MANHATTAN COLLEGE

Manhattan College Parkway
Riverdale, New York City, New York 10471-4098
(718) 862-7281 fax (718) 862-8015
deanengr@manhattan.edu

Office of the Dean of Engineering

February 3, 2005

U.S. Nuclear Regulatory Commission
Attn: Pat Madden
Mail Stop 012-G13
Washington, DC 20555-0001

Subject: Termination of Facility License R-94; Docket 50-199

Dear Mr. Madden:

Manhattan College is hereby requesting, in accordance with the provisions of the approved Decommissioning Plan, that the Possession-only license R-94 be terminated. All of the nuclear material under the license has been removed, decommissioning activites have been performed as required, and the Final Status Survey has been completed. Specifically the following has been performed:

- All of the reactor fuel was transferred in August 2004, to the University of Texas by the Department of Energy contractor personnel from the INEL (see enclosed 741 transfer form).
- The three fission chambers originally acquired by transfer from Cintichem, and covered by R-94 license amendment No. 11, were also transferred to the University of Texas in the same shipment as the fuel (same enclosed 741 transfer form).
- The CS-137 calibration source procured under R-94 license amendment No. 10, was transferred to Co – Physics Corporation in November 2004, (see enclosed Transfer of Custody agreement).
- Amendment No. 10 also deleted the license condition which permitted possession of 3.2 kgs of uranium since this material had been previously removed from our facility.
- In May 2002, the NRC transferred license No. SNM-1892 to the regulatory authority of the State of New York, New York City Department of Health. In April 2002, Region 1 had amended the license to remove the 80 gms of Pu-239 contained in the 5 sources transferred to Georgia Tech in 1998 thus reducing the quantity of Pu-239 remaining on the license to below that sufficient to form a critical mass. This, required transfer of the regulatory authority to the State of New York.

  Subsequently, in December 2003 the remaining Pu-239 sources were transferred from Manhattan College to the Los Alamos National Laboratory (see enclosed letter, S. Leonard to Lickerman of 12/17/03 and Authorization to Transfer dated 8/21/03). Thus, all plutonium sources covered by NRC and State License have been removed from our facility.

- All of the remaining old test and check sources onsite were either transferred to Co-Physics Corporation in November 2004 (see enclosed Transfer of Custody Agreement 11/5/04); or disposed of in December 2004 using Radiac Corporation as the carrier (see enclosed Bill of Lading 76305 dated 12/9/04 and Radioactive Waste Disposal Record 76305 of 12/9/04).
- Nine small rods containing U238 of unknown origin, that had been stored in a lead box in our Facility for decades, were also disposed of in December 2004 using Radiac Corporation as the carrier (see enclosed LLW manifest Form 540 dated 12/9/04 and Radioactive Waste Disposal Record 76225 of 12/9/04)

As a result of the action described above, Manhattan College no longer possess any nuclear material originally covered by NRC License R-94 or New York City License 76-2. We will also be applying to the NYC Bureau of Radiation Control for termination of License 76-2. In addition any unlicensed nuclear material has been disposed of as waste material.

The Final Status Survey of the Nuclear Engineering Facility has been performed and documented. The results of the Survey demonstrated that the activity and exposure levels are well within the NRC limits for unrestricted use, with the great majority of the individual readings being at or near background levels. The Final Status Survey Report is enclosed.

Please contact me if any additional information is required in support of this request for termination of License R-94.

Sincerely,

Robert Berlin, DPH
Acting Reactor Administrator

I declare under penalty of perjury that the foregoing is true and correct.

Executed on February 3, 2005
Richard H. Heist, Dean School of Engineering

Enclosures:

1. 741 transfer form for reactor fuel and fission chambers
2. Transfer of Custody Agreement with Co-Physics Corp.
3. Letter, S. Leonard to T. Lickerman
4. Authorization to Transfer dated 8/21/03
5. Bill of Lading 76305 and Radioactive Waste Disposal Record 76305
6. LLW Manifest Form 540 and Radioactive Waste Disposal Record 76225
7. Final Status Survey Report

DOE/NRC FORM 741
MANDATORY DATA COLLECTION

U.S. DEPARTMENT OF ENERGY AND U.S. NUCLEAR REGULATORY COMMISSION

NUCLEAR MATERIAL TRANSACTION REPORT

1. Shipper's RIS	2. Receiver's RIS	3. Transaction No.	4. Correction No.	5. Processing Code	6. Action Code
ZMH	ZVS	1		A	A

8a. Name and Address of Shipper: Manhattan College, School of Engineering, 3825 Corlear Avenue, Bronx, NY 10463
License: R-94
Attention: M. Berlin/R. Heist
Telephone: 718-862-7307

9a. Name and Address of Receiver: University of Texas, Nuclear Engineering Teaching Lab., Pickle Research Campus, Bldg. 159, 10100 Burnet Rd., Austin, TX 78758
License: R-129
Attention / Telephone: S. O'Kelly 512-232-5378

Shipper: (SAME AS 8a) JSG
Receiver: (SAME AS 8a) JSG

No.	RIS
1	ZMH-ZVS
2	ZVS
3	QTA
4	ZVS
6	ZMH

Authority: DOE

13. Material description: 17 Fuel Elements (16 full & 1 partial) containing 19635gm Uranium, 19.8% enrichment (3880gmU235) and 3 Fission chambers containing 4gm U., 93% enriched in U235

Remarks: Per verbal discussions with John Gaverthage of DOE and Tony Vinola at INEL.

	Month	Day	Year
Shipped	08	11	04
Received	8	16	04

26. Shipper's Data

Line No.	Batch	Material Type	Composition	Number of Items	Element Weight	Enrichment (%)	Isotope Weight
01	JAV 4000000 20	880 G		17	19635gm	19.8	3880gm
02	[illegible] 20	880 J		3	4gm	93	4gm

26a. SHIPPER'S DATA — Signature: [signature] 8/11/04

27a. RECEIVER'S DATA — Signature: [signature] 8-16-04

27. Receiver's Data

Line No.	Batch	Material Type	Composition	Number of Items	Element Weight	Enrichment (%)	Isotope Weight
01	[illegible] 20	880 G		17	19635g	19.8	3880gm
02	[illegible] 20	880 J		3	4g	93	4gm

WARNING: FALSE STATEMENTS IN THIS CERTIFICATE MAY BE SUBJECT TO CIVIL AND/OR CRIMINAL PENALTIES. NRC REGULATIONS REQUIRE THAT SUBMISSIONS TO THE NRC BE COMPLETE AND ACCURATE IN ALL MATERIAL RESPECTS. 18 U.S.C. SECTION 1001 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.

MANHATTAN COLLEGE

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Office of the Dean of Engineering

TRANSFER OF CUSTODY OF RADIOACTIVE SOURCES

Manhattan College hereby transfers custody of the following radioactive sources to Co-Physics Corporation, license No: 2691-3949.

1. From Manhattan College license No.: R-94; 2 m ci CS-137 source, serial No.: 404-37 dated June 1, 1992.

2. From Manhattan College possession;

   A. TC-99 set of 4 sources; serial No.: 7755, 7756, 7757, 7758, undated
   B. 1 TH-230 source; serial No.: 4167, dated January 13, 1994.
   C. 1 Multi - Nuclide source; serial No.: 469-80-2, dated November 1, 1994.

Acknowledgement of Transfer by Manhattan College:

Official Name / Title Richard H. Heist (Name) Dean of Engineering (Title)

Signature Rich H. Heist Date Nov 5, 2004

Acknowledgement of Receipt by Physics Corporation

Office Name / Title Theodore E. Rahon (Name) President (Title)

Signature Theodore E Rahon Date 11/5/04

Los Alamos
NATIONAL LABORATORY

Risk Reduction and Environmental Stewardship
Transuranic Waste Characterization Group
Off-Site Source Recovery (OSR) Project
P.O. Box 1663, Mail Stop: J552
Los Alamos, New Mexico 87545

Date: December 17, 2003
Refer to: RRES-CH 03-064

Tobias Lickerman, Chief Materials Unit
Bureau of Radiological Health
NYC Department of Health
2 Lafayette Street
11th Floor
New York, NY 10007

Dear Mr. Lickerman:

Enclosed please find a signed *Authorization to Transfer/Relinquishment of Custody* form concerning:

Manhattan College
3825 Corlear Avenue
Bronx, NY 10463-2348

The radioactive sources described on the form have been removed from Manhattan College in Bronx, NY and are in storage at Los Alamos National Laboratory Facilities. These sources have been transferred to Department of Energy (DOE) ownership and are being stored under DOE license exemption.

This action was completed as part of the Off-Site Source Recovery (OSR) Project managed by this office. If you need any further information on this action, please contact the OSR Project Office at 505/667-6701.

