1-1

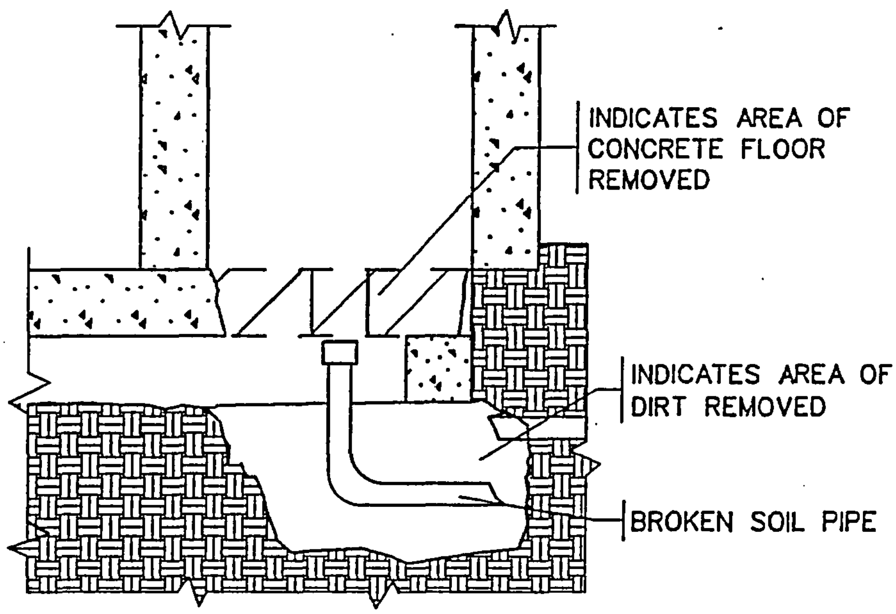
PATHFINDER
SUBFLOOR - SPENT
FUEL POOL
CONTAMINATION REMOVAL

FIGURE 6-26 PATHFINDER REACTOR BUILDING CAVITY CONTAMINATION REMOVAL

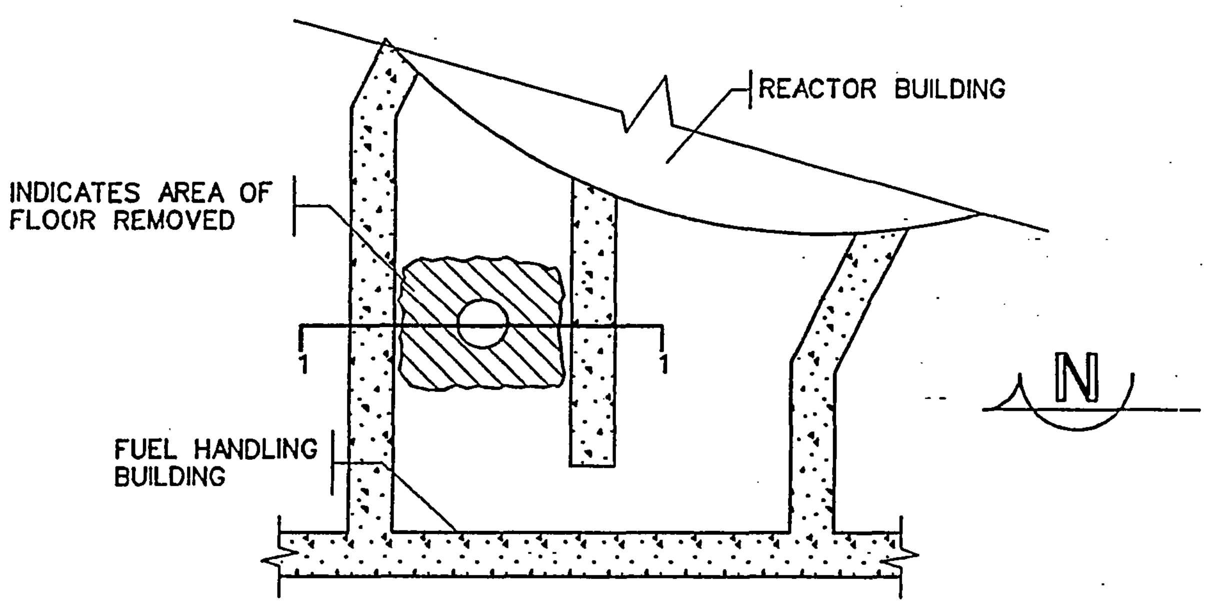


PATHFINDER RB CAVITY
CONTAMINATION REMOVAL

FIGURE 6-27 PATHFINDER FTV CONTAMINATION REMOVAL

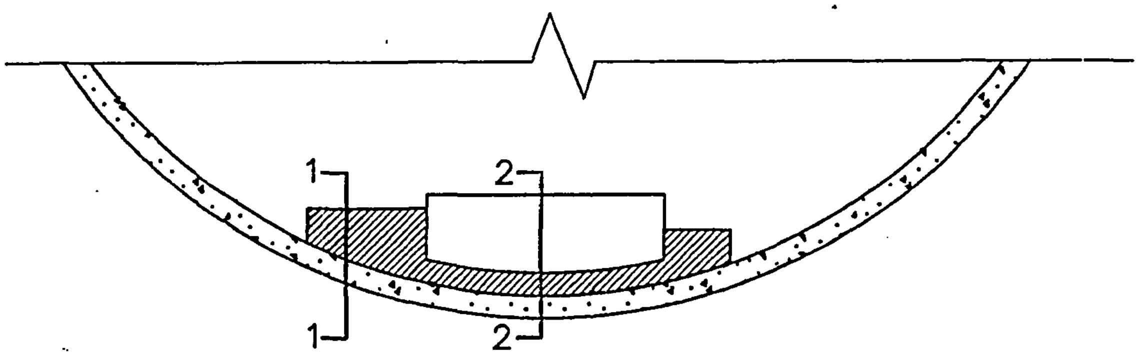


SECTION 1-1

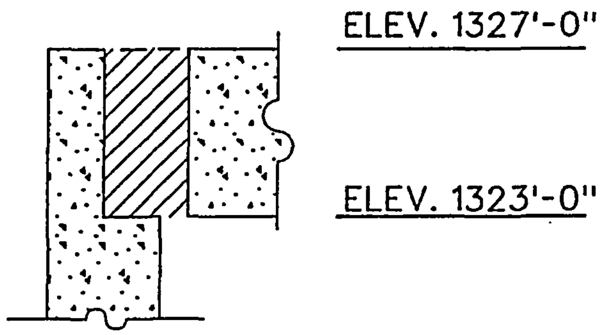


PATHFINDER FTV
CONTAMINATION REMOVAL

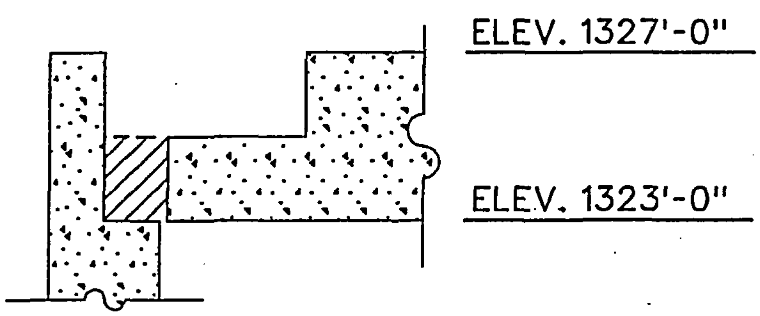
FIGURE 6-28 PATHFINDER REACTOR BUILDING OPERATING FLOOR AT EQUIPMENT DOOR CONCRETE REMOVAL



PATHFINDER RB OPERATING FLOOR
@ EQUIPMENT DOOR CONCRETE
REMOVAL ELEV. 1327'-0"



SECTION 1-1



SECTION 2-2

APPENDIX C

TABLES

TABLE 4-1 PATHFINDER TOTAL PROCESS EQUIPMENT RADIONUCLIDE INVENTORY (REF. 3)

Radionuclide	Total Inventory (Curies)	
	July 1980 [(a)]	January 1990 [(b)]
^{60}Co	1.05×10^{-1}	3.01×10^{-2}
^{63}Ni	1.42×10^{-2}	1.33×10^{-2}
^{55}Fe	7.95×10^{-3}	6.94×10^{-4}
^{137}Cs	1.2×10^{-4}	9.65×10^{-5}
^{59}Ni	1.0×10^{-4}	1.0×10^{-4}
^{108m}Ag	3.6×10^{-6}	3.42×10^{-6}
^{152}Eu	1.9×10^{-6}	1.16×10^{-6}
^{238}Pu	8.0×10^{-7}	7.42×10^{-7}
^{241}Am	2.0×10^{-7}	1.97×10^{-7}
Total	1.274×10^{-1} Ci	4.43×10^{-2} Ci

(a) As reported by Topical Report: Residual Radionuclide Distribution and Inventory at the Pathfinder Generating Plant, PNL-4326, June 1982, Pacific Northwest Laboratory, Richland, Washington

(b) Calculated from PNL study data for 9.5 years of radioactive decay

TABLE 4-2 ESTIMATED RADIONUCLIDE INVENTORY IN THE REACTOR VESSEL AND INTERNAL STRUCTURES AS OF JANUARY 1990 (REF. 4)

Component	^{3}H	^{14}C	^{55}Fe	^{60}Co	^{59}Ni	^{63}Ni	^{94}Nb	^{99}Tc	^{152}Eu	^{154}Eu	Total Others	Curies
Superheater Baffle	0.08	0.03	4.63	34.81	0.19	22.24	-	-	0.03	-	-	62.0
Superheater fuel insul. tubes	0.15	0.06	8.88	66.71	0.36	42.61	-	-	0.05	-	-	118.8
Superheater support plate	-	-	-	-	-	-	-	-	-	-	-	<0.01
Superheater control rods	-	-	0.07	0.49	-	0.31	-	-	-	-	-	0.9
Boiler fuel boxes	0.01	0.05	0.83	7.62	0.04	4.49	-	-	-	-	1.33	14.4
Boiler shroud	0.23	0.09	14.51	78.09	0.59	70.88	-	-	-	-	-	164.4
Boiler hold down structure	0.02	-	0.92	6.93	0.04	4.43	-	-	-	-	0.01	12.3
Boiler CR tubes/remain structure	0.01	-	0.74	5.58	0.03	3.56	-	-	-	-	-	9.9
Boiler element poison shims	0.03	0.01	1.88	14.14	0.08	9.03	-	-	0.01	-	-	25.2
Boiler control blades	0.11	0.04	6.47	48.61	0.26	31.05	-	-	0.04	-	-	86.6
Instrumentation/sample holders	-	-	0.48	3.58	0.02	2.29	-	-	-	-	0.01	6.4
Boiler grid plate	0.07	0.02	3.82	28.69	0.15	18.33	-	-	0.02	-	-	51.1
Steam separators & supports	0.01	-	0.72	3.89	0.03	3.53	-	-	-	-	-	8.2
Feedwater ring & supports	-	-	0.02	0.13	-	0.11	-	-	-		-	0.3
Vessel cladding	-	-	0.10	0.52	-	0.47	-	-	-	-	-	1.1
Vessel	0.01	-	0.46	0.16	-	0.11	-	-	-	-	-	0.7
Total by isotope (curies)	0.74	0.31	44.52	299.95	1.78	213.44	<0.01	<0.01	0.15	<0.01	1.36	562.2
Percentage of total by isotope	0.13	0.05	7.92	53.35	0.32	37.96	<0.1	<0.01	0.03	<0.01	0.24	

TABLE 6-2 SURVEY UNITS

Location	Number of Survey Units		Survey Unit Surface Area (m^2)			Number of Grid Points Surveyed	
	Lower	Upper	Avg	Min	Max	Lower	Upper
FHB - Bsmt	13	12	67	39	95	588	530
FHB - Crane	2	2	77	48	98	104	69
FHB - Fan	3	4	69	51	89	152	182
FHB - Mezz	7	7	82	57	99	351	328
FHB - Oper	9	12	68	35	92	338	569
FHB - Roof	3	0	91	79	97	145	0
RB - Cavity	5	0	79	57	95	296	0
RB - Equip	4	1	71	58	90	158	45
RB - FTV	1	0	71	N/A	N/A	74	0
RB - Oper	3	8	83	53	94	111	351
RB - Plug	3	1	73	58	96	137	37
RB - Pump	7	0	90	65	99	408	0
RB - Steam Chase	3	0	86	76	99	161	0
RB - Sump Chase	2	0	52	48	56	68	0
RWS	6	0	88	71	99	333	0