Sincerely,

Shelby Leonard

Shelby Leonard
Team Leader OSR Project

SL/lh

Cy: Dr. Richard H. Heist, Manhattan College
Douglas Broaddus, NRC HQ
Robert Campbell, DOE-HQ EM-36
Joel Grimm, DOE-AL/WMD
RRES-CH File / OSRP File
Doc#3109

Los Alamos
NATIONAL LABORATORY

ATRC # 2003:006

Off-Site Source Recovery Project
Authorization to Transfer/Relinquishment of Custody

SOURCE OWNER: Manhattan College
CONTACT NAME: Bob Berlin
ADDRESS: 3825 Corlear Avenue
School of Engineering
Riverdale, NY 10471

TELEPHONE: (718) 862-7281
FAX: (718) 862-8015

Manhattan College is authorized by the University of California at Los Alamos National Laboratory (UC/LANL), on behalf of the U.S. Department of Energy (DOE), to transfer the sealed source(s) indicated below to Los Alamos National Laboratory.

Manhattan College hereby relinquishes and UC/LANL, on behalf of DOE, hereby accepts all custody of the sealed source(s) indicated below upon receipt or acceptance of the sources at Los Alamos National Laboratory.

SOURCE INFORMATION

Type: 239Pu/Be	Serial No: M274	Mfg. Date: 07/17/1961	Curies: 4.650	Grams Isotopic: 74.000
Type: 239Pu/Be	Serial No: M605	Mfg. Date: 09/01/1961	Curies: 0.933	Grams Isotopic: 14.850
Type: 239Pu/Be	Serial No: N800P7	Mfg. Date: 06/24/1964	Curies: 4.650	Grams Isotopic: 74.000

SOURCE CUSTODIAN:

OFFICIAL NAME/TITLE Richard H. Heist — Dean of Engineering
NAME (Please Print or Type) — TITLE (Please Print or Type)

SIGNATURE [signature] DATE Aug. 21, 2003

UC/LANL AUTHORIZATION:

OFFICIAL NAME/TITLE: Shelby J. Leonard, Team Leader, Off-Site Source Recovery Project

SIGNATURE [signature] DATE 8-21-03

ACKNOWLEDGEMENT OF RECEIPT BY LANL:

OFFICIAL NAME/TITLE James Matzke — Recovery Coordinator
NAME (Please Print or Type) — TITLE (Please Print or Type)

SIGNATURE [signature] DATE 12/11/03

Robert Replin 845.251.3486 [illegible]

RADIAC RESEARCH CORP.

RWSD No. ______

261 KENT AVENUE
BROOKLYN, NEW YORK 11211
718 - 963-2233
FAX 718 - 388-5107

No.

DATE 12/1/01
BLDG. NO. ______
ROOM NO. ______
DEPT. NO. ______

RADIOACTIVE WASTE DISPOSAL RECORD

COMPANY/INSTITUTION Manhattan College

CONTAINERS NUMBER

71995.01 — [illegible] [illegible] [illegible] [illegible]

TYPE	P/U	DEL
5 Gallon Dry 7A	1	
30 Gallon Dry		
30 Gallon A/P		
30 Gallon S/P		
30 Gallon LSV		
55 Gallon Dry		
55 Gallon LSV		
De Reg LSV		
Cases 1 Gallon		
5 Gallon Liners		
55 Gallon Liners		
Security Seals		
Labels (Roll)		
Preservative		
Absorbent Material		
Miscellaneous		

I hereby certify that the above listed radioactive wastes are properly described, packaged marked and labeled, in accordance with D.O.T. Regulations and RADIAC'S General Terms and Conditions.

CUSTOMER REP. [illegible] R.R.C. REP [illegible]

ISOTOPE	ACTIVITY	ISOTOPE	ACTIVITY

ID # ______ Site # ______ Expiration Date ______ Instrument ______

WHITE COPY - OFFICE CANARY - CUSTOMER PINK - BILLING YELLOW - DUPLICATE

RWSD No. ______

RADIAC RESEARCH CORP.

261 KENT AVENUE
BROOKLYN, NEW YORK 11211
718 - 963-2233
FAX 718 - 388-5107

No.

DATE 12/9/04

BLDG. NO. ______

ROOM NO. ______

DEPT. NO. ______

RADIOACTIVE WASTE DISPOSAL RECORD

COMPANY/INSTITUTION Manhattan College

CONTAINERS NUMBER

76365. C1 ______ Exempt Source(s) ______ DOT-7A
Lot of check sources
packaging w Sealed DOT 7A

TYPE	P/U	DEL
5 Gallon Dry Cells	1	1
30 Gallon Dry		
30 Gallon A/P		
30 Gallon S/P		
30 Gallon LSV		
55 Gallon Dry		
55 Gallon LSV		
De Reg LSV		
Cases 1 Gallon		
5 Gallon Liners		
55 Gallon Liners		
Security Seals		
Labels (Roll)		
Preservative		
Absorbent Material		
Miscellaneous		

I hereby certify that the above listed radioactive wastes are properly described, packaged marked and labeled, in accordance with D.O.T. Regulations and RADIAC'S General Terms and Conditions.

CUSTOMER REP. [signature] R.R.C. REP [signature]

ISOTOPE	ACTIVITY	ISOTOPE	ACTIVITY

ID # ______ Site # ______ Expiration Date ______ Instrument ______

WHITE COPY - OFFICE CANARY - CUSTOMER PINK - BILLING YELLOW - DUPLICATE

***** CONTAINS HAZARDOUS MATERIALS *****

radiac
RESEARCH CORP.

Non-Negotiable STRAIGHT BILL OF LADING

No. 76305

NYSDEC: 2A-004 43593 * DOT Reg. No: 051303 009 011LN * NRC License: 31-17528-01

261 Kent Avenue
Brooklyn, NY 11211
Phone (800) 640 - 7511
Fax (718) 388 - 5107

1 OF 1

Driver:	Truck No:	Trailer No:
HECTOR A. MARTOS	#109	N/A

SHIPPER (ORIGIN)		CONSIGNEE (DESTINATION)		NOTES
Name	MANHATTAN COLLEGE	Name	RADIAC RESEARCH CORP.	
Street Address	3825 CORLEAR AVENUE	Street Address	261 KENT AVENUE	
City, State	RIVERDALE, NY 10463	City, State	BROOKLYN, NY 11211	
Notify/Contact	ROBERT BERLIN 845.351.3486 or 2880	Notify/Contact	JOSEPH SPEKTOR 800.640.7511	

PARTICULARS FURNISHED BY SHIPPER

Units	HM	Description, Proper Shipping Name	Hazardous Class	UN/NA Number	Packing Group	Weight Lbs.
1x 5 G. DRUM METAL DOT--7A TYPE A	✔	RADIOACTIVE MATERIAL, TYPE A PACKAGE [SOLID, OXIDE, Co-60, 89.6 KBq; Na-22, 68.5 KBq; Mn-54, 72.3 KBq; Cd-109, 404 KBq; Co-57, 56 KBq; Cs-137, 105.5 KBq; Zn-65, 37 KBq; Ba-133, 91.5 KBq; Pb-210, 37 KBq; U-238, 37 KBq; Sr-90, 37 KBq; C-14, 0.37 Bq] Total activity - 1.0354 MBq DOT Label: "Radioactive WHITE I"; TI - N/A Radiation @ container surface - 0.005 mSv/hr (0.5 mR/hr) Security Seal:	7	UN2915	NA	10

SHIPPER'S CERTIFICATIONS	Placards Required: (Furnished by Carrier) YES ☐ NO ☑	Emergency Response Phone: Chemtrec: (800) 434-9300	ERG No.: 163

This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation (49 C.F.R. §172.204).

Signature: [signature]

Special Instruction:

Received in good order, count and condition unless otherwise noted above.

SHIPPER:	CARRIER: RADIAC RESEARCH CORP.	CONSIGNEE:
ROBERT E. BERLIN (Print Name)	HECTOR A. MARTOS	(Print Name)
[signature] (Authorized Signature) 12/9/04 (Date)	[signature] (Authorized Signature)	(Authorized Signature) (Date)

Monitored at all times the Hazardous Material is in transportation including storage incidental to transportation (172.604)

Shipper

FORM 540 — **RADIAC RESEARCH CORP.**

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

SHIPPING PAPER

1. EMERGENCY TELEPHONE NUMBER *(Include Area Code)*: (800) 424 - 9300

ORGANIZATION: CHEMTREC

2. IS THIS AN "EXCLUSIVE USE" SHIPMENT? [ ] YES [X] NO

3. TOTAL NUMBER OF PACKAGES IDENTIFIED ON THIS MANIFEST ===> 1

4. DOES EPA REGULATED WASTE REQUIRING A MANIFEST ACCOMPANY THIS SHIPMENT? If "Yes," provide Manifest Number ===> [ ] YES [X] NO

EPA MANIFEST NUMBER: NA

5. SHIPPER -- NAME AND FACILITY: MANHATTAN COLLEGE, 3825 CORLEAR AVENUE, RIVERDALE, NY 10463

SHIPMENT I.D. NUMBER: NA

[ ] COLLECTOR
[ ] PROCESSOR
[X] GENERATOR TYPE *(Specify)* A

Permit #: NA

SHIPMENT NUMBER: NA

CONTACT: ROBERT BERLIN

TELEPHONE NUMBER (Include Area Code): 845.351.3486 or 2880

6. CARRIER -- Name and Address: RADIAC RESEARCH CORP., 261 KENT AVE., BROOKLYN, NY 11211

Truck #: 109
Trailer #: N/A

EPA I.D. NUMBER: NYD049178296

SHIPPING DATE: NA

CONTACT: ARTHUR GREEN

TELEPHONE NUMBER (Include Area Code): 718 963 - 2233

SIGNATURE -- Authorized carrier acknowledging waste receipt: Hector A. Mattos

DATE: 10/9/04

7. FORM 540 AND 540A — PAGE 1 OF 1 PAGE(S)
FORM 541 AND 541A — 1 PAGE(S)
FORM 542 AND 542A — None PAGE(S)
ADDITIONAL INFORMATION — None PAGE(S)

8. MANIFEST NUMBER (Use this number on all continuation pages): 76225

9. CONSIGNEE - Name and Facility Address: RADIAC RESEARCH CORP., 261 KENT AVENUE, BROOKLYN, NY 11211

CONTACT: JOSEPH SPEKTOR

TELEPHONE NUMBER (Include Area Code): 718 963 - 2233

SIGNATURE - *Authorized consignee acknowledging waste receipt*

DATE

10. CERTIFICATION

This is to certify that the herein-named materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation. This also certifies that the materials are classified, packaged, marked, and labeled and are in proper condition for transportation and disposal as described in accordance with the requirements of 10 CFR Parts 20 and 61, or equivalent state regulations.

AUTHORIZED SIGNATURE	TITLE	DATE

11. U.S. DEPARTMENT OF TRANSPORTATION DESCRIPTION (including proper shipping name, hazard class, UN ID number, and any additional information)	12. DOT LABEL "RADIOACTIVE"	13. TRANSPORT INDEX	14. PHYSICAL AND CHEMICAL FORM	15. INDIVIDUAL RADIONUCLIDES		16. TOTAL PACKAGE ACTIVITY MBq	mCi	17. LSA/SCO CLASS	18. TOTAL WEIGHT OR VOLUME (Use appropriate units)	19. IDENTIFICATION NUMBER OF PACKAGE
Radioactive material, Type A package, 7, UN2915 / 9 URANIUM FUEL SLUGS	Yellow III	1.5	Solid 9 URANIUM FUEL SLUGS	U-238		2.6640E+02	7.2000E+00	NA	50. LBS; 0.67 FT3	76225-01
										SGS-04-11-116

FOR CONSIGNEE USE ONLY

20. *Certification is hereby made to Radiac Research Corp., that this shipment of low - level radioactive waste is accurately described in the above manifest. The waste described above has been prepared in accordance with current "RADIAC Acceptance Criteria", federal and state regulations, including those of the NRC, DOT, EPA and applicable agreement state agencies. Unless specifically included or excluded in writing, the shipper authorizes RADIAC to select the "best authorized treatment and / or disposal method".*

Date ______________ Signature ______________

Telephone ______________

FORM 540 (10-96)

FORM 541 RADIAC RESEARCH CORP.

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION

Additional Nuclear Regulatory Commission (NRC) Requirements for Control, Transfer and Disposal of Radioactive Waste

1. MANIFEST TOTALS

NUMBER OF PACKAGES/ DISPOSAL CONTAINERS	NET WASTE VOLUME		NET WASTE WEIGHT		SPECIAL NUCLEAR MATERIAL (grams) U-233	U-235	Pu	TOTAL
1	m3	0.0190	kg	22.6796	NP	NP	NP	NP
	ft3	0.6700	lb	50.0000				

ACTIVITY	ALL NUCLIDES	TRITIUM	C-14	Tc-99	I-129	SOURCE	
MBq	2.6640E+02	NP	NP	NP	NP	(kgs)	2.1620E+01
mCi	7.2000E+00	NP	NP	NP	NP	(lbs)	4.7664E+01

2. MANIFEST NUMBER 76225

3. PAGE 1 OF 1 PAGE(S)

4. SHIPPER NAME MANHATTAN COLLEGE

SHIPMENT ID NUMBER NA

DISPOSAL CONTAINER DESCRIPTION / WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER

5. CONTAINER IDENTIFICATION NUMBER / GENERATOR ID NUMBER	6. CONTAINER DESCRIPTION (See Note 1) PROCESS REQUESTED (See Note 1A) BURIAL/DISPOSITION (See Note 2A)	7. VOLUME (m3) (ft3)	8. WASTE AND CONTAINER WEIGHT (kg) (lb)	9. SURFACE RADIATION LEVEL mSv/hr mrem/hr	10. SURFACE CONTAMINATION MBq/100 cm2 dpm/100 cm2 ALPHA	BETA-GAMMA	11. WASTE DESCRIPTOR (See Note 2)	12. APPROXIMATE WASTE VOLUME(S) IN CONTAINER (m3) (FT3)	13. SOLIDIFICATION OR STABILIZATION MEDIA (See Note 3)	14. CHEMICAL FORM/ CHELATING AGENT	WEIGHT % CHELATING AGENT IF>0.1%	15. RADIONUCLIDES	MBq	mCi	16. WASTE CLASSIFICATION AS-Class A Stable AU-Class A Unstable B-Class B C-Class C
76225-01/MCLG	4 O E	0.0190	22.6796	1.5000E-01	<3.3400E-06	<3.3400E-05	59-OTHER.	0.0190	100	9 URANIUM FUEL SLUGS/NP	NP	U-238 [2.1620E+01 kgs]	2.6640E+02	7.2000E+00	NA
												Subtotal	2.6640E+02	7.2000E+00	
		0.6700	50.0000	1.5000E+01	<2.000E+02	<2.000E+03		0.6700				Total	2.6640E+02	7.2000E+00	
												Source: [2.1620E+01 kgs]			
Shipment Totals		0.0190	22.6796									Source: [2.1620E+01 kgs]	2.6640E+02	7.2000E+00	
		0.6700	50.0000												

NOTE 1: Container Description Codes. For containers/waste requiring disposal in approved structural over-packs the numerical code must be followed by "-OP."

1. Wooden Box or Crate
2. Metal Box
3. Plastic Drum or Pail
4. Metal Drum or Pail
5. Metal Tank or Liner
6. Concrete Tank or Liner
7. Polyethlene Tank or Liner
8. Fiberglass Tank or Liner
9. Demineralizer
10. Gas Cylinder
11. Bulk, Unpackaged Waste
12. Unpackaged Components
13. High Integrity Container
19. Other. Describe in Item 6, or additional page.

Note 1A: Process Requested

- C. Compaction
- SR. Steam Reforming
- DI. Direct Incineration
- SI. Sort & Incinerate
- D. Decon
- G. Green is Clean
- M. Metal Melt
- T. Trans-Ship
- LI. Liquid for Incineration
- OI. Oil for Incineration
- O. Other (describe)

NOTE 2: Waste Descriptor Codes. (Choose up to three which predominate by volume.)

20. Charcoal
21. Incinerator Ash
22. Soil
23. Gas
24. Oil
25. Aqueous Liquid
26. Filter Media
27. Mechanical Filter
28. EPA or State Hazardous
29. Demolition Rubble
30. Cation Ion-exchange Media
31. Anion Ion-exchange Media
32. Mixed Bed Ion-exchange Media
33. Contaminated Equipment
34. Organic Liquid (except oil)
35. Glassware or Labware
36. Sealed Source/Device
37. Paint or Plating
38. Evaporator Bottoms/Sludges/ Concentrates
39. Compactible Trash
40. Noncompactible Trash
41. Animal Carcass
42. Biological Material (except animal carcass)
43. Activated Material
59. Other. Describe in Item 11, or additional page

Note 2A: Burial/Disposition Site

- B Barnwell Waste Management Facility
- E Envirocare
- R Richland, WA
- PR Process and Return
- O Other

Note 3: Solidification and Stabilization Media Codes. (Choose up to three which predominate by volume. For media meeting disposal site structural stability requirements, the numerical code must be followed by "-S" and the media vendor and brand name must also be identified in Item 13. Code 100=NONE REQUIRED.

Solidification

90. Cement
91. Concrete (encapsulation)
92. Bitumen
93. Vinyl Chloride
94. Vinyl Ester Styrene
99. Other. Describe in Item 13, or additional page
100. None Required.

FORM 541 (10-96)

FINAL STATUS SURVEY REPORT
REACTOR FACILITY
MANHATTAN COLLEGE SCHOOL OF ENGINEERING

PREPARED FOR:
MANHATTAN COLLEGE

DECEMBER 2004

PREPARED BY:
ROBERT E. BERLIN D.P.H.