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TABLE 6-3 SURVEY AREAS EXCEEDING TRIGGER LEVEL

Location		Unit	Area	Point	Results (dpm/100 cm^2)	
Bldg	Floor				Pre-Decon	Post-Decon
FHB	OPER	2L	019	A9-A1	4182	1934
FHB	OPER	3L	015	H7-H3	7587	1539
FHB	OPER	3L	019	A2-A5	4708	262
FHB	OPER	6U	010	F14	1134	202
FHB	OPER	6U	027	A1-E2	1608	Note [1]
FHB	MEZZ	1L	M1	A1-B6	4508	-88
FHB	MEZZ	1L	B79	A2	11532	341
FHB	BASE	2L	B32	A1	4498	87
FHB	BASE	2L	B80	B3-B4	14913	-1190
FHB	BASE	3L	B29	A1-B4	6325	538
FHB	BASE	3L	B83	A1-H9	3982	611
FHB	BASE	3L	B84	C1-7FS	7691	874
FHB	BASE	4L	B13	C1-D3	7770	314
FHB	BASE	4L	B17	C1-D3	3746	2291
FHB	BASE	7L	B23	A1-C10	3688	341
FHB	BASE	11L	B36	A11	4563	-377
FHB	BASE	3U	B31	C1-D4	3435	87
FHB	BASE	10U	B48	C2	5127	238
FHB	BASE	11U	B104	B1	6442	-652
RB	SUMP	1L	S1	A1-C4	6415	-763
RB	STMCH	1L	C2	A1-E6	3854	372
RB	STMCH	1L	C3	D6	3800	-254
RB	STMCH	2L	C3	E6	3746	-703
RB	CAVE	3L	V6	B6-7	4262	-509
RB	PUMP	5L	R30	A1-H3	6166	-242
RB	PUMP	5L	R31	A1-F2	6057	1853
RB	PUMP	6L	R28	A2	7361	101

Note 1 Chipped off approximately 1/4" thick cinder block. Readings did not change. HpGe sample of chiseled block showed no isotopes of plant origin.

TABLE 6-4 SURVEY POINTS EXCEEDING TRIGGER LEVEL

Location		Unit	Area	Point	Results (dpm/100 cm^2)	
Bldg	Floor				Pre-Decon	Post-Decon
FHB	MEZZ	IL	M1	A4	11830	-1040
FHB	MEZZ	IL	M61	C2	15621	-1215
FHB	MEZZ	3L	M23	A6	20566	-971
FHB	MEZZ	3L	M31	A10	4517	363
FHB	MEZZ	7L	M69	A3	6525	727
FHB	BASE	1L	B77	A2	4382	-560
FHB	BASE	1L	B79	A4	33044	-647
FHB	BASE	2L	B34	B4	4398	786
FHB	BASE	2L	B34	A4	4217	786
FHB	BASE	8L	B82	G2	6481	-1134
FHB	BASE	9L	B58	A12	11900	-828
FHB	BASE	9L	B58	B12	3477	-1029
FHB	BASE	12L	B61	A1	7928	1949
FHB	BASE	12L	B61	A2	6792	1145
FHB	BASE	12L	B62	A5	9352	-648
FHB	BASE	12L	B62	A6	8949	716
FHB	BASE	12L	B62	A7	7020	-187
FHB	BASE	12L	B62	A8	5797	536
FHB	BASE	12L	B62	A9	20449	362
FHB	BASE	12L	B62	A10	9009	797
FHB	BASE	12L	B62	A11	7031	-230
FHB	BASE	12L	B62	A12	5748	-295
FHB	BASE	1L	B75	C2	992	419
FHB	BASE	1U	B75	E1	1065	252
FHB	BASE	1U	B75	H4	1156	419
FHB	BASE	1U	B76	C1	1230	347
FHB	BASE	1U	B77	E2	1287	371
FHB	BASE	1U	B77	E4	912	264
FHB	BASE	1U	B77	F1	1134	562
FHB	BASE	1U	B77	G3	1475	484

TABLE 6-4 SURVEY POINTS EXCEEDING TRIGGER LEVEL

Location		Unit	Area	Point	Results (dpm/100 cm^2)	
Bldg	Floor				Pre-Decon	Post-Decon
FHB	BASE	1U	B77	H2	1162	591
FHB	BASE	1U	B77	H4	940	484
FHB	BASE	1L	B78	C1	1293	318
FHB	BASE	1L	B78	C4	1014	478
FHB	BASE	1U	B78	D2	1003	288
FHB	BASE	1U	B78	F1	946	109
FHB	BASE	1U	B78	H1	1156	562
FHB	BASE	1U	B78	H4	1094	663
FHB	BASE	1U	B98	B4	952	127
FHB	BASE	1U	B98	C3	1100	-4
FHB	BASE	1U	B98	D1	1179	157
FHB	BASE	7U	B23	C6	2445	-733
FHB	BASE	10U	B48	C2	4817	-43
RB	SUMP	2L	S6	F2	4216	-610
RB	STMCH	1L	C1	C4	12168	-369
RB	STMCH	1L	C1	D4	4276	-610
RB	STMCH	2L	C1	H1	8613	-796
RB	CAVE	5L	V8	B13	928	33

TABLE 6-5 SPECIAL SCAN AREAS EXCEEDING TRIGGER LEVEL

Location		Unit	Area	Point	Results (dpm/100 cm^2)	
Bldg	Floor				Pre-Decon	Post-Decon
FHB	CRANE	1L	C016-10	MAX	3327	Note [1]
FHB	FAN	5L	F016-01	MAX	5103	2285
FHB	OPER	6U	O010-01	MAX	1072	249
FHB	OPER	14U	A002-OB	MAX	5862	Note [2]
FHB	OPER	15U	A006-OD	MAX	2342	Note [3]

Note [1] This is the crane drum. A number of samples were taken with the following results:

a. Interior scrapings - no isotopes of plant origin found.
b. Core sample - no isotopes of plant found.
c. millings - no isotopes of plant origin found.
d. Plug sample - no isotopes of plant origin found.

Note [2] Ventillation Duct Fins.
The internal survey of the ventilation duct fins indicated the presence of ^{137}Cs. This ventilation system was used to draw outside intake air into the building. This isotope was previously identified in the PNL report as from non plant origin.

Note [3] Ventilation Duct Louvers
Internal survey of ventillation ductwork louvers indicated the presence of ^{137}Cs. The ventilation system was used to draw outside intake air into the building. This isotope was previously identified in the PNL report as from non plant origin.

TABLE 6-5 SPECIAL SURVEY POINTS EXCEEDING TRIGGER LEVEL

Location		Unit	Area	Point	Results	
Bldg	Floor				Pre-Decon	Post-Decon
FHB[1]	CRANE	1L	C016-10	SV24	3448 dpm/100 cm^2	Note [4]
FHB[1]	FAN	1U	F016-01	BA14	996 dpm/100 cm^2	920 dpm/100 cm^2
FHB[1]	OPER	6U	0010-10	BA46	1567 dpm/100 cm^2	622 dpm/100 cm^2
FHB[1]	MEZZ	6L	M65-1	BB12	8764 dpm/100 cm^2	-915 dpm/100 cm^2
RB[1]	OPER	7U	0003-0I	CZ27	20368 dpm/100 cm^2	Note [5]
RB[1]	OPER	7U	0003-0I	CZ28	4987 dpm/100 cm^2	Note [5]
FHB[3]	MEZZ	1L	M62-1	BA25	5 μr/hr [6]	0 μr/hr [6]
FHB[2]	MEZZ	7U	M65-1	BB10	110 dpm/100 cm^2	82 dpm/100 cm^2
FHB[3]	BASE	10U	B43-2	BA18	6 μr/hr [6]	1 μr/hr [6]
FHB[2]	BASE	12U	B62-2	BB31	112 dpm/100 cm^2	1 dpm/100 cm^2

Note [1] Direct readings.

Note [2] Smear Survey.

Note [3] Exposure rate.

Note [4] This is the crane drum. A number of samples were taken with the following results:

a. Interior scrapings - no isotopes of plant origin found.
b. Core sample - no isotopes of plant found.
c. millings - no isotopes of plant origin found.
d. Plug sample - no isotopes of plant origin found.

Note [5] "Hot Spots" on Polar Crane Controls
Points: CZ27: 4158 cpm
CZ28 1328 cpm
SR7H11, bkg 213, eff. 0184
Crane controls were removed

Note [6] Gamma exposure rate above background.

TABLE 6-7 PATHFINDER FINAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS

Building	Floor	Survey Unit	Upper or Lower	Number of Points	Average Contamination (dpm/100cm^2)	Maximum Contamination (dpm/100cm^2)	Gamma Level (microR/hr)	Removable Beta Contamination (dpm/100cm^2)	Contamination
EXT	FHRB	2	G	128	-1045.71	-59.67	-0.72 [1]	1.86	YES
EXT	GRND	1	G	851	N/A	N/A	-0.76 [1]	N/A	YES
FHB	BASE	1	L	49	203.38	1488.09	-0.56	7.80	YES
FHB	BASE	1	U	39	455.28	849.55	-1.84	6.85	YES
FHB	BASE	2	L	50	-693.27	887.02	-0.88	5.34	YES
FHB	BASE	2	U	45	-735.85	-132.17	-1.24	7.75	YES
FHB	BASE	3	L	59	-661.46	1712.86	-0.06	5.64	YES
FHB	BASE	3	U	44	-792.50	-418.57	-0.11	7.35	YES
FHB	BASE	4	L	37	-579.26	399.63	-0.10	7.56	YES
FHB	BASE	6	L	35	-772.19	62.55	-0.23	5.13	YES
FHB	BASE	6	U	36	-588.23	-94.71	-0.97	8.14	YES
FHB	BASE	7	L	58	-676.66	-132.86	-0.16	9.82	YES
FHB	BASE	7	U	39	-636.26	-332.27	-0.75	10.28	YES
FHB	BASE	8	L	40	-367.30	1230.86	-1.06	9.13	YES
FHB	BASE	8	U	31	-550.05	-82.94	-1.14	10.24	YES
FHB	BASE	9	L	49	-492.59	655.87	-1.48	4.94	YES
FHB	BASE	9	U	46	-679.41	-423.18	-1.14	6.60	YES
FHB	BASE	10	L	40	-662.70	47.17	-1.26	8.10	YES
FHB	BASE	10	U	34	-845.81	-593.64	-0.66	9.16	YES
FHB	BASE	11	L	51	-541.72	2251.68	-1.01	7.02	YES

TABLE 6-7 PATHFINDER FINAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS

Building	Floor	Survey Unit	Upper or Lower	Number of Points	Average Contamination (dpm/100cm^2)	Maximum Contamination (dpm/100cm^2)	Gamma Level (microR/hr)	Removable Beta Contamination (dpm/100cm^2)	Contamination
FHB	BASE	11	U	38	-828.01	-467.50	-1.03	7.80	YES
FHB	BASE	12	L	38	-85.31	1949.35	-0.79	5.71	YES
FHB	BASE	13	L	37	-522.46	1101.52	-0.77	5.69	YES
FHB	BASE	14	U	61	-750.45	-182.94	-1.14	3.69	YES
FHB	BASE	15	U	58	-715.96	152.35	-1.14	1.90	YES
FHB	BASE	16	U	40	-721.10	-41.76	-1.14	2.03	YES
FHB	BASE	17	L	44	-740.00	436.67	-0.16	2.79	YES
FHB	CRANE	1	L	48	-617.10	-180.55	-1.05	7.54	YES
FHB	CRANE	1	U	48	-853.17	399.41	-1.54	4.65	YES
FHB	CRANE	2	L	56	-453.75	500.99	-0.88	2.99	YES
FHB	CRANE	2	U	32	-323.59	588.71	-0.60	5.22	YES
FHB	FAN	1	L	56	-152.64	920.00	0.30	2.99	YES
FHB	FAN	1	U	57	-571.24	583.95	0.48	2.11	YES
FHB	FAN	2	L	37	-527.51	258.37	-1.13	3.85	YES
FHB	FAN	2	U	37	-841.08	333.95	-1.46	6.23	YES
FHB	FAN	3	L	58	-517.11	442.51	0.55	1.64	YES
FHB	FAN	3	U	48	-828.20	-621.81	0.70	3.75	YES
FHB	FAN	4	U	40	-532.90	495.15	0.07	3.87	YES
FHB	MEZZ	1	L	53	-367.66	1503.70	-0.77	5.12	YES
FHB	MEZZ	1	U	49	-539.56	-230.00	0.03	13.97	YES