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1.0 BACKGROUND INFORMATION

The Manhattan College Zero Power Reactor (MCZPR) was constructed in 1964 and operated under Reactor License R-94. The Reactor was a 0.1 watt swimming pool reactor whose core contained 15 full assemblies and one partial fuel assembly. The Reactor was situated in a Nuclear Engineering Facility within the Leo Engineering Building of Manhattan College. The Reactor operated using 92 percent enriched uranium (High Enriched or HEU fuel) until 1992 when the fuel was replaced with new fuel assemblies using 19 percent enriched uranium (Low Enriched or LEU fuel). Operation resumed in 1995 after maintenance on the reactor tank and ceased in 1996. The fuel and plutonium sources were then removed from the Reactor and placed in storage. The plutonium sources were packaged and transported to the Los Alamos National Laboratory in December, 2003 and the fuel assemblies were sent to the University of Texas in August, 2004.

In addition to the MCZPR, the Nuclear Engineering Facility also contained a graphite moderated sub critical reactor, and a light water moderated sub critical reactor. Both sub critical reactors were removed from the Facility in the late 1990's.

A Decommissioning Plan and Final Radiological Status Survey Plan for the Facility were prepared and approved by the Nuclear Regulatory Commission (NRC) in 1998. The approved Survey Plan is based on the requirements of NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination". This Final Status Survey Report describes the procedure and criteria followed and provides the results of the Final Status Survey. The results of the Survey demonstrate that the radiation levels in the Nuclear Engineering Facility satisfy NRC residual contamination guidelines established for release of formerly licensed sites to unrestricted use.

2.0 SITE INFORMATION

2.1 Site Description

Manhattan College's main campus is situated along Manhattan College Parkway on the heights above Van Cortland Park, in the Riverdale section of the Bronx, New York City, just a few blocks south of the Yonkers city line.

The Nuclear Engineering Facility is located on the first floor of the Leo Engineering Building (two blocks from the main campus) on Corlear Avenue between 238th and 240th Streets. This building has been owned and occupied by Manhattan College since 1963. The Leo Engineering Building provides classrooms, laboratories, and faculty offices and may be occupied by as many as 600 persons at any one time. The location of the building and its relationship to its surroundings is shown in Figure 1-1. As shown, the Leo building is readily accessible from Interstate Highway 87 and the Henry Hudson Parkway by connecting roads. Municipal Transit Authority trains run regularly on elevated tracks on Broadway, one block from Corlear Avenue.

The complex of rooms comprising the former Nuclear Engineering Facility are located near the southeast corner of the Leo Engineering building. The floor plans for the first and second floors of the building are shown in Figures 1-2 and 1-3 respectively, with the facility areas shaded.

The Nuclear Engineering Facility consists of 3 separate areas. Room 221 contained the MCZPR and the 2 sub critical reactors. The MCZPR was separated from the sub critical reactors by a wall. The wall dividing the room will be used to separate room 221 into 2 areas thus creating survey units 1 and 2. The third survey area is in room 109 directly below room 221 where the fuel and sources were stored.

2.2 Facility Conditions at Time of Final Survey

As part of the decommissioning activities, reactor components (base plate, control rods, control rod drives) have been removed and shipped to the University of Texas. The fuel assembly and source storage containers, and other empty containers and non-radioactive equipment had been removed. At the time of the Final Survey, only the reactor console, reactor and critical experiment tanks, and piping from the water purification systems remained in the Facility. No contaminated surfaces existed.

2.3 Identity of Potential Contamination and Release Guidelines

The two critical experiments utilized natural uranium as fuel and the reactor fuel was enriched uranium, both low and high enrichment over the lifetime of the reactor. Thus, potential contamination would be the uranium isotopes UNAT, U238 and U235. Repeated wipes of the plutonium sources and testing of the moderater water prior to release have show that there was no potential for contamination from the plutonium.

Therefore based on the combination of uranium isotopes, the acceptable residual surface contamination release guidelines values (alpha and beta – gamma emitters) are;

5000 dpm / 100 cm^2, average over 1 m^2

15000 dpm / 100 cm^2, maximum over 100 cm^2

1000 dpm / 100 cm^2, removable over 100 cm^2

3.0 FINAL STATUS SURVEY OVERVIEW

3.1 Survey Objectives

The purpose of the Final Status Survey was to demonstrate that the residual radiological conditions in the Manhattan College Nuclear Engineering Facility satisfy NRC guidelines (see section 2.3 above) and that the Facility can, therefore, be released for unrestricted future use (no radiological controls). The specific objectives of the Final Status Survey for the Facility are to show that:

- Average Total direct (fixed and removable) surface contamination levels are within the guideline values defined in Section 2.3.
- Small areas of residual activity, known as "hot spots" do not exceed three times the guideline value, when averaged over a surface region of 100 cm^2, and provided that the average level within a 1 m^2 area containing the hot spot is within the guideline value.
- Removable activity in any 100 cm^2 area does not exceed 20% of the average surface activity guideline.
- External exposure rates do not exceed 5 ^{ur}/h above background at 1 m above the surface where averaged over a 100 m^2 grid area. Maximum exposure rates over any discrete area may not exceed 10 ^{ur}/h above background.

A 95% minimum level of confidence that the above conditions have been met was to be demonstrated. The rooms in the Nuclear Engineering Facility were divided into 3 survey units (see section 3.4) and the 95% level of confidence was to be applied to each survey unit separately.

3.2 Organization and Responsibilities

The Final Status Survey was conducted by Dr. Robert Berlin, the Acting Reactor Administrator. Dr. Berlin had conducted previous scans and surveys of the Facility and of other facilities under decommissioning. He was assisted by Manhattan College engineering students Paul Larocque, Robert Brancazzio, and Kathryn Vega. Each of the students was provided a training session prior to their participation which covered facility history, survey program purpose and parameters, radiological measurements, and use of the instruments. Dr. Berlin monitored the students activities, performed the bulk of the measurements, and analyzed the surface smears.

3.3 Instrumentation

The instruments that were used to take the measurements are listed in Table 3-1. The table also describes the specific use of each instrument and provides the detection (conversion) efficiency (E) as measured at the most recent calibration for the alpha and beta surface measurement instruments. Each instrument had been calibrated to NIST – traceable standards by either Eberline or Ludlum as appropriate. Operational checks were performed each day that an instrument was used.

3.4 Survey Procedures

Survey planning and procedure were conducted in accordance with the Manual for Conducting Radiological Surveys in Support of License Termination, NUREG/CR-5849, as reflected in the Manhattan College Zero Power Reactor Final Radiological Status Survey Plan (the "Plan")

3.4.1 Area Classification

As stated in the Plan prior scans and surveys of the Facility had indicated that there was no evidence of surface contamination in the Facility. All areas were therefore classified as unaffected areas.

3.4.2 Survey Units and Reference Grids

The Facility was divided into 3 surveys units based on physical layout and prior history as shown in figure 3-1 to 3-3 and as below;

Survey Unit	Description	Room	Approximate Size	Found on Figure
1	Sub critical Reactor Lab	221	28' X 25'	3-1
2	MCZPR Lab	221	28' x 18'	3-2
3	Fuel & Source storage room	109	29'x38'	3-3

While the Facility had been classified as unaffected, and a preliminary scan had verified that there were no area of elevated activity (hot spots), a reference grid system was established using chalk lines that provided measurement coverage consistant with assuring that no residual contamination existed at any location (as provided in the Plan). A grid interval of 1 meter by 1 meter was used on all floor surfaces and walls up to 2 meters from the floor. The system of grid labeling for identifications purposes is shown on Figures 3-1 to 3-3.

3.4.3 Surface Scan

A preliminary scan of approximately 10% of the floor and lower wall surface area was performed using the ESP-2 instruments in the rate meter mode to verify that there were no hot spots. In addition, the entire area of Survey Unit 3 under the overhang (see figure 3-3) that has not been used for fuel and source storage was scanned and verified to contain no residual contamination. No further measurements were made in this separate area.

3.4.4 Surface Activity Measurements

Surface direct measurements of alpha and beta activity were performed at the center of each grid block using the instrumentation described in the scalar mode in Table 3-1. A one minute count time was used. The measurements were made at approximately 1 cm above the surface.

Removable alpha and beta contamination was measured by taking 100 cm^2 swipes (smears) at the center of each survey block. The swipes were placed in labeled glassine envelopes and the ID No. of the swipe correlated with the location designation on the data sheet. Swipes were read using the instruments described in Table 3-1.

Gamma exposure rates were measured at one meter from the floor or wall surface at the center of each survey block using the Bicron Micro Rem meter described in Table 3-1. Sample survey forms are provided in Appendix 1.

3.5 Background Level Determinations

Background measurements were taken in an area adjacent to the Facility in the Leo Engineering Building that had similar surface characteristics and materials as in the Facility. These locations had no history of radioactive material use. The following background surfaces were separately sampled.

(1) Floor surfaces in the building stairwell and selected corridors having concrete surfaces comparable to the floor and exposed wall in areas in the Facility.

(2) Painted cinderblock wall and door surfaces in corridors whose surfaces were comparable to the majority of walls in the Facility.