TABLE 6-7 PATHFINDER FINAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS

Building	Floor	Survey Unit	Upper or Lower	Number of Points	Average Contamination (dpm/100cm^2)	Maximum Contamination (dpm/100cm^2)	Gamma Level (microR/hr)	Removable Beta Contamination (dpm/100cm^2)	Contamination
FHB	MEZZ	2	L	46	-608.38	-171.49	-1.16	7.08	YES
FHB	MEZZ	2	U	63	-355.07	951.25	-0.05	10.40	YES
FHB	MEZZ	3	L	52	-505.39	255.08	-0.87	6.98	YES
FHB	MEZZ	3	U	46	-343.19	-11.25	0.00	8.80	YES
FHB	MEZZ	4	L	54	-486.79	2895.91	-0.81	10.39	YES
FHB	MEZZ	4	U	49	-635.28	-117.50	-0.05	11.39	YES
FHB	MEZZ	5	L	41	-638.79	-99.11	-1.19	11.35	YES
FHB	MEZZ	5	U	39	-507.32	-161.25	0.00	11.84	YES
FHB	MEZZ	6	L	52	-491.56	201.10	-0.91	12.27	YES
FHB	MEZZ	6	U	33	-515.26	-230.00	-0.10	7.74	YES
FHB	MEZZ	7	L	53	-727.82	-167.06	-1.44	7.61	YES
FHB	MEZZ	7	U	49	-642.53	-255.00	-0.32	10.60	YES
FHB	OPER	1	L	37	-812.22	-173.50	-1.03	2.44	YES
FHB	OPER	2	L	35	-819.34	-65.98	-1.11	4.20	YES
FHB	OPER	3	L	35	-472.26	139.70	-0.29	3.29	YES
FHB	OPER	4	L	30	-574.84	618.48	-0.09	4.45	YES
FHB	OPER	5	U	58	-529.46	11.18	-0.76	4.79	YES
FHB	OPER	6	U	51	437.98	1120.00	-0.27	7.69	YES
FHB	OPER	7	U	59	-1263.07	-993.64	-1.55	4.73	YES
FHB	OPER	8	U	51	-1156.72	127.14	-1.95	5.09	YES

TABLE 6-7 PATHFINDER FINAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS

Building	Floor	Survey Unit	Upper or Lower	Number of Points	Average Contamination (dpm/100cm^2)	Maximum Contamination (dpm/100cm^2)	Gamma Level (microR/hr)	Removable Beta Contamination (dpm/100cm^2)	Contamination
FHB	OPER	9	U	45	-1001.30	-708.02	-2.09	4.34	YES
FHB	OPER	10	U	49	-821.10	-557.87	-1.33	4.77	YES
FHB	OPER	11	U	41	-851.83	-591.70	-1.23	2.44	YES
FHB	OPER	12	L	50	-956.92	-341.73	-0.87	3.37	YES
FHB	OPER	12	U	54	-1127.89	126.76	-0.70	1.15	YES
FHB	OPER	13	L	59	-694.82	349.88	-0.25	4.55	YES
FHB	OPER	13	U	48	-518.12	168.84	0.15	3.89	YES
FHB	OPER	14	L	32	-905.77	-541.48	-1.05	3.46	YES
FHB	OPER	14	U	47	-766.97	-399.40	-1.60	10.06	YES
FHB	OPER	15	L	30	-884.60	-600.37	-1.60	1.05	YES
FHB	OPER	15	U	30	-996.33	-692.86	-2.28	3.11	YES
FHB	OPER	16	L	30	-447.40	-224.15	-1.72	5.96	YES
FHB	OPER	16	U	36	-903.40	-504.85	-1.70	4.47	YES
FHB	ROOF	1	L	53	-163.05	1195.93	-0.53	-0.02	YES
FHB	ROOF	2	L	52	-515.80	523.09	-0.70	-1.28	YES
FHB	ROOF	3	L	40	1341.13	2541.60	-1.21	0.81	YES
RB	CAVE	1	L	106	-578.25	2705.29	0.49	1.56	YES
RB	CAVE	2	L	52	-1076.36	-502.73	0.36	4.19	YES
RB	CAVE	3	L	79	-612.68	2115.24	-0.56	6.84	YES
RB	CAVE	5	L	54	-550.11	442.51	-0.87	12.97	YES

TABLE 6-7 PATHFINDER FINAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS

Building	Floor	Survey Unit	Upper or Lower	Number of Points	Average Contamination (dpm/100cm^2)	Maximum Contamination (dpm/100cm^2)	Gamma Level (microR/hr)	Removable Beta Contamination (dpm/100cm^2)	Contamination
RB	EQUIP	1	L	46	-883.09	-541.66	-0.65	2.66	YES
RB	EQUIP	2	L	38	-622.15	286.48	0.08	4.52	YES
RB	EQUIP	3	L	34	-667.06	-443.48	0.06	2.62	YES
RB	EQUIP	4	L	40	-387.34	534.04	0.26	5.38	YES
RB	EQUIP	5	U	45	-369.45	-5.00	-0.18	6.77	YES
RB	FTV	1	L	74	-756.71	816.24	-1.14	2.51	YES
RB	OPER	1	L	33	-727.97	-451.59	-2.43	6.76	YES
RB	OPER	2	L	31	-653.21	240.36	-2.09	4.82	YES
RB	OPER	3	L	47	-778.74	-285.25	-2.16	15.72	YES
RB	OPER	4	U	46	-894.23	-617.10	-2.28	13.27	YES
RB	OPER	5	U	48	-826.79	-455.81	-3.42	12.54	YES
RB	OPER	6	U	46	-850.30	-396.67	-3.42	12.68	YES
RB	OPER	7	U	47	-815.07	-552.58	-3.42	11.67	YES
RB	OPER	8	U	46	-636.62	-200.41	-3.42	14.23	YES
RB	OPER	9	U	41	-717.30	-538.90	-3.34	17.56	YES
RB	OPER	10	U	47	-580.50	-292.83	-3.36	19.73	YES
RB	OPER	11	U	30	-656.55	-356.32	-3.31	13.15	YES
RB	PLUG	1	L	46	-857.06	-576.39	-0.51	11.34	YES
RB	PLUG	2	L	33	-811.50	-218.57	0.08	9.30	YES
RB	PLUG	3	L	58	-804.67	-208.26	0.06	6.31	YES

TABLE 6-7 PATHFINDER FINAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS

Building	Floor	Survey Unit	Upper or Lower	Number of Points	Average Contamination (dpm/100cm^2)	Maximum Contamination (dpm/100cm^2)	Gamma Level (microR/hr)	Removable Beta Contamination (dpm/100cm^2)	Contamination
RB	PLUG	4	U	37	-797.01	-570.66	-0.20	6.02	YES
RB	PUMP	1	L	54	-743.91	1086.09	0.12	7.97	YES
RB	PUMP	2	L	60	-1099.68	-632.30	-0.38	6.24	YES
RB	PUMP	3	L	60	-340.38	1970.00	0.06	9.42	YES
RB	PUMP	4	L	67	-642.28	466.97	-0.28	10.32	YES
RB	PUMP	5	L	46	-519.82	1823.25	-0.08	8.68	YES
RB	PUMP	6	L	50	-546.63	3444.56	-0.37	3.00	YES
RB	PUMP	7	L	111	-478.58	2212.42	-0.07	4.58	YES
RB	SHLD	4	L	30	-717.96	-344.75	-0.34	9.81	YES
RB	STMCH	1	L	51	-772.65	1351.15	0.38	3.26	YES
RB	STMCH	2	L	42	-936.00	-431.18	0.00	4.08	YES
RB	STMCH	3	L	63	-868.55	-289.17	0.00	3.18	YES
RB	SUMP	1	L	36	-1115.22	-561.33	1.01	5.63	YES
RB	SUMP	2	L	32	-823.40	-115.54	1.20	9.57	YES
RWS	MAIN	1	L	50	-1061.44	-998.46	-1.14	0.58	YES
RWS	MAIN	2	L	60	-833.52	-611.10	-1.14	2.93	YES
RWS	MAIN	3	L	45	-883.36	-727.27	-1.14	-0.28	YES
RWS	MAIN	4	L	54	-919.97	-711.32	-1.14	2.35	YES
RWS	MAIN	5	L	62	-1123.94	-833.17	-1.14	4.94	YES
RWS	MAIN	6	L	62	-1122.73	-970.74	-1.14	5.44	YES

1 To ensure a conservative determination of compliance, the interior background value of 8 μR/hr was used in the calculation of this result.

TABLE 6-8 PATHFINDER SPECIAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS

Building	Floor	Survey Unit	Upper or Lower	Number of Points	Average Contamination (dpm/100cm^2)	Maximum Contamination (dpm/100cm^2)	Gamma Level (microR/hr)	Removable Beta Contamination (dpm/100cm^2)	Compliance
FHB	BASE	1	L	1	N/A	-541.76	0.57	6.00	YES
FHB	BASE	3	L	5[1]	-559.25	-477.06	1.40	19.08	YES
FHB	BASE	3	U	22	-673.30	-253.53	-1.74	6.60	YES
FHB	BASE	4	L	8	-798.43	-665.03	0.22	9.18	YES
FHB	BASE	6	L	19	-863.89	-347.65	-3.98	5.50	YES
FHB	BASE	6	U	13	-666.34	-353.53	-0.33	14.27	YES
FHB	BASE	7	L	23	-999.36	-706.47	-2.88	1.47	YES
FHB	BASE	7	U	13	-554.63	-247.65	0.00	8.90	YES
FHB	BASE	8	L	1	N/A	-724.12	0.00	0.00	YES
FHB	BASE	8	U	10	-520.27	-218.37	-2.02	12.61	YES
FHB	BASE	9	L	1	N/A	-706.47	4.56	-6.00	YES
FHB	BASE	9	U	6	-422.36	-264.88	-1.12	13.13	YES
FHB	BASE	10	L	3[1]	22.37	-224.12	2.92	-5.36	YES
FHB	BASE	10	U	14	-552.65	-288.82	-2.58	3.89	YES
FHB	BASE	11	L	6	-106.32	-4.01	-0.74	9.85	YES
FHB	BASE	11	U	11	-368.46	46.84	-2.72	22.22	YES
FHB	BASE	12	L	5[1]	-312.44	-224.12	0.68	26.76	YES
FHB	BASE	14	U	3[1]	628.19	187.65	2.69	9.28	YES
FHB	BASE	17	L	3[1]	-581.40	-670.68	-4.56	18.15	YES
FHB	CRANE	1	L	315	-891.97	3447.60	-4.45	4.67	YES

TABLE 6-8 PATHFINDER SPECIAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS

Building	Floor	Survey Unit	Upper or Lower	Number of Points	Average Contamination (dpm/100cm^2)	Maximum Contamination (dpm/100cm^2)	Gamma Level (microR/hr)	Removable Beta Contamination (dpm/100cm^2)	Compliance
FHB	CRANE	1	U	88	-809.14	323.67	-4.56	4.18	YES
FHB	CRANE	2	L	39	-672.93	617.46	-4.56	2.87	YES
FHB	CRANE	2	U	42	-686.94	397.12	-4.56	1.15	YES
FHB	FAN	1	L	16	-345.58	216.33	-4.56	7.75	YES
FHB	FAN	1	U	51	-350.75	920.60	-4.26	8.72	YES
FHB	FAN	2	L	79	-1159.10	-683.49	-4.56	4.65	YES
FHB	FAN	2	U	67	-1082.54	-299.77	-4.56	5.91	YES
FHB	FAN	3	L	7	-469.91	-286.50	-4.56	4.53	YES
FHB	FAN	3	U	26	-698.31	-365.59	-3.90	6.26	YES
FHB	FAN	4	U	19	-494.97	544.01	-3.57	6.87	YES
FHB	FAN	5	L	220	-636.39	3051.25	-1.92	7.16	YES
FHB	FAN	5	U	223	-856.61	873.03	-2.24	1.55	YES
FHB	MEZZ	1	L	12	-45.46	723.49	0.60	11.48	YES
FHB	MEZZ	2	L	29	-854.94	-435.88	-3.56	10.54	YES
FHB	MEZZ	2	U	3[1]	-72.10	-253.26	0.39	46.03	YES
FHB	MEZZ	3	L	8	-271.08	164.12	0.07	6.61	YES
FHB	MEZZ	3	U	3[1]	360.34	-26.51	-0.20	12.84	YES
FHB	MEZZ	4	L	46	-893.00	-485.81	-2.56	6.92	YES
FHB	MEZZ	4	U	8	-533.62	-352.09	-0.07	30.42	YES
FHB	MEZZ	5	L	8	-620.57	-369.53	-0.16	9.97	YES

TABLE 6-8 PATHFINDER SPECIAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS

Building	Floor	Survey Unit	Upper or Lower	Number of Points	Average Contamination (dpm/100cm^2)	Maximum Contamination (dpm/100cm^2)	Gamma Level (microR/hr)	Removable Beta Contamination (dpm/100cm^2)	Compliance
FHB	MEZZ	5	U	5[1]	-513.69	-340.47	0.07	7.69	YES
FHB	MEZZ	6	L	15	-249.38	880.47	-0.45	14.19	YES
FHB	MEZZ	6	U	6	-180.90	-119.53	-4.56	28.95	YES
FHB	MEZZ	7	L	6	-1047.67	-764.88	0.25	11.33	YES
FHB	MEZZ	7	U	18	-333.14	-20.70	-3.02	35.01	YES
FHB	OPER	1	L	55	-971.21	-572.54	-4.56	5.81	YES
FHB	OPER	2	L	46	-719.97	830.77	-4.56	5.40	YES
FHB	OPER	3	L	59	-553.33	1007.29	-3.40	4.90	YES
FHB	OPER	4	L	29	-334.88	669.41	-4.56	0.74	YES
FHB	OPER	5	U	116	-781.67	734.71	-4.56	5.69	YES
FHB	OPER	6	U	51	18.29	735.12	-4.38	6.58	YES
FHB	OPER	7	U	36	-889.16	-466.99	-4.56	5.29	YES
FHB	OPER	8	U	58	-1161.17	-191.54	-4.56	6.22	YES
FHB	OPER	9	U	20	-696.51	-197.03	-4.56	10.57	YES
FHB	OPER	10	U	130	-709.79	70.00	-3.81	5.73	YES
FHB	OPER	11	U	51	-581.32	259.36	-4.56	7.98	YES
FHB	OPER	12	L	90	-1076.53	-224.32	-4.56	3.69	YES
FHB	OPER	12	U	50	-1049.28	-165.14	-4.56	8.85	YES
FHB	OPER	13	L	29	-679.62	376.94	-4.56	7.36	YES
FHB	OPER	13	U	113	-648.49	111.04	-4.56	6.23	YES

TABLE 6-8 PATHFINDER SPECIAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS

Building	Floor	Survey Unit	Upper or Lower	Number of Points	Average Contamination (dpm/100cm^2)	Maximum Contamination (dpm/100cm^2)	Gamma Level (microR/hr)	Removable Beta Contamination (dpm/100cm^2)	Compliance
FHB	OPER	14	L	48	-625.83	-21.91	-4.13	2.71	YES
FHB	OPER	14	U	116	-739.61	-264.68	-4.56	7.74	YES
FHB	OPER	15	L	20	-490.07	452.08	-4.56	7.08	YES
FHB	OPER	15	U	96	-755.18	-339.83	-4.56	4.48	YES
FHB	OPER	16	L	158	-1049.78	-288.48	-4.56	1.97	YES
FHB	OPER	16	U	22	-855.05	-504.73	-4.56	7.35	YES
FHB	ROOF	3	L	6	1248.04	1467.53	-4.56	22.11	YES
RB	CAVE	1	L	74	-740.66	380.78	-3.64	1.47	YES
RB	CAVE	2	L	135	-1109.33	-505.28	-2.95	9.04	YES
RB	CAVE	3	U	2[1]	-439.42	-918.52	-4.56	53.20	YES
RB	CAVE	4	L	17	-769.50	513.17	-3.67	11.76	YES
RB	CAVE	5	L	5[1]	-401.89	-426.72	-0.68	10.37	YES
RB	DOME	1	U	9	-376.94	-230.00	-1.71	16.46	YES
RB	EQUIP	1	L	120	-767.11	324.29	-4.56	3.58	YES
RB	EQUIP	2	L	65	-751.60	-401.43	-4.56	2.12	YES
RB	EQUIP	3	L	157	-1021.03	187.14	-4.56	1.45	YES
RB	EQUIP	4	L	62	-475.25	1924.29	-4.56	4.77	YES
RB	EQUIP	5	U	37	-631.22	-155.71	-4.56	6.63	YES
RB	FTV	1	L	18	-1055.72	-780.00	-4.56	3.03	YES
RB	OPER	1	L	35	-531.03	389.32	-4.56	7.66	YES

TABLE 6-8 PATHFINDER SPECIAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS

Building	Floor	Survey Unit	Upper or Lower	Number of Points	Average Contamination (dpm/100cm^2)	Maximum Contamination (dpm/100cm^2)	Gamma Level (microR/hr)	Removable Beta Contamination (dpm/100cm^2)	Compliance
RB	OPER	2	L	50	331.13	3007.50	-4.56	11.33	YES
RB	OPER	3	L	258	-1131.96	2770.00	-4.56	5.65	YES
RB	OPER	4	L	32	-718.03	178.84	-4.56	17.27	YES
RB	OPER	5	U	9	-96.73	119.46	-4.56	34.05	YES
RB	OPER	6	U	129	-488.14	329.14	-4.56	10.22	YES
RB	OPER	7	U	266	-513.84	327.38	-4.56	6.79	YES
RB	PLUG	1	L	318	-964.46	2391.47	-4.16	9.78	YES
RB	PLUG	2	L	76	-720.39	165.06	-4.36	4.42	YES
RB	PLUG	3	L	125	-629.48	1307.04	-4.56	3.37	YES
RB	PLUG	4	U	82	-801.64	634.20	-4.56	12.06	YES
RB	PUMP	1	L	54	-975.62	597.38	-0.23	5.75	YES
RB	PUMP	2	L	111	-1147.50	-21.67	-0.42	6.16	YES
RB	PUMP	3	L	44	-703.03	685.15	-4.56	0.73	YES
RB	PUMP	4	L	88	-789.30	454.85	-4.56	6.04	YES
RB	PUMP	5	L	27	-526.93	817.34	-4.56	9.44	YES
RB	PUMP	6	L	56	-755.38	1308.46	-4.56	9.91	YES
RB	PUMP	7	L	40	-398.69	814.69	-4.56	6.40	YES
RB	STMCH	1	L	26	-683.09	1131.26	-4.56	9.23	YES
RB	STMCH	2	L	19	-487.37	497.75	-4.56	14.88	YES
RB	STMCH	3	L	63	-942.95	230.73	-4.34	8.55	YES

TABLE 6-8 PATHFINDER SPECIAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS

Building	Floor	Survey Unit	Upper or Lower	Number of Points	Average Contamination (dpm/100cm^2)	Maximum Contamination (dpm/100cm^2)	Gamma Level (microR/hr)	Removable Beta Contamination (dpm/100cm^2)	Compliance
RB	SUMPC	1	L	9	-663.08	123.26	-4.56	12.58	YES
RB	SUMPC	2	L	11	-441.89	438.48	-4.56	24.37	YES

1 When the number of data points is small, i.e., five or less, the "Average Contamination" result may be significantly different than the mean due to the generally large values of the standard deviation and t.

TABLE 6-11 ALPHA RESULTS WITH LOCAL AREA BACKGROUND

	DIRECT		REMOVABLE
	NUMBER OF POINTS	MEAN ($dpm/100cm^2$)	MEAN ($dpm/100cm^2$)
FHB-BASE	15	15.57	1.20
FHB-MEZZ	15	3.85	1.82
FHB-OPER	15	-24.73	0.81
FHB-FAN	15	-23.63	0.90
FHB-CRANE	15	-23.63	1.14
RB-OPER	15	11.17	2.69
RB-EQUIP	15	-0.55	1.23
RB-PLUG	15	10.44	1.58
RB-CAVE	15	-4.21	0.90
RB-FTV	13	6.38	1.26
RWS	15	-7.14	1.14

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APPENDIX D

ALTERNATE METHOD OF DATA ANALYSIS

ALTERNATE METHOD OF DATA ANALYSIS

The Pathfinder Final Survey Plan specifies a data analysis method which uses local area measurements to determine background levels. This local background data is expected to conform to a log-normal distribution. The value of background used in determining the net value of the measurements from Pathfinder is calculated from the local area data as a "best estimate" of the expected log-normal distribution as described in NUREG/CR-2082. When this background value is used, the resulting net values for much of the Pathfinder data are negative.

The two sets of alternative background values were used in the following data analyses to confirm compliance with decommissioning requirements. First, daily instrument background was used for the contamination measurements and no background was used for the μR/hr values. The statistical evaluation of the resulting data was performed. The results of this evaluation are shown in Tables D-1 and D-2. Second, arithmetic means were calculated for the local area data instead of the method of NUREG/CR-2082. The results of the statistical evaluation using the mean values of background are shown in Tables D-3 and D-4. Both evaluations demonstrate that the compliance standard has been met.

TABLE D-1

PATHFINDER FINAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS
Using Instrument Background

BUILDING	FLOOR	SURVEY UNIT	UPPER OR LOWER	NUMBER OF POINTS	AVERAGE CONTAMINATION ($DPM/100cm^2$)	MAXIMUM CONTAMINATION ($DPM/100cm^2$)	GAMMA LEVEL (microR/hr)	REMOVABLE BETA CONTAMINATION ($DPM/100cm^2$)	COMPLIANCE
EXT	FHRB	2	G	128	-92.79	961.54	7.15	1.86	YES
EXT	GRND	1	G	851	N/A	N/A	7.11	N/A	YES
FHB	BASE	1	L	49	1455.48	2654.26	7.31	7.80	YES
FHB	BASE	1	U	39	1637.69	2005.95	6.03	6.85	YES
FHB	BASE	2	L	50	488.60	2106.38	6.99	5.34	YES
FHB	BASE	2	U	45	339.31	956.52	6.63	7.75	YES
FHB	BASE	3	L	59	484.68	2902.86	7.81	5.64	YES
FHB	BASE	3	U	44	425.62	1028.57	7.75	7.35	YES
FHB	BASE	4	L	37	601.25	1460.32	7.76	7.56	YES
FHB	BASE	6	L	35	533.79	1351.06	7.64	5.13	YES
FHB	BASE	6	U	36	639.46	1047.06	6.90	8.14	YES
FHB	BASE	7	L	58	542.46	1057.14	7.71	9.82	YES
FHB	BASE	7	U	39	702.76	977.14	7.12	10.28	YES
FHB	BASE	8	L	40	801.65	2184.08	6.81	9.13	YES
FHB	BASE	8	U	31	591.54	1058.82	6.73	10.24	YES
FHB	BASE	9	L	49	633.22	1793.48	6.38	4.94	YES
FHB	BASE	9	U	46	564.92	789.77	6.73	6.60	YES
FHB	BASE	10	L	40	591.87	1326.09	6.60	8.10	YES
FHB	BASE	10	U	34	584.15	900.00	7.20	9.16	YES
FHB	BASE	11	L	51	706.45	3486.91	6.86	7.02	YES
FHB	BASE	11	U	38	593.02	1031.25	6.84	7.80	YES
FHB	BASE	12	L	38	1166.74	3260.87	7.08	5.71	YES
FHB	BASE	13	L	37	807.36	2413.04	7.10	5.69	YES
FHB	BASE	14	U	61	467.78	1035.29	6.73	3.69	YES
FHB	BASE	15	U	58	461.10	1329.41	6.73	1.90	YES
FHB	BASE	16	U	40	474.47	1135.29	6.73	2.03	YES
FHB	BASE	17	L	44	511.58	1785.71	7.71	2.79	YES
FHB	CRANE	1	L	48	509.66	835.16	6.81	7.54	YES
FHB	CRANE	1	U	48	362.16	1676.47	6.33	4.65	YES
FHB	CRANE	2	L	56	643.62	1666.67	6.98	2.99	YES
FHB	CRANE	2	U	32	790.63	1754.39	7.27	5.22	YES
FHB	FAN	1	L	56	648.65	2300.00	8.17	2.99	YES
FHB	FAN	1	U	57	364.40	1912.79	8.34	2.11	YES
FHB	FAN	2	L	37	236.75	1261.63	6.73	3.85	YES
FHB	FAN	2	U	37	191.21	1337.21	6.41	6.23	YES
FHB	FAN	3	L	58	258.88	1497.08	8.41	1.64	YES