(3) Painted brick surfaces in the Mechanical Engineering Laboratory whose surface was comparable to a small part of the wall surface in the Facility.

(4) Painted metal walls in a storage area adjacent to Survey unit 3 comparable to a similar wall in Survey unit 3.

The same instruments were used to take the background measurements as were used in the measurements in the Facility. A minimum of 8-10 measurements was taken for each background parameter. Background removable activity measurements were made on a blank swipe. Statistical procedure described in NUREG/CR-5849 were used to assess that the averages determined for each parameter were representative of true average background levels.

3.6 Data Interpretation

Survey results for fixed measurements were recorded on data sheets. The data conversion and statistical analysis techniques in NUREG/CR-5849 were used to convert the reported data into a form that permitted a direct comparison with residual contamination guidelines. The calculational methodology is shown in Appendix 2 of this Report and the analyzed data is provided in Tables 4-2 to 4-4. Surface unit measurement were converted to units of dpm/100 cm^2, and exposure rates are represented in uR/h. The effective activity and exposure rates reported in Tables 4-2 to 4-4 have been adjusted by subtracting the natural background levels.

3.7 Quality Control

Every tenth measurement and swipe was repeated to provide a basis for comparison with the original measurement and thus assure that measurement program accuracy and repeatability was being maintained.

3.8 Records

All original survey data records and swipes have been archived at Manhattan College and will be held until such time as authorized by the NRC for disposal.

4.0 SURVEY FINDINGS AND RESULTS

4.1 Background Levels / MDA

Background average surface activity measurements are provided in Table 4-1 for both total (direct) and removable measurements. The MDA values provided in the table were calculated using the procedure in section 5.2 of NUREG/CR-5849. In each case the MDA is less than 25% of the guideline value for average levels (or 1250 dpm/100 cm^2 alpha and 1250 dpm/100 cm^2 beta).

4.2 Nuclear Engineering Facility Survey

4.2.1 Surface Activity Measurement

Tables 4-2 to 4-4 present the results of the final surface activity measurements in the 3 survey units. The measured counts and the corresponding converted effective activity are provided with the calculated uncertainties at the 95% confidence level. All individual measurement values were well within the average total residual contamination guidelines of 5000 dpm/100 cm^2 and removable contamination is well within 20% of the guidelines of 1000 dpm/ 100 cm^2. Many of the measurements were below the sensitivity levels of the procedures. There were no hot spots.

4.2.2 Exposure Rates

Exposure rates inside each of the survey units are provided in Tables 4-2 to 4-4. All individual readings do not exceed 5 ^{ur}/h above background, the guideline value.

4.3 Data Evaluation

Using the analytical approach in NUREG/CR-5849, a comparison of the average values for the activity and exposure rate measurement with the guidelines showed that the guidelines were satisfied at the 95% confidence level.

4.4 Quality Control

Original and duplicate measurements of the total and removable alpha and beta activity at every tenth location are provided in Table 4-5 to 4-7. The uncertainty (standard deviation) on the activity was calculated for the original and duplicate measurement. When the resultant bounding limits were determined for each pair of values (original and duplicate), all of the pairs for each parameter fell within the boundary limits (overlapped).

5.0 SUMMARY

Results of the final status survey of the three survey units in the Nuclear Engineering Facility demonstrate that the activity and exposure levels are within the NRC limits for unrestricted use. This will provide the basis for applying for license termination.

Manhattan College

NUMERICAL	ALPHABETICAL
1 · Memorial Hall	8 · Alumni Hall
2 · De La Salle Hall	32 · Birches Cottage
3 · Manhattan Hall	43 · Bluff Cottage
4 · Hayden Hall	40 · Broderick Hall
5 · Cardinal Hayes Library	5 · Cardinal Hayes Library
6 · Smith Auditorium/ Chapel of De La Salle and His Brothers	15 · Christian Brothers Center
7 · Chrysostom Hall	24 · Christian Brothers' Residence (1)
8 · Alumni Hall	25 · Christian Brothers' Residence (2)
9 · Draddy Gymnasium	39 · Christian Brothers' Residence (3)
0 · Jasper Hall	7 · Chrysostom Hall
1 · Thomas Hall (Student Center)	2 · De La Salle Hall
2 · Solomon House	44 · Donohue Hall
3 · Lavelle Hall (Alumni & College Relations Offices)	42 · Dowling Hall
4 · Sears Hall (Development Office)	9 · Draddy Gymnasium
5 · Christian Brothers Center	22 · Farrell Hall
0 · Paulian Hall	41 · Galway House
1 · Leo Engineering Building	28 · Granville Hall
2 · Farrell Hall	4 · Hayden Hall
3 · Neumann House	10 · Jasper Hall
4 · Christian Brothers' Residence (1)	13 · Lavelle Hall (Alumni & College Relations Offices)
5 · Christian Brothers' Residence (2)	21 · Leo Engineering Building
8 · Granville Hall	30 · Lloyd Hall
0 · Lloyd Hall	3 · Manhattan Hall
1 · Mundelein Hall	1 · Memorial Hall
2 · Birches Cottage	33 · Mitty Hall
3 · Mitty Hall	31 · Mundelein Hall
7 · St. Joseph's Hall	23 · Neumann House
8 · Rock Ledge	46 · Overlook Manor
9 · Christian Brothers' Residence (3)	20 · Paulian Hall
0 · Broderick Hall	38 · Rock Ledge
1 · Galway House	37 · St Joseph's Hall
2 · Dowling Hall	14 · Sears Hall (Development Office)
3 · Bluff Cottage	6 · Smith Auditorium/Chapel of De La Salle and His Brothers
4 · Donohue Hall	12 · Solomon House
5 · Sullivan Hall	45 · Sullivan Hall
6 · Overlook Manor	11 · Thomas Hall (Student Center)