TABLE D-1

PATHFINDER FINAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS
Using Instrument Background

BUILDING	FLOOR	SURVEY UNIT	UPPER OR LOWER	NUMBER OF POINTS	AVERAGE CONTAMINATION (DPM/100cm^2)	MAXIMUM CONTAMINATION (DPM/100cm^2)	GAMMA LEVEL (microR/hr)	REMOVABLE BETA CONTAMINATION (DPM/100cm^2)	COMPLIANCE
FHB	FAN	3	U	48	150.37	432.75	8.57	3.75	YES
FHB	FAN	4	U	40	449.16	1549.71	7.94	3.87	YES
FHB	MEZZ	1	L	53	779.82	2646.74	7.10	5.12	YES
FHB	MEZZ	1	U	49	780.72	1000.00	7.90	13.97	YES
FHB	MEZZ	2	L	46	441.10	835.11	6.71	7.08	YES
FHB	MEZZ	2	U	63	907.91	2225.00	7.82	10.40	YES
FHB	MEZZ	3	L	52	619.44	1304.81	6.99	6.98	YES
FHB	MEZZ	3	U	46	925.94	1262.50	7.87	8.80	YES
FHB	MEZZ	4	L	54	574.59	3828.37	7.06	10.39	YES
FHB	MEZZ	4	U	49	692.87	1081.25	7.82	11.39	YES
FHB	MEZZ	5	L	41	485.96	1036.65	6.68	11.35	YES
FHB	MEZZ	5	U	39	765.15	1037.50	7.86	11.84	YES
FHB	MEZZ	6	L	52	705.85	1480.00	6.95	12.27	YES
FHB	MEZZ	6	U	33	768.56	982.86	7.76	7.74	YES
FHB	MEZZ	7	L	53	371.22	784.78	6.43	7.61	YES
FHB	MEZZ	7	U	49	628.32	1087.50	7.55	10.60	YES
FHB	OPER	1	L	37	80.86	685.31	6.84	2.44	YES
FHB	OPER	2	L	35	171.86	1079.37	6.76	4.20	YES
FHB	OPER	3	L	35	403.01	1193.94	7.57	3.29	YES
FHB	OPER	4	L	30	308.80	1672.73	7.77	4.45	YES
FHB	OPER	5	U	58	591.76	1247.06	7.11	4.79	YES
FHB	OPER	6	U	51	1375.89	2018.75	7.60	7.69	YES
FHB	OPER	7	U	59	-130.98	265.90	6.31	4.73	YES
FHB	OPER	8	U	51	-123.97	1104.40	5.92	5.09	YES
FHB	OPER	9	U	45	147.78	390.11	5.78	4.34	YES
FHB	OPER	10	U	49	74.43	338.80	6.54	4.77	YES
FHB	OPER	11	U	41	-44.77	108.70	6.64	2.44	YES
FHB	OPER	12	L	50	27.58	703.91	7.00	3.37	YES
FHB	OPER	12	U	54	44.21	1243.24	7.17	1.15	YES
FHB	OPER	13	L	59	199.17	1189.35	7.62	4.55	YES
FHB	OPER	13	U	48	266.80	953.76	8.02	3.89	YES
FHB	OPER	14	L	32	62.77	508.20	6.82	3.46	YES
FHB	OPER	14	U	47	247.66	650.27	6.27	10.06	YES
FHB	OPER	15	L	30	108.39	544.97	6.26	1.05	YES
FHB	OPER	15	U	30	-29.18	274.29	5.59	3.11	YES
FHB	OPER	16	L	30	667.93	906.59	6.15	5.96	YES

TABLE D-1

PATHFINDER FINAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS
Using Instrument Background

BUILDING	FLOOR	SURVEY UNIT	UPPER OR LOWER	NUMBER OF POINTS	AVERAGE CONTAMINATION (DPM/100cm^2)	MAXIMUM CONTAMINATION (DPM/100cm^2)	GAMMA LEVEL (microR/hr)	REMOVABLE BETA CONTAMINATION (DPM/100cm^2)	COMPLIANCE
FHB	OPER	16	U	36	149.57	573.10	6.17	4.47	YES
FHB	ROOF	1	L	53	697.32	2061.73	7.33	-0.02	YES
FHB	ROOF	2	L	52	343.06	1388.89	7.17	-1.28	YES
FHB	ROOF	3	L	40	2206.93	3407.41	6.66	0.81	YES
RB	CAVE	1	L	106	253.57	3447.06	8.35	1.56	YES
RB	CAVE	2	L	52	-35.80	536.14	8.22	4.19	YES
RB	CAVE	3	L	79	411.93	3160.71	7.31	6.84	YES
RB	CAVE	5	L	54	504.29	1532.16	7.00	12.97	YES
RB	EQUIP	1	L	46	-34.13	307.30	7.22	2.66	YES
RB	EQUIP	2	L	38	448.91	1362.64	7.95	4.52	YES
RB	EQUIP	3	L	34	442.13	662.92	7.92	2.62	YES
RB	EQUIP	4	L	40	453.99	1286.52	8.13	5.38	YES
RB	EQUIP	5	U	45	504.30	868.75	7.69	6.77	YES
RB	FTV	1	L	74	588.66	2144.51	6.73	2.51	YES
RB	OPER	1	L	33	172.49	448.86	5.44	6.76	YES
RB	OPER	2	L	31	138.10	1031.67	5.78	4.82	YES
RB	OPER	3	L	47	365.70	861.88	5.70	15.72	YES
RB	OPER	4	U	46	-2.94	274.19	5.59	13.27	YES
RB	OPER	5	U	48	86.01	456.99	4.45	12.54	YES
RB	OPER	6	U	46	131.27	629.03	4.45	12.68	YES
RB	OPER	7	U	47	151.71	380.43	4.45	11.67	YES
RB	OPER	8	U	46	303.44	739.64	4.45	14.23	YES
RB	OPER	9	U	41	287.57	465.97	4.53	17.56	YES
RB	OPER	10	U	47	502.90	790.58	4.50	19.73	YES
RB	OPER	11	U	30	420.82	721.05	4.56	13.15	YES
RB	PLUG	1	L	46	32.40	337.48	7.36	11.34	YES
RB	PLUG	2	L	33	12.78	605.71	7.95	9.30	YES
RB	PLUG	3	L	58	169.90	766.30	7.93	6.31	YES
RB	PLUG	4	U	37	249.48	467.03	7.67	6.02	YES
RB	PUMP	1	L	54	425.06	2166.67	7.98	7.97	YES
RB	PUMP	2	L	60	190.00	798.85	7.48	6.24	YES
RB	PUMP	3	L	60	552.06	2854.55	7.93	9.42	YES
RB	PUMP	4	L	67	275.00	1436.36	7.59	10.32	YES
RB	PUMP	5	L	46	286.74	2763.31	7.78	8.68	YES
RB	PUMP	6	L	50	320.77	4325.44	7.49	3.00	YES
RB	PUMP	7	L	111	448.23	2939.39	7.79	4.58	YES

TABLE D-1

PATHFINDER FINAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS
Using Instrument Background

BUILDING	FLOOR	SURVEY UNIT	UPPER OR LOWER	NUMBER OF POINTS	AVERAGE CONTAMINATION (DPM/100cm^2)	MAXIMUM CONTAMINATION (DPM/100cm^2)	GAMMA LEVEL (microR/hr)	REMOVABLE BETA CONTAMINATION (DPM/100cm^2)	COMPLIANCE
FHB	OPER	16	U	36	149.57	573.10	6.17	4.47	YES
FHB	ROOF	1	L	53	697.32	2061.73	7.33	-0.02	YES
FHB	ROOF	2	L	52	343.06	1388.89	7.17	-1.28	YES
FHB	ROOF	3	L	40	2206.93	3407.41	6.66	0.81	YES
RB	CAVE	1	L	106	253.57	3447.06	8.35	1.56	YES
RB	CAVE	2	L	52	-35.80	536.14	8.22	4.19	YES
RB	CAVE	3	L	79	411.93	3160.71	7.31	6.84	YES
RB	CAVE	5	L	54	504.29	1532.16	7.00	12.97	YES
RB	EQUIP	1	L	46	-34.13	307.30	7.22	2.66	YES
RB	EQUIP	2	L	38	448.91	1362.64	7.95	4.52	YES
RB	EQUIP	3	L	34	442.13	662.92	7.92	2.62	YES
RB	EQUIP	4	L	40	453.99	1286.52	8.13	5.38	YES
RB	EQUIP	5	U	45	504.30	868.75	7.69	6.77	YES
RB	FTV	1	L	74	588.66	2144.51	6.73	2.51	YES
RB	OPER	1	L	33	172.49	448.86	5.44	6.76	YES
RB	OPER	2	L	31	138.10	1031.67	5.78	4.82	YES
RB	OPER	3	L	47	365.70	861.88	5.70	15.72	YES
RB	OPER	4	U	46	-2.94	274.19	5.59	13.27	YES
RB	OPER	5	U	48	86.01	456.99	4.45	12.54	YES
RB	OPER	6	U	46	131.27	629.03	4.45	12.68	YES
RB	OPER	7	U	47	151.71	380.43	4.45	11.67	YES
RB	OPER	8	U	46	303.44	739.64	4.45	14.23	YES
RB	OPER	9	U	41	287.57	465.97	4.53	17.56	YES
RB	OPER	10	U	47	502.90	790.58	4.50	19.73	YES
RB	OPER	11	U	30	420.82	721.05	4.56	13.15	YES
RB	PLUG	1	L	46	32.40	337.48	7.36	11.34	YES
RB	PLUG	2	L	33	12.78	605.71	7.95	9.30	YES
RB	PLUG	3	L	58	169.90	766.30	7.93	6.31	YES
RB	PLUG	4	U	37	249.48	467.03	7.67	6.02	YES
RB	PUMP	1	L	54	425.06	2166.67	7.98	7.97	YES
RB	PUMP	2	L	60	190.00	798.85	7.48	6.24	YES
RB	PUMP	3	L	60	552.06	2854.55	7.93	9.42	YES
RB	PUMP	4	L	67	275.00	1436.36	7.59	10.32	YES
RB	PUMP	5	L	46	286.74	2763.31	7.78	8.68	YES
RB	PUMP	6	L	50	320.77	4325.44	7.49	3.00	YES
RB	PUMP	7	L	111	448.23	2939.39	7.79	4.58	YES

TABLE D-1

PATHFINDER FINAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS
Using Instrument Background

BUILDING	FLOOR	SURVEY UNIT	UPPER OR LOWER	NUMBER OF POINTS	AVERAGE CONTAMINATION ($DPM/100cm^2$)	MAXIMUM CONTAMINATION ($DPM/100cm^2$)	GAMMA LEVEL (microR/hr)	REMOVABLE BETA CONTAMINATION ($DPM/100cm^2$)	COMPLIANCE
RB	SHLD	4	L	30	216.96	590.16	7.53	9.81	YES
RB	STMCH	1	L	51	101.73	2267.02	8.25	3.26	YES
RB	STMCH	2	L	42	-4.03	899.41	7.87	4.08	YES
RB	STMCH	3	L	63	125.41	1041.42	7.87	3.18	YES
RB	SUMP	1	L	36	325.74	831.33	8.88	5.63	YES
RB	SUMP	2	L	32	634.72	1289.16	9.06	9.57	YES
RWS	MAIN	1	L	50	-160.03	-97.04	6.73	0.58	YES
RWS	MAIN	2	L	60	15.44	237.87	6.73	2.93	YES
RWS	MAIN	3	L	45	-16.51	139.58	6.73	-0.28	YES
RWS	MAIN	4	L	54	-18.55	190.10	6.73	2.35	YES
RWS	MAIN	5	L	62	-271.86	84.66	6.73	4.94	YES
RWS	MAIN	6	L	62	-204.90	-52.91	6.73	5.44	YES

TABLE D-2

PATHFINDER SPECIAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS
Using Instrument Background

BUILDING	FLOOR	SURVEY UNIT	UPPER OR LOWER	NUMBER OF POINTS	AVERAGE CONTAMINATION ($DPM/100cm^2$)	MAXIMUM CONTAMINATION ($DPM/100cm^2$)	GAMMA LEVEL (microR/hr)	REMOVABLE BETA CONTAMINATION ($DPM/100cm^2$)	COMPLIANCE
FHB	BASE	1	L	1	600.00	600.00	8.05	6.00	YES
FHB	BASE	3	L	5[1]	648.12	664.71	9.26	19.08	YES
FHB	BASE	3	U	22	586.41	888.24	6.13	6.60	YES
FHB	BASE	4	L	8	644.78	864.41	8.09	9.18	YES
FHB	BASE	6	L	19	406.76	929.41	3.88	5.50	YES
FHB	BASE	6	U	13	484.56	800.00	7.54	14.27	YES
FHB	BASE	7	L	23	187.56	582.35	4.99	1.47	YES
FHB	BASE	7	U	13	702.78	958.82	7.86	8.90	YES
FHB	BASE	8	L	1	417.65	417.65	7.86	0.00	YES
FHB	BASE	8	U	10	585.74	877.91	5.85	12.61	YES
FHB	BASE	9	L	1	435.29	435.29	3.31	-6.00	YES
FHB	BASE	9	U	6	687.61	831.40	6.75	13.13	YES
FHB	BASE	10	L	3[1]	1075.05	929.41	10.78	-5.36	YES
FHB	BASE	10	U	14	532.70	864.71	5.29	3.89	YES
FHB	BASE	11	L	6	1244.49	1525.42	7.12	9.85	YES
FHB	BASE	11	U	11	696.34	888.24	5.15	22.22	YES
FHB	BASE	12	L	5[1]	790.51	917.65	8.55	26.76	YES
FHB	BASE	14	U	3[1]	1732.23	1405.88	10.56	9.28	YES
FHB	BASE	17	L	3[1]	224.87	135.59	3.31	18.15	YES
FHB	CRANE	1	L	315	75.53	4289.62	3.42	4.67	YES
FHB	CRANE	1	U	88	274.04	1853.11	3.31	4.18	YES
FHB	CRANE	2	L	39	512.63	2146.89	3.31	2.87	YES
FHB	CRANE	2	U	42	417.71	1926.55	3.31	1.15	YES
FHB	FAN	1	L	16	500.18	1118.64	3.31	7.75	YES
FHB	FAN	1	U	51	504.79	1915.66	3.61	8.72	YES
FHB	FAN	2	L	79	-45.65	465.12	3.31	4.65	YES
FHB	FAN	2	U	67	-33.09	848.84	3.31	5.91	YES
FHB	FAN	3	L	7	336.36	519.77	3.31	4.53	YES
FHB	FAN	3	U	26	107.96	440.68	3.96	6.26	YES
FHB	FAN	4	U	19	311.30	1350.28	4.29	6.87	YES
FHB	FAN	5	L	220	462.48	3893.75	5.94	7.16	YES
FHB	FAN	5	U	223	340.03	1927.27	5.63	1.55	YES
FHB	MEZZ	1	L	12	1143.84	1912.79	8.47	11.48	YES
FHB	MEZZ	2	L	29	410.27	841.18	4.31	10.54	YES
FHB	MEZZ	2	U	3[1]	1117.20	936.05	8.26	46.03	YES
FHB	MEZZ	3	L	8	892.18	1317.65	7.93	6.61	YES

TABLE D-2

PATHFINDER SPECIAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS
Using Instrument Background

BUILDING	FLOOR	SURVEY UNIT	UPPER OR LOWER	NUMBER OF POINTS	AVERAGE CONTAMINATION ($DPM/100cm^2$)	MAXIMUM CONTAMINATION ($DPM/100cm^2$)	GAMMA LEVEL (microR/hr)	REMOVABLE BETA CONTAMINATION ($DPM/100cm^2$)	COMPLIANCE
FHB	MEZZ	3	U	3[1]	1549.64	1162.79	7.66	12.84	YES
FHB	MEZZ	4	L	46	179.94	703.49	5.31	6.92	YES
FHB	MEZZ	4	U	8	606.92	779.07	7.79	30.42	YES
FHB	MEZZ	5	L	8	540.49	761.63	7.71	9.97	YES
FHB	MEZZ	5	U	5[1]	617.47	790.70	7.94	7.69	YES
FHB	MEZZ	6	L	15	923.35	2069.77	7.42	14.19	YES
FHB	MEZZ	6	U	6	913.03	976.74	3.31	28.95	YES
FHB	MEZZ	7	L	6	89.81	366.28	8.12	11.33	YES
FHB	MEZZ	7	U	18	767.70	1075.58	4.85	35.01	YES
FHB	OPER	1	L	55	-30.77	367.23	3.31	5.81	YES
FHB	OPER	2	L	46	225.47	1756.91	3.31	5.40	YES
FHB	OPER	3	L	59	344.32	1847.46	4.47	4.90	YES
FHB	OPER	4	L	29	538.75	2106.51	3.31	0.74	YES
FHB	OPER	5	U	116	265.75	1970.59	3.31	5.69	YES
FHB	OPER	6	U	51	1038.12	2059.17	3.49	6.58	YES
FHB	OPER	7	U	36	107.47	461.54	3.31	5.29	YES
FHB	OPER	8	U	58	-251.06	1032.97	3.31	6.22	YES
FHB	OPER	9	U	20	480.50	1027.47	3.31	10.57	YES
FHB	OPER	10	U	130	124.12	981.82	4.06	5.73	YES
FHB	OPER	11	U	51	214.16	941.49	3.31	7.98	YES
FHB	OPER	12	L	90	44.40	940.54	3.31	3.69	YES
FHB	OPER	12	U	50	109.31	1010.81	3.31	8.85	YES
FHB	OPER	13	L	29	291.98	1161.85	3.31	7.36	YES
FHB	OPER	13	U	113	107.24	849.71	3.31	6.23	YES
FHB	OPER	14	L	48	339.07	942.20	3.74	2.71	YES
FHB	OPER	14	U	116	164.26	682.08	3.31	7.74	YES
FHB	OPER	15	L	20	271.72	1219.65	3.31	7.08	YES
FHB	OPER	15	U	96	-8.07	427.75	3.31	4.48	YES
FHB	OPER	16	L	158	-41.38	695.91	3.31	1.97	YES
FHB	OPER	16	U	22	94.57	472.53	3.31	7.35	YES
FHB	ROOF	3	L	6	2113.84	2333.33	3.31	22.11	YES
RB	CAVE	1	L	74	232.49	1367.47	4.22	1.47	YES
RB	CAVE	2	L	135	-158.16	365.17	4.92	9.04	YES
RB	CAVE	3	U	2[1]	544.68	65.57	3.31	53.20	YES
RB	CAVE	4	L	17	165.42	1448.09	4.19	11.76	YES
RB	CAVE	5	L	5[1]	499.54	431.69	7.19	10.37	YES

TABLE D-2

PATHFINDER SPECIAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS
Using Instrument Background

BUILDING	FLOOR	SURVEY UNIT	UPPER OR LOWER	NUMBER OF POINTS	AVERAGE CONTAMINATION (DPM/100cm^2)	MAXIMUM CONTAMINATION (DPM/100cm^2)	GAMMA LEVEL (microR/hr)	REMOVABLE BETA CONTAMINATION (DPM/100cm^2)	COMPLIANCE
RB	DOME	1	U	9	525.79	672.73	6.16	16.46	YES
RB	EQUIP	1	L	120	248.13	1405.71	3.31	3.58	YES
RB	EQUIP	2	L	65	272.08	611.43	3.31	2.12	YES
RB	EQUIP	3	L	157	-45.44	1200.00	3.31	1.45	YES
RB	EQUIP	4	L	62	388.19	2794.29	3.31	4.77	YES
RB	EQUIP	5	U	37	450.21	925.71	3.31	6.63	YES
RB	FTV	1	L	18	-97.94	177.78	3.31	3.03	YES
RB	OPER	1	L	35	477.38	1397.73	3.31	7.66	YES
RB	OPER	2	L	50	1086.13	3762.50	3.31	11.33	YES
RB	OPER	3	L	258	-185.29	3525.00	3.31	5.65	YES
RB	OPER	4	U	32	180.48	1077.35	3.31	17.27	YES
RB	OPER	5	U	9	794.56	1010.75	3.31	34.05	YES
RB	OPER	6	U	129	508.40	1295.70	3.31	10.22	YES
RB	OPER	7	U	266	465.22	1239.13	3.31	6.79	YES
RB	PLUG	1	L	318	-20.17	3372.88	3.71	9.78	YES
RB	PLUG	2	L	76	219.94	1080.25	3.51	4.42	YES
RB	PLUG	3	L	125	270.82	2154.32	3.31	3.37	YES
RB	PLUG	4	U	82	226.73	1567.90	3.31	12.06	YES
RB	PUMP	1	L	54	240.84	1732.14	7.64	5.75	YES
RB	PUMP	2	L	111	84.52	1160.71	7.45	6.16	YES
RB	PUMP	3	L	44	290.75	1587.88	3.31	0.73	YES
RB	PUMP	4	L	88	179.45	1357.58	3.31	6.04	YES
RB	PUMP	5	L	27	365.82	1698.22	3.31	9.44	YES
RB	PUMP	6	L	56	143.60	2248.52	3.31	9.91	YES
RB	PUMP	7	L	40	550.59	1776.54	3.31	6.40	YES
RB	STMCH	1	L	26	421.26	2282.72	3.31	9.23	YES
RB	STMCH	2	L	19	655.67	1746.99	3.31	14.88	YES
RB	STMCH	3	L	63	241.77	1382.20	3.53	8.55	YES
RB	SUMPC	1	L	9	668.96	1293.48	3.31	12.58	YES
RB	SUMPC	2	L	11	867.33	1608.70	3.31	24.37	YES

1 When the number of data points is small, i.e., five or less, the "Average Contamination" result may be significantly different than the mean due to the generally large values of the standard deviation and t.

TABLE D-3

PATHFINDER FINAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS
Using Average Local Background

BUILDING	FLOOR	SURVEY UNIT	UPPER OR LOWER	NUMBER OF POINTS	AVERAGE CONTAMINATION ($DPM/100cm^2$)	MAXIMUM CONTAMINATION ($DPM/100cm^2$)	GAMMA LEVEL (microR/hr)	REMOVABLE BETA CONTAMINATION ($DPM/100cm^2$)	COMPLIANCE
EXT	FHRB	2	G	128	-540.71	445.33	0.36	1.86	YES
EXT	GRND	1	G	851	N/A	N/A	0.33	N/A	YES
FHB	BASE	1	L	49	704.74	1993.09	0.52	7.80	YES
FHB	BASE	1	U	39	960.28	1354.55	-0.76	6.85	YES
FHB	BASE	2	L	50	-191.20	1392.02	0.21	5.34	YES
FHB	BASE	2	U	45	-230.85	372.83	-0.16	7.75	YES
FHB	BASE	3	L	59	-160.62	2217.86	1.02	5.64	YES
FHB	BASE	3	U	44	-287.50	86.43	0.97	7.35	YES
FHB	BASE	4	L	37	-76.74	904.63	0.98	7.56	YES
FHB	BASE	6	L	35	-271.73	567.55	0.85	5.13	YES
FHB	BASE	6	U	36	-83.23	410.29	0.11	8.14	YES
FHB	BASE	7	L	58	-177.30	372.14	0.92	9.82	YES
FHB	BASE	7	U	39	-131.26	172.73	0.33	10.28	YES
FHB	BASE	8	L	40	119.41	1686.86	0.02	9.13	YES
FHB	BASE	8	U	31	-45.05	422.06	-0.06	10.24	YES
FHB	BASE	9	L	49	-7.88	1160.87	-0.40	4.94	YES
FHB	BASE	9	U	46	-174.41	81.82	-0.06	6.60	YES
FHB	BASE	10	L	40	-176.03	552.17	-0.18	8.10	YES
FHB	BASE	10	U	34	-340.81	-88.64	0.42	9.16	YES
FHB	BASE	11	L	51	-52.74	2756.68	0.07	7.02	YES
FHB	BASE	11	U	38	-323.01	37.50	0.05	7.80	YES
FHB	BASE	12	L	38	412.03	2454.35	0.29	5.71	YES
FHB	BASE	13	L	37	-24.98	1606.52	0.32	5.69	YES
FHB	BASE	14	U	61	-245.45	322.06	-0.06	3.69	YES
FHB	BASE	15	U	58	-210.96	657.35	-0.06	1.90	YES
FHB	BASE	16	U	40	-216.10	463.24	-0.06	2.03	YES
FHB	BASE	17	L	44	-252.54	941.67	0.92	2.79	YES
FHB	CRANE	1	L	48	-142.58	324.45	0.03	7.54	YES
FHB	CRANE	1	U	48	-348.17	904.41	-0.46	4.65	YES
FHB	CRANE	2	L	56	28.95	1005.99	0.20	2.99	YES
FHB	CRANE	2	U	32	181.41	1093.71	0.49	5.22	YES
FHB	FAN	1	L	56	335.86	1425.00	1.38	2.99	YES
FHB	FAN	1	U	57	-66.24	1088.95	1.56	2.11	YES
FHB	FAN	2	L	37	-40.90	763.37	-0.05	3.85	YES
FHB	FAN	2	U	37	-336.08	838.95	-0.37	6.23	YES
FHB	FAN	3	L	58	-34.69	947.51	1.63	1.64	YES