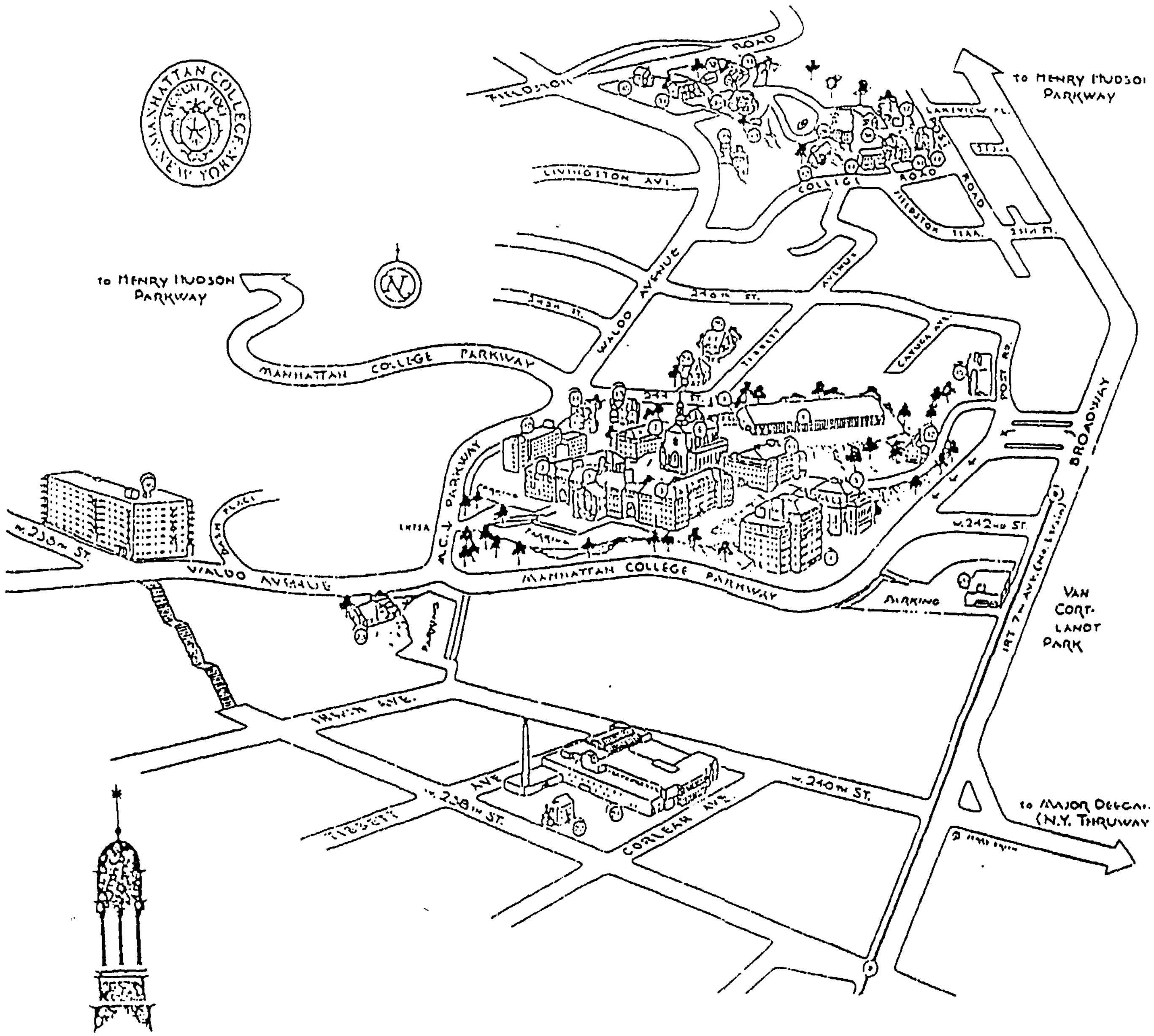


Figure 1-1. Plan of Manhattan College Campus

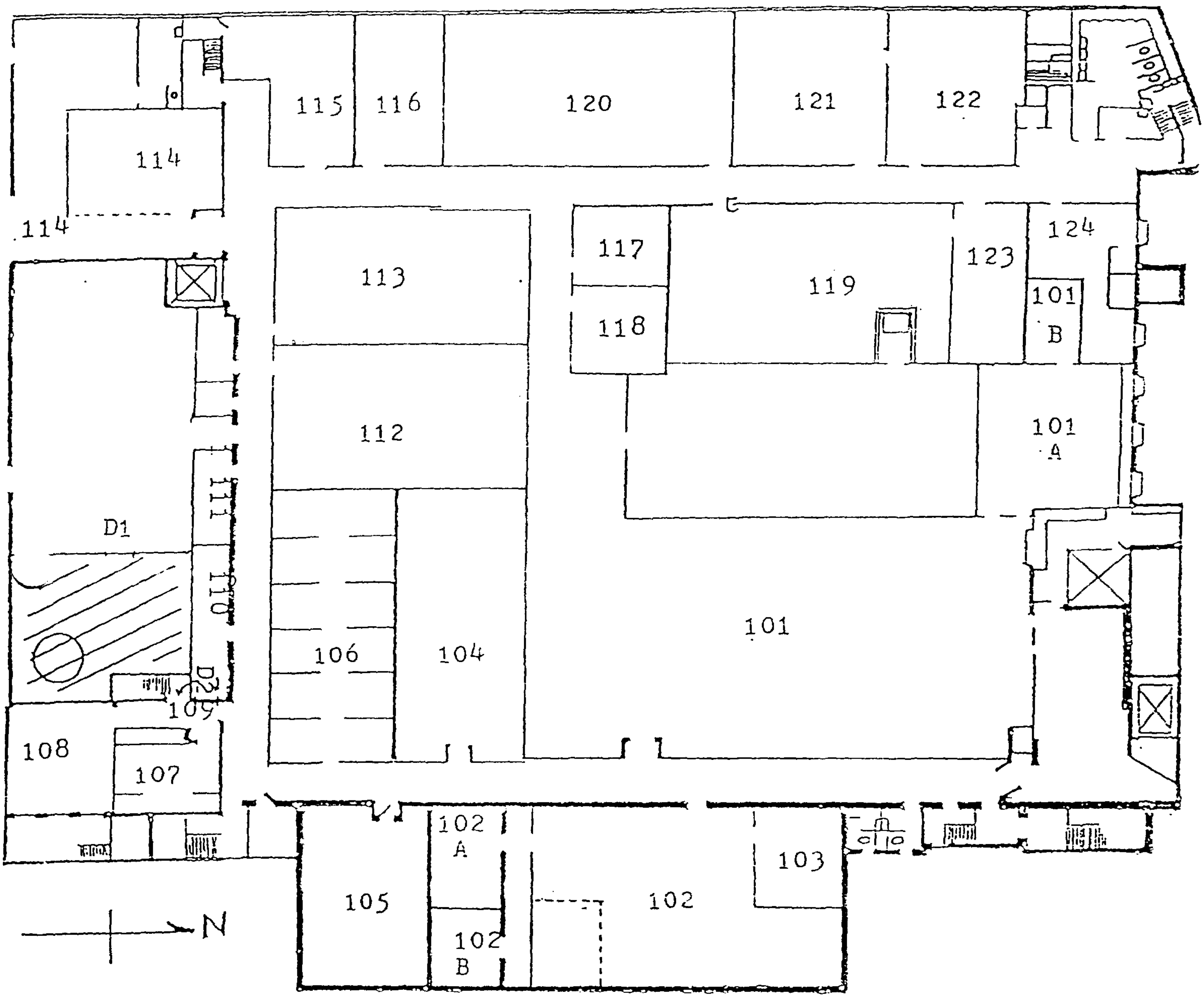


FIGURE 1-2