TABLE D-3

PATHFINDER FINAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS
Using Average Local Background

BUILDING	FLOOR	SURVEY UNIT	UPPER OR LOWER	NUMBER OF POINTS	AVERAGE CONTAMINATION (DPM/100cm^2)	MAXIMUM CONTAMINATION (DPM/100cm^2)	GAMMA LEVEL (microR/hr)	REMOVABLE BETA CONTAMINATION (DPM/100cm^2)	COMPLIANCE
FHB	FAN	3	U	48	-323.20	-116.81	1.78	3.75	YES
FHB	FAN	4	U	40	-27.90	1000.15	1.15	3.87	YES
FHB	MEZZ	1	L	53	112.05	2008.70	0.31	5.12	YES
FHB	MEZZ	1	U	49	-34.56	275.00	1.11	13.97	YES
FHB	MEZZ	2	L	46	-128.40	333.51	-0.08	7.08	YES
FHB	MEZZ	2	U	63	149.93	1456.25	1.03	10.40	YES
FHB	MEZZ	3	L	52	-20.64	711.08	0.21	6.98	YES
FHB	MEZZ	3	U	46	161.81	493.75	1.08	8.80	YES
FHB	MEZZ	4	L	54	-5.27	3351.91	0.28	10.39	YES
FHB	MEZZ	4	U	49	-130.28	387.50	1.03	11.39	YES
FHB	MEZZ	5	L	41	-150.20	405.89	-0.11	11.35	YES
FHB	MEZZ	5	U	39	-2.32	343.75	1.08	11.84	YES
FHB	MEZZ	6	L	52	-1.73	657.10	0.17	12.27	YES
FHB	MEZZ	6	U	33	-10.26	275.00	0.98	7.74	YES
FHB	MEZZ	7	L	53	-228.09	288.94	-0.35	7.61	YES
FHB	MEZZ	7	U	49	-137.53	250.00	0.76	10.60	YES
FHB	OPER	1	L	37	-335.83	331.50	0.06	2.44	YES
FHB	OPER	2	L	35	-340.75	439.02	-0.03	4.20	YES
FHB	OPER	3	L	35	24.23	644.70	0.79	3.29	YES
FHB	OPER	4	L	30	-69.84	1123.48	0.99	4.45	YES
FHB	OPER	5	U	58	-24.46	516.18	0.32	4.79	YES
FHB	OPER	6	U	51	942.98	1625.00	0.82	7.69	YES
FHB	OPER	7	U	59	-758.07	-488.64	-0.47	4.73	YES
FHB	OPER	8	U	51	-651.72	632.14	-0.87	5.09	YES
FHB	OPER	9	U	45	-496.30	-203.02	-1.01	4.34	YES
FHB	OPER	10	U	49	-316.10	-52.87	-0.25	4.77	YES
FHB	OPER	11	U	41	-346.83	-86.70	-0.15	2.44	YES
FHB	OPER	12	L	50	-462.06	163.27	0.21	3.37	YES
FHB	OPER	12	U	54	-622.89	631.76	0.38	1.15	YES
FHB	OPER	13	L	59	-195.50	854.88	0.83	4.55	YES
FHB	OPER	13	U	48	-13.12	673.84	1.24	3.89	YES
FHB	OPER	14	L	32	-418.60	-36.48	0.03	3.46	YES
FHB	OPER	14	U	47	-261.97	105.60	-0.52	10.06	YES
FHB	OPER	15	L	30	-404.29	-95.37	-0.52	1.05	YES
FHB	OPER	15	U	30	-491.33	-187.86	-1.20	3.11	YES
FHB	OPER	16	L	30	57.60	280.85	-0.64	5.96	YES

TABLE D-3

PATHFINDER FINAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS
Using Average Local Background

BUILDING	FLOOR	SURVEY UNIT	UPPER OR LOWER	NUMBER OF POINTS	AVERAGE CONTAMINATION ($DPM/100cm^2$)	MAXIMUM CONTAMINATION ($DPM/100cm^2$)	GAMMA LEVEL (microR/hr)	REMOVABLE BETA CONTAMINATION ($DPM/100cm^2$)	COMPLIANCE
FHB	OPER	16	U	36	-398.40	0.15	-0.62	4.47	YES
FHB	ROOF	1	L	53	310.78	1700.93	0.55	-0.02	YES
FHB	ROOF	2	L	52	-50.60	1028.09	0.38	-1.28	YES
FHB	ROOF	3	L	40	1846.13	3046.60	-0.13	0.81	YES
RB	CAVE	1	L	106	-73.25	3210.29	1.57	1.56	YES
RB	CAVE	2	L	52	-571.36	2.27	1.44	4.19	YES
RB	CAVE	3	L	79	-107.68	2620.24	0.53	6.84	YES
RB	CAVE	5	L	54	-45.11	947.51	0.21	12.97	YES
RB	EQUIP	1	L	46	-427.09	-85.66	0.43	2.66	YES
RB	EQUIP	2	L	38	-117.15	791.48	1.16	4.52	YES
RB	EQUIP	3	L	34	-162.06	61.52	1.14	2.62	YES
RB	EQUIP	4	L	40	117.66	1039.04	1.34	5.38	YES
RB	EQUIP	5	U	45	135.55	500.00	0.91	6.77	YES
RB	FTV	1	L	74	-251.71	1321.24	-0.06	2.51	YES
RB	OPER	1	L	33	-222.97	53.41	-1.34	6.76	YES
RB	OPER	2	L	31	-197.21	696.36	-1.01	4.82	YES
RB	OPER	3	L	47	-273.74	219.75	-1.08	15.72	YES
RB	OPER	4	U	46	-389.23	-112.10	-1.20	13.27	YES
RB	OPER	5	U	48	-321.79	49.19	-2.33	12.54	YES
RB	OPER	6	U	46	-345.30	108.33	-2.33	12.68	YES
RB	OPER	7	U	47	-310.07	-47.58	-2.33	11.67	YES
RB	OPER	8	U	46	-131.62	304.59	-2.33	14.23	YES
RB	OPER	9	U	41	-212.30	-33.90	-2.25	17.56	YES
RB	OPER	10	U	47	-75.50	212.17	-2.28	19.73	YES
RB	OPER	11	U	30	-151.55	148.68	-2.22	13.15	YES
RB	PLUG	1	L	46	-386.19	-120.39	0.57	11.34	YES
RB	PLUG	2	L	33	-306.50	286.43	1.17	9.30	YES
RB	PLUG	3	L	58	-299.67	296.74	1.15	6.31	YES
RB	PLUG	4	U	37	-292.01	-65.66	0.88	6.02	YES
RB	PUMP	1	L	54	-238.91	1591.09	1.20	7.97	YES
RB	PUMP	2	L	60	-594.68	-127.30	0.70	6.24	YES
RB	PUMP	3	L	60	164.62	2475.00	1.14	9.42	YES
RB	PUMP	4	L	67	-137.28	971.97	0.81	10.32	YES
RB	PUMP	5	L	46	-14.82	2328.25	1.00	8.68	YES
RB	PUMP	6	L	50	-41.63	3949.56	0.71	3.00	YES
RB	PUMP	7	L	111	26.42	2717.42	1.01	4.58	YES

TABLE D-3

PATHFINDER FINAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS
Using Average Local Background

BUILDING	FLOOR	SURVEY UNIT	UPPER OR LOWER	NUMBER OF POINTS	AVERAGE CONTAMINATION (DPM/100cm^2)	MAXIMUM CONTAMINATION (DPM/100cm^2)	GAMMA LEVEL (microR/hr)	REMOVABLE BETA CONTAMINATION (DPM/100cm^2)	COMPLIANCE
RB	SHLD	4	L	30	-212.96	160.25	0.74	9.81	YES
RB	STMCH	1	L	51	-267.65	1856.15	1.47	3.26	YES
RB	STMCH	2	L	42	-431.00	73.82	1.08	4.08	YES
RB	STMCH	3	L	63	-363.55	215.83	1.08	3.18	YES
RB	SUMP	1	L	36	-610.22	-56.33	2.09	5.63	YES
RB	SUMP	2	L	32	-318.40	389.46	2.28	9.57	YES
RWS	MAIN	1	L	50	-605.44	-542.46	-0.06	0.58	YES
RWS	MAIN	2	L	60	-377.52	-155.10	-0.06	2.93	YES
RWS	MAIN	3	L	45	-427.36	-271.27	-0.06	-0.28	YES
RWS	MAIN	4	L	54	-463.97	-255.32	-0.06	2.35	YES
RWS	MAIN	5	L	62	-618.94	-328.17	-0.06	4.94	YES
RWS	MAIN	6	L	62	-617.73	-465.74	-0.06	5.44	YES

TABLE D-4

PATHFINDER SPECIAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS
Using Average Local Background

BUILDING	FLOOR	SURVEY UNIT	UPPER OR LOWER	NUMBER OF POINTS	AVERAGE CONTAMINATION (DPM/100cm^2)	MAXIMUM CONTAMINATION (DPM/100cm^2)	GAMMA LEVEL (microR/hr)	REMOVABLE BETA CONTAMINATION (DPM/100cm^2)	COMPLIANCE
FHB	BASE	1	L	1	-36.76	-36.76	-1.14	6.00	YES
FHB	BASE	3	L	5[1]	-54.25	27.94	2.48	19.08	YES
FHB	BASE	3	U	22	-168.30	251.47	-0.66	6.60	YES
FHB	BASE	4	L	8	-293.43	-160.03	1.30	9.18	YES
FHB	BASE	6	L	19	-358.89	157.35	-2.90	5.50	YES
FHB	BASE	6	U	13	-161.34	151.47	0.76	14.27	YES
FHB	BASE	7	L	23	-494.36	-201.47	-1.80	1.47	YES
FHB	BASE	7	U	13	-49.63	257.35	1.08	8.90	YES
FHB	BASE	8	L	1	-219.12	-219.12	1.45	0.00	YES
FHB	BASE	8	U	10	-15.27	286.63	-0.94	12.61	YES
FHB	BASE	9	L	1	-201.47	-201.47	-3.47	-6.00	YES
FHB	BASE	9	U	6	82.64	240.12	-0.04	13.13	YES
FHB	BASE	10	L	3[1]	527.37	280.88	4.00	-5.36	YES
FHB	BASE	10	U	14	-47.65	216.18	-1.50	3.89	YES
FHB	BASE	11	L	6	398.68	500.99	0.34	9.85	YES
FHB	BASE	11	U	11	136.54	551.84	-1.64	22.22	YES
FHB	BASE	12	L	5[1]	192.56	280.88	1.77	26.76	YES
FHB	BASE	14	U	3[1]	1133.19	692.65	3.77	9.28	YES
FHB	BASE	17	L	3[1]	-76.40	-165.68	-3.47	18.15	YES
FHB	CRANE	1	L	315	-386.97	3952.60	-3.37	4.67	YES
FHB	CRANE	1	U	88	-304.14	828.67	-3.47	4.18	YES
FHB	CRANE	2	L	39	-167.93	1122.46	-3.47	2.87	YES
FHB	CRANE	2	U	42	-181.94	902.12	-3.47	1.15	YES
FHB	FAN	1	L	16	159.42	721.33	-3.47	7.75	YES
FHB	FAN	1	U	51	154.25	1425.60	-3.17	8.72	YES
FHB	FAN	2	L	79	-654.10	-178.49	-3.47	4.65	YES
FHB	FAN	2	U	67	-577.54	205.23	-3.47	5.91	YES
FHB	FAN	3	L	7	35.09	218.50	-3.47	4.53	YES
FHB	FAN	3	U	26	-193.31	139.41	-2.82	6.26	YES
FHB	FAN	4	U	19	10.03	1049.01	-2.49	6.87	YES
FHB	FAN	5	L	220	-131.39	3556.25	-0.84	7.16	YES
FHB	FAN	5	U	223	-351.61	1378.03	-1.16	1.55	YES
FHB	MEZZ	1	L	12	459.54	1228.49	1.69	11.48	YES
FHB	MEZZ	2	L	29	-349.94	69.12	-2.48	10.54	YES
FHB	MEZZ	2	U	5[1]	452.90	251.74	1.47	46.03	YES
FHB	MEZZ	3	L	8	233.92	669.12	1.15	6.61	YES