PLAN OF FIRST FLOOR OF THE LEO ENGINEERING BUILDING

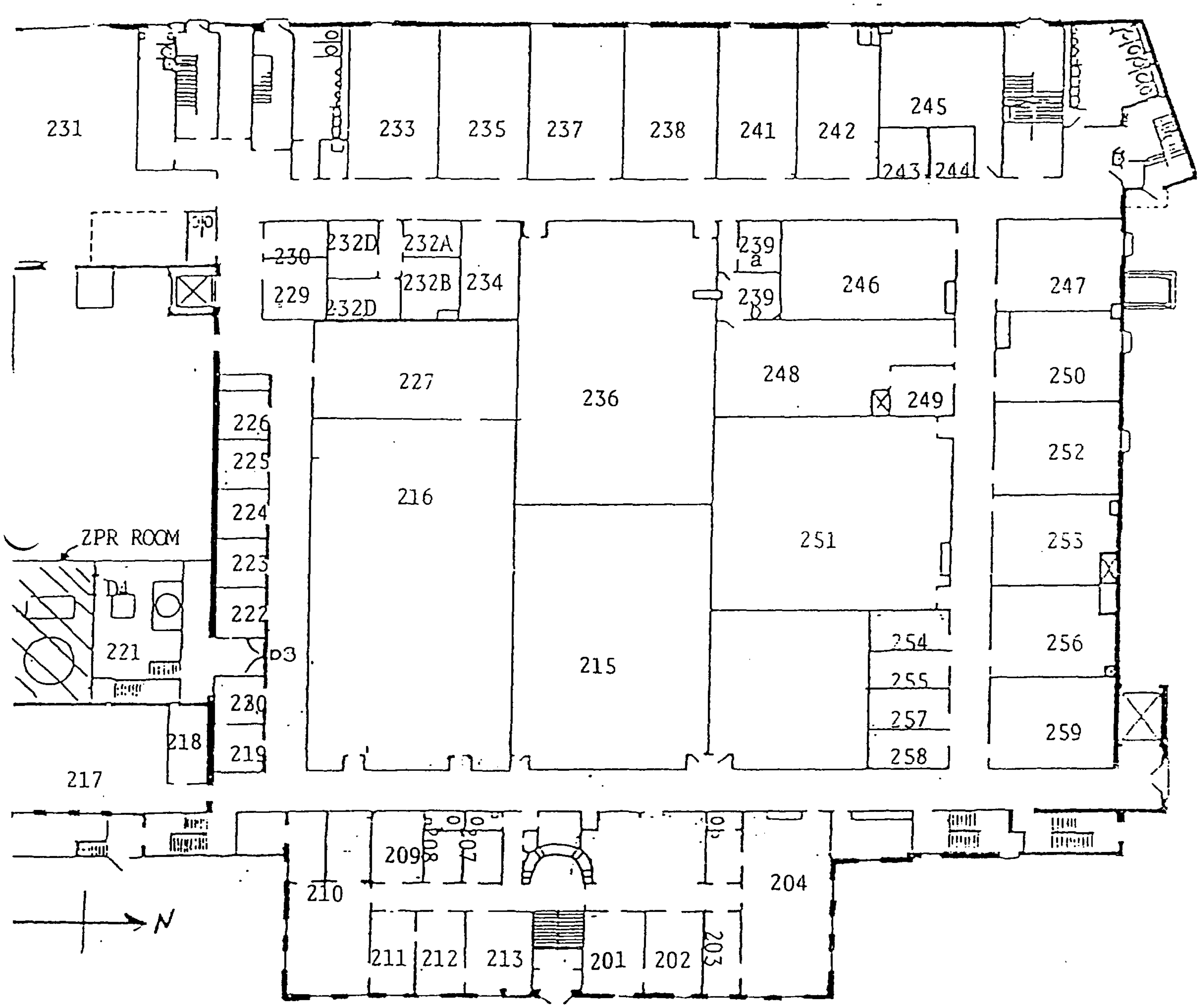
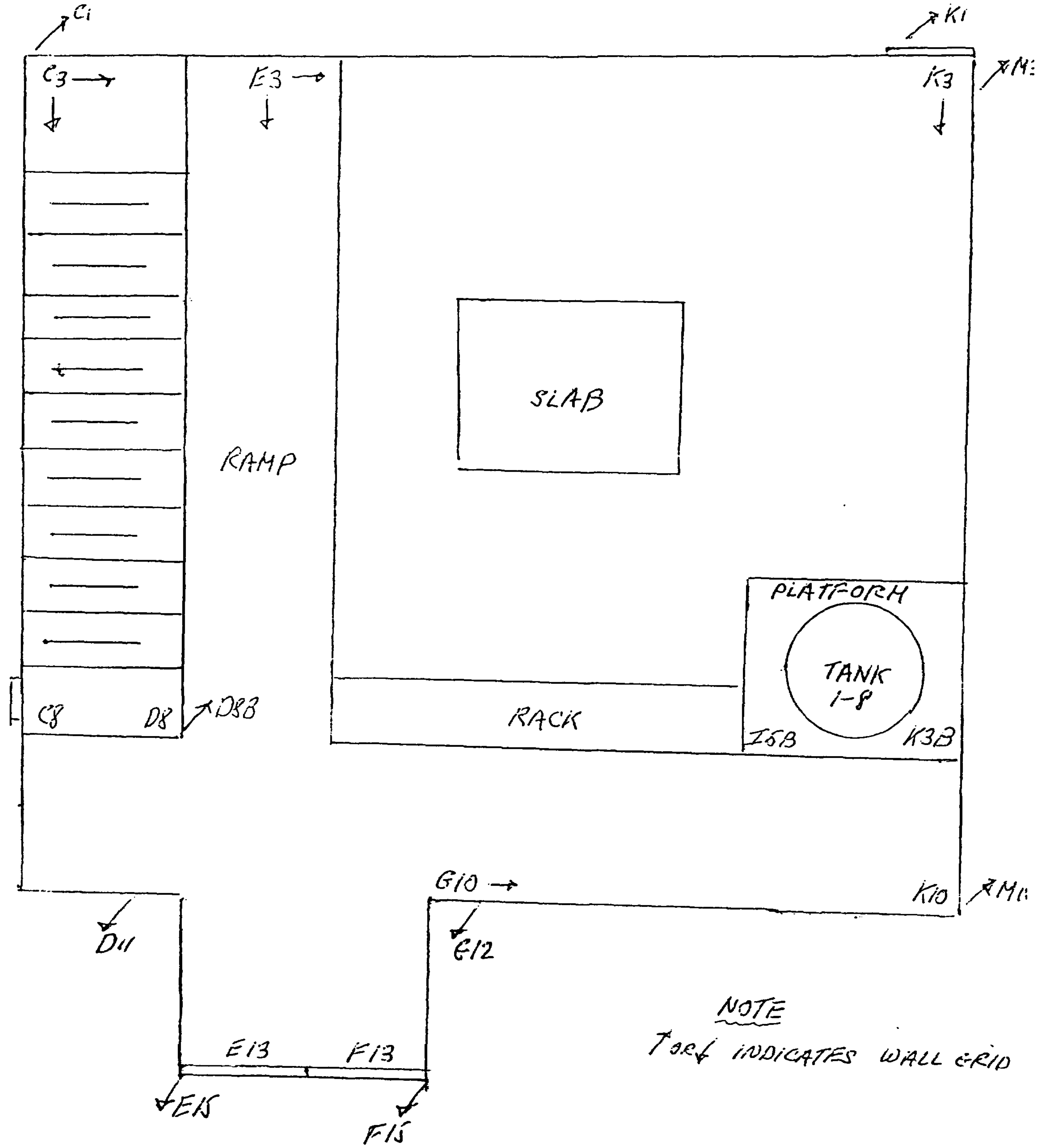