TABLE D-4

PATHFINDER SPECIAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS
Using Average Local Background

BUILDING	FLOOR	SURVEY UNIT	UPPER OR LOWER	NUMBER OF POINTS	AVERAGE CONTAMINATION ($DPM/100cm^2$)	MAXIMUM CONTAMINATION ($DPM/100cm^2$)	GAMMA LEVEL (microR/hr)	REMOVABLE BETA CONTAMINATION ($DPM/100cm^2$)	COMPLIANCE
FHB	MEZZ	3	U	3[1]	865.34	478.49	0.88	12.84	YES
FHB	MEZZ	4	L	46	-388.00	19.19	-1.47	6.92	YES
FHB	MEZZ	4	U	8	-28.62	152.91	1.01	30.42	YES
FHB	MEZZ	5	L	8	-115.57	135.47	0.92	9.97	YES
FHB	MEZZ	5	U	5[1]	-8.69	164.53	1.15	7.69	YES
FHB	MEZZ	6	L	15	255.62	1385.47	0.63	14.19	YES
FHB	MEZZ	6	U	6	324.10	385.47	-3.47	28.95	YES
FHB	MEZZ	7	L	6	-542.67	-259.88	1.33	11.33	YES
FHB	MEZZ	7	U	18	171.86	484.30	-1.94	35.01	YES
FHB	OPER	1	L	55	-466.21	-67.54	-3.47	5.81	YES
FHB	OPER	2	L	46	-214.97	1335.77	-3.47	5.40	YES
FHB	OPER	3	L	59	-48.33	1512.29	-2.31	4.90	YES
FHB	OPER	4	L	29	170.12	1174.41	-3.47	0.74	YES
FHB	OPER	5	U	116	-276.67	1239.71	-3.47	5.69	YES
FHB	OPER	6	U	51	523.29	1240.12	-3.29	6.58	YES
FHB	OPER	7	U	36	-384.16	38.01	-3.47	5.29	YES
FHB	OPER	8	U	58	-656.17	313.46	-3.47	6.22	YES
FHB	OPER	9	U	20	-191.51	307.97	-3.47	10.57	YES
FHB	OPER	10	U	130	-204.79	575.00	-2.73	5.73	YES
FHB	OPER	11	U	51	-76.32	764.36	-3.47	7.98	YES
FHB	OPER	12	L	90	-571.53	280.68	-3.47	3.69	YES
FHB	OPER	12	U	50	-544.28	339.86	-3.47	8.85	YES
FHB	OPER	13	L	29	-174.62	881.94	-3.47	7.36	YES
FHB	OPER	13	U	113	-143.49	616.04	-3.47	6.23	YES
FHB	OPER	14	L	48	-120.83	483.09	-3.04	2.71	YES
FHB	OPER	14	U	116	-234.61	240.32	-3.47	7.74	YES
FHB	OPER	15	L	20	14.93	957.08	-3.47	7.08	YES
FHB	OPER	15	U	96	-250.18	165.17	-3.47	4.48	YES
FHB	OPER	16	L	158	-544.78	216.52	-3.47	1.97	YES
FHB	OPER	16	U	22	-350.05	0.27	-3.47	7.35	YES
FHB	ROOF	3	L	6	1753.04	1972.53	-3.47	22.11	YES
RB	CAVE	1	L	74	-235.66	885.78	-2.56	1.47	YES
RB	CAVE	2	L	135	-604.33	-0.28	-1.86	9.04	YES
RB	CAVE	3	U	2[1]	65.58	-413.52	-3.47	53.20	YES
RB	CAVE	4	L	17	-264.50	1018.17	-2.59	11.76	YES
RB	CAVE	5	L	5[1]	103.11	78.28	0.40	10.37	YES

TABLE D-4

PATHFINDER SPECIAL SURVEY RESULTS
UPPER ONE-SIDED CONFIDENCE LIMITS
Using Average Local Background

BUILDING	FLOOR	SURVEY UNIT	UPPER OR LOWER	NUMBER OF POINTS	AVERAGE CONTAMINATION (DPM/100cm^2)	MAXIMUM CONTAMINATION (DPM/100cm^2)	GAMMA LEVEL (microR/hr)	REMOVABLE BETA CONTAMINATION (DPM/100cm^2)	COMPLIANCE
RB	DOME	1	U	9	128.06	275.00	-0.63	16.46	YES
RB	EQUIP	1	L	120	-262.11	829.29	-3.47	3.58	YES
RB	EQUIP	2	L	65	-246.60	103.57	-3.47	2.12	YES
RB	EQUIP	3	L	157	-516.03	692.14	-3.47	1.45	YES
RB	EQUIP	4	L	62	29.75	2429.29	-3.47	4.77	YES
RB	EQUIP	5	U	37	-126.22	349.29	-3.47	6.63	YES
RB	FTV	1	L	18	-550.72	-275.00	-3.47	3.03	YES
RB	OPER	1	L	35	-26.03	894.32	-3.47	7.66	YES
RB	OPER	2	L	50	836.13	3512.50	-3.47	11.33	YES
RB	OPER	3	L	258	-626.96	3275.00	-3.47	5.65	YES
RB	OPER	4	U	32	-213.03	683.84	-3.47	17.27	YES
RB	OPER	5	U	9	408.27	624.46	-3.47	34.05	YES
RB	OPER	6	U	129	16.86	834.14	-3.47	10.22	YES
RB	OPER	7	U	266	-8.84	832.38	-3.47	6.79	YES
RB	PLUG	1	L	318	-459.46	2896.47	-3.08	9.78	YES
RB	PLUG	2	L	76	-215.39	670.06	-3.28	4.42	YES
RB	PLUG	3	L	125	-124.48	1812.04	-3.47	3.37	YES
RB	PLUG	4	U	82	-296.64	1139.20	-3.47	12.06	YES
RB	PUMP	1	L	54	-470.62	1102.38	0.86	5.75	YES
RB	PUMP	2	L	111	-642.50	483.33	0.67	6.16	YES
RB	PUMP	3	L	44	-198.03	1190.15	-3.47	0.73	YES
RB	PUMP	4	L	88	-284.30	959.85	-3.47	6.04	YES
RB	PUMP	5	L	27	-21.93	1322.34	-3.47	9.44	YES
RB	PUMP	6	L	56	-250.38	1813.46	-3.47	9.91	YES
RB	PUMP	7	L	40	106.31	1319.69	-3.47	6.40	YES
RB	STMCH	1	L	26	-178.09	1636.26	-3.47	9.23	YES
RB	STMCH	2	L	19	17.63	1002.75	-3.47	14.88	YES
RB	STMCH	3	L	63	-437.95	735.73	-3.26	8.55	YES
RB	SUMPC	1	L	9	-158.08	628.26	-3.47	12.58	YES
RB	SUMPC	2	L	11	63.11	943.48	-3.47	24.37	YES

1 When the number of data points is small, i.e., five or less, the "Average Contamination" result may be significantly different than the mean due to the generally large values of the standard deviation and t.

APPENDIX E

SURVEY DATA PACKAGES

GRID SURVEYS

Buiding	Floor	Survey Unit
EXT	FHRB	2G
EXT	GRND	1G
FHB	BASE	1L, 1U
FHB	BASE	2L, 2U
FHB	BASE	3L, 3U
FHB	BASE	4L
FHB	BASE	6L, 6U
FHB	BASE	7L, 7U
FHB	BASE	8L, 8U
FHB	BASE	9L, 9U
FHB	BASE	10L, 10U
FHB	BASE	11L, 11U
FHB	BASE	12L
FHB	BASE	13L
FHB	BASE	14U
FHB	BASE	15U
FHB	BASE	16U
FHB	BASE	17L
FHB	CRANE	1L, 1U
FHB	CRANE	2L, 2U
FHB	FAN	1L, 1U
FHB	FAN	2L, 2U
FHB	FAN	3L, 3U
FHB	FAN	4U
FHB	MEZZ	1L, 1U
FHB	MEZZ	2L, 2U
FHB	MEZZ	3L, 3U
FHB	MEZZ	4L, 4U
FHB	MEZZ	5L, 5U
FHB	MEZZ	6L, 6U
FHB	MEZZ	7L, 7U
FHB	OPER	1L
FHB	OPER	2L
FHB	OPER	3L

GRID SURVEYS

Buiding	Floor	Survey Unit
FHB	OPER	4L
FHB	OPER	5U
FHB	OPER	6U
FHB	OPER	7U
FHB	OPER	8U
FHB	OPER	9U
FHB	OPER	10U
FHB	OPER	11U
FHB	OPER	12L, 12U
FHB	OPER	13L, 13U
FHB	OPER	14L, 14U
FHB	OPER	15L, 15U
FHB	OPER	16L, 16U
FHB	ROOF	1L
FHB	ROOF	2L
FHB	ROOF	3L
RB	CAVE	1L
RB	CAVE	2L
RB	CAVE	3L
RB	CAVE	5L
RB	EQUIP	1L
RB	EQUIP	2L
RB	EQUIP	3L
RB	EQUIP	4L
RB	EQUIP	5U
RB	FTV	1L
RB	OPER	1L
RB	OPER	2L
RB	OPER	3L
RB	OPER	4U
RB	OPER	5U
RB	OPER	6U
RB	OPER	7U
RB	OPER	8U

GRID SURVEYS

Buiding	Floor	Survey Unit
RB	OPER	9U
RB	OPER	10U
RB	OPER	11U
RB	PLUG	1L
RB	PLUG	2L
RB	PLUG	3L
RB	PLUG	4U
RB	PUMP	1L
RB	PUMP	2L
RB	PUMP	3L
RB	PUMP	4L
RB	PUMP	5L
RB	PUMP	6L
RB	PUMP	7L
RB	SHLD	4L
RB	STMCH	1L
RB	STMCH	2L
RB	STMCH	3L
RB	SUMP	1L
RB	SUMP	2L
RB	RWS	1L
RB	RWS	2L
RB	RWS	3L
RB	RWS	4L
RB	RWS	5L
RB	RWS	6L

SURVEY DATA PACKAGES
SPECIAL SURVEYS

Building	Floor	Survey Unit
FHB	BASE	1L
FHB	BASE	3L, 3U
FHB	BASE	4L
FHB	BASE	6L, 6U
FHB	BASE	7L, 7U
FHB	BASE	8L, 8U
FHB	BASE	9L, 9U
FHB	BASE	10L, 10U
FHB	BASE	11L, 11U
FHB	BASE	12L
FHB	BASE	14U
FHB	BASE	17L
FHB	FAN	1L, 1U
FHB	FAN	2L, 2U
FHB	FAN	3L, 3U
FHB	FAN	4U
FHB	FAN	5L, 5U
FHB	MEZZ	1L
FHB	MEZZ	2L, 2U
FHB	MEZZ	3L, 3U
FHB	MEZZ	4L, 4U
FHB	MEZZ	5L, 5U
FHB	MEZZ	6L, 6U
FHB	MEZZ	7L, 7U
FHB	OPER	1L
FHB	OPER	2L
FHB	OPER	3L
FHB	OPER	4L
FHB	OPER	5U
FHB	OPER	6U
FHB	OPER	7U
FHB	OPER	8U
FHB	OPER	9U

SURVEY DATA PACKAGES
SPECIAL SURVEYS

Building	Floor	Survey Unit
FHB	OPER	10U
FHB	OPER	11U
FHB	ROOF	3L
RB	CAVE	1L
RB	CAVE	2L
RB	CAVE	3U
RB	CAVE	4L
RB	CAVE	5L
RB	DOME	1U
RB	EQUIP	1L
RB	EQUIP	2L
RB	EQUIP	3L
RB	EQUIP	4L
RB	EQUIP	5U
RB	FTV	1L
RB	PLUG	1L
RB	PLUG	2L
RB	PLUG	3L
RB	PLUG	4U
RB	STMCH	1L
RB	STMCH	2L
RB	STMCH	3L
RB	SUMP	1L

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