FIGURE 1-3
PLAN OF SECOND FLOOR OF THE LEO ENGINEERING BUILDING

FIGURE 3-1
SUB-CRITICAL REACTOR LAB



SURVEY UNIT 2
MCZPR LAB

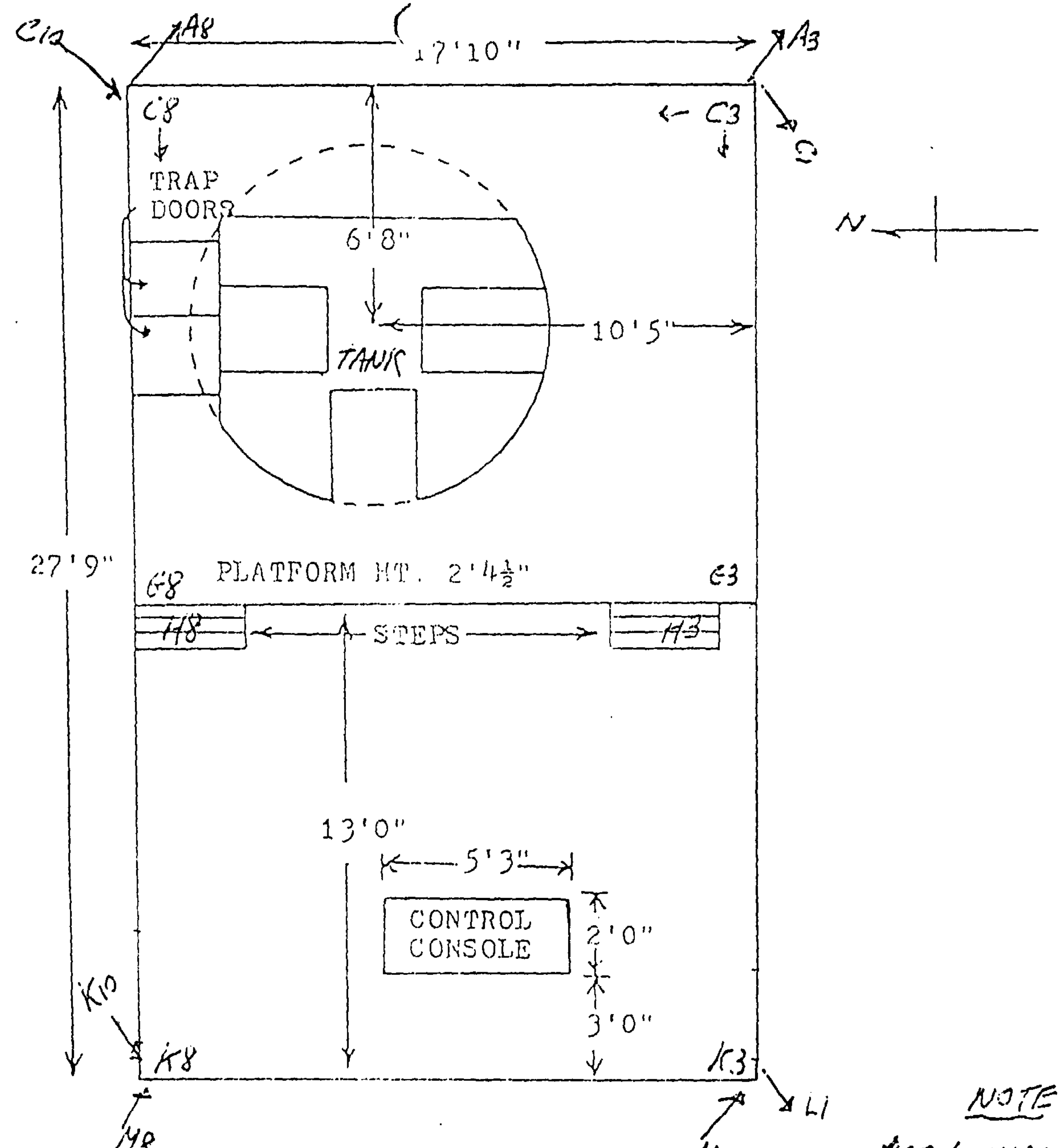


FIGURE 3-Z

NOTE
+ OR ↑ INDICATES WALL GRID

SURVEY UNIT 3
FUEL AND SOURCE STORAGE ROOM

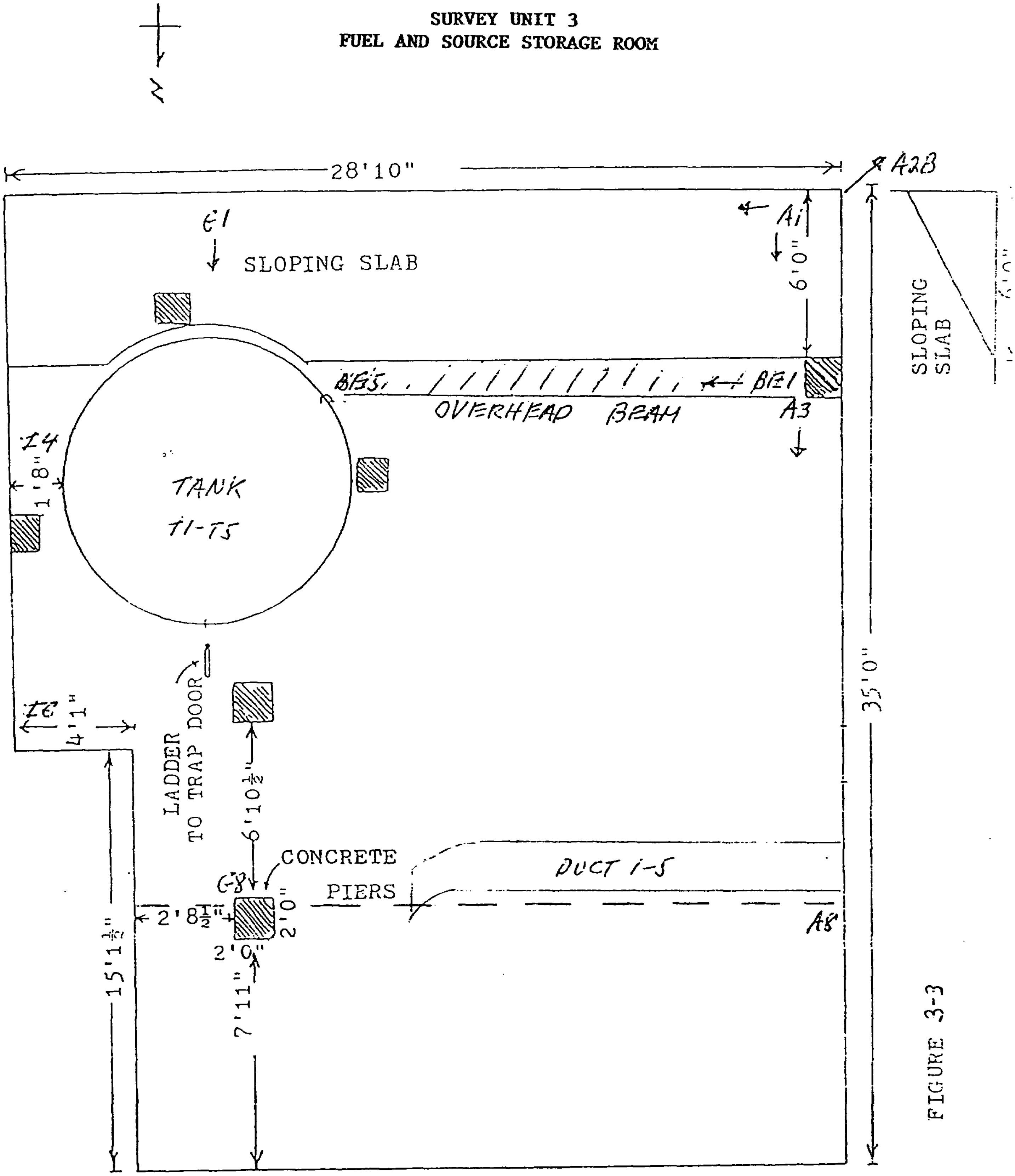


FIGURE 3-3

TABLE 3-1 RADIATION SURVEY INSTRUMENTS

INSTRUMENT DESCRIPTION	APPLICABILITY	DETECTION [1] EFFICIENCY (E)
Eberline ESP-2 "Smart Portable" in the Scalar mode with Eberline Alpha Scintillation Probe Model AC-3.	Alpha surface activity	0.38
Eberline ESP-2 in the Scalar Mode with Eberline Pancake GM probe Model HP-260	Beta-Gamma surface activity	0.39
Ludlum Model 1000 Scalar with Ludlum Model 43-10 Alpha Sample Counter	Alpha activity on Smears	—
Bicron Micro Rem Tissue Equivalent Survey Meter	Exposure Rates	—

[1] E measured in counts per disintegrations

TABLE 4-1

BACKGROUND MEASUREMENTS AND MDAs

	AVERAGE BACKGROUND ACTIVITY (dpm/100 cm^2)[1]				MDA (dpm/100cm^2)[7]			BACKGROUND[1] EXPOSURE RATE (μR/hr)
SURFACE	ALPHA		BETA-GAMMA		ALPHA	BETA-GAMMA		
	TOTAL	REMOVABLE	TOTAL	REMOVABLE	TOTAL	TOTAL	REMOVABLE	
Painted cinderblock wall and metal doors[2]	13/4[6]	0	562/116	546/116	48	493	487	6
Painted brick wall[3]	9/5	0	1390/152	546/116	37	750	487	8
Concrete floor and walls[4]	4/4	0	860/195	546/116	33	600	487	8,5
Painted metal wall[5]	13/4	0	562/116	546/116	48	493	487	5

NOTES

(1) Average of 8-10 readings. In each case the average level accurately represents the true background average to within ± 20% accuracy at the 95% confidence level using calculation approach in section 8.5.5 of NUREG/CR-5849.

(2) Measurements made in corridor of Leo Engineering Building

(3) Measurements made in Mechanical Engineering Laboratory

(4) Measurements made in stairwell and in corridor in machine shop except for exposure rate measurement of 5 ur/hr which was made in separate storage room adjoining the fuel storage area.

(5) Made in separate storage room adjoining the fuel storage area

(6) Values provided for alpha and beta-gamma background are activity / uncertainty

(7) MDAs calculated

TABLE 4-2			FINAL S.ATUS SURVEY					SURVEY U..IT 1			
GRID POINT	TOTAL ACTIVITY (dpm / 100 CM^2)(1) (3)						SMEAR #	REMOVABLE ACTIVITY (dpm/100 CM^2)			
	ALPHA		BETA		GAMMA IN uR/hr			ALPHA		BETA -GAMMA	
	COUNTS / M	ACT. / UNCERT(2)	COUNTS / M	ACT / UNCERT.	TOTAL	ABOVE bkg		COUNTS / M	ACT./ UNCERT.	COUNTS / M	ACT. / UNCERT.
FLOOR											
C_3	0	-4/8	37	-248/306	8	0	32	0	0/0	28	-66/251
D_3	3	9/17	50	-33/327	7	-1	31	0	0/0	38	99/271
E_3	0	-4/8	28	-397/290	6	-2	30	0	0/0	37	83/269
F_3	1	0/12	48	-66/324	7	-1	33	0	0/0	34	33/263
G_3	2	4/15	35	-281/302	6	-2	34	0	0/0	33	17/261
H_3	1	0/12	41	-182/313	5	-3	35	0	0/0	34	33/263
I_3	1	0/12	51	-17/329	6	-2	36	0	0/0	26	-99/247
J_3	1	0/12	33	-314/299	6	-2	37	0	0/0	24	-132/243
K_3	1	0/12	44	-132/318	7	-1	38	0	0/0	38	99/271
C_4	1	0/12	48	-66/324	6	-2	98	0	0/0	36	66/267
D_4	3	9/17	52	0/331	8	0	99	0	0/0	31	-17/257
E_4	1	0/12	37	-248/306	6	-2	29	0	0/0	22	-165/238
F_4	1	0/12	41	-182/313	6	-2	45	0	0/0	33	17/261
G_4	1	0/12	48	-66/324	7	-1	43	0	0/0	40	132/275
H_4	3	9/17	54	33/334	7	-1	44	0	0/0	22	-165/238
I_4	1	0/12	40	-198/311	7	-1	41	0	0/0	32	0/259
J_4	2	4/15	54	33/334	6	-2	40	0	0/0	29	50/253
K_4	0	-4/8	41	-182/313	7	-1	39	0	0/0	44	198/283
C_5	0	-4/8	71	314/360	9	1	1A	0	0/0	38	99/271
D_5	3	9/17	67	248/354	10	2	2A	0	0/0	34	33/263
E_5	1	0/12	33	-314/299	6	-2	28	0	0/0	37	83/269
F_5	0	-4/8	35	-281/302	5	-3	46	0	0/0	44	198/283
G_5	0	-4/8	32	-331/297	5	-3	47	0	0/0	28	-66/251
H_5	1	0/12	39	-215/309	6	-2	48	0	0/0	28	-66/251
I_{5A}	0	-4/8	37	-248/306	5	-3	49	0	0/0	30	-33/255
J_{5A}	0	-4/8	30	-364/294	5	-3	50	0	0/0	30	-33/255
K_{5A}	2	4/15	58	99/340	6	-2	51	0	0/0	30	-33/255
I_{5B}	0	-4/8	28	-397/290	5	-3	76	0	0/0	30	-33/255
J_{5B}	1	0/12	42	-165/314	6	-2	82	0	0/0	41	149/277
K_{5B}	0	-4/8	38	-232/308	5	-3	84	0	0/0	44	198/283

TABLE 4-2 CONTINUED				FINAL STATUS SURVEY					SURVEY UNIT 1		
GRID POINT	TOTAL ACTIVITY (dpm / 100 CM^2)[1][3]						SMEAR #	REMOVABLE ACTIVITY (dpm/100 CM^2)			
	ALPHA		BETA		GAMMA IN uR/hr			ALPHA		BETA -GAMMA	
	COUNTS / M	ACT. / UNCERT[2]	COUNTS / M	ACT / UNCERT.	TOTAL	ABOVE bkg		COUNTS / M	ACT./ UNCERT.	COUNTS / M	ACT. / UNCERT.
C_6	1	0/12	45	-116/319	13	5	3A	0	0/0	41	149/277
D_6	0	-4/8	63	182/348	13	5	4A	0	0/0	35	50/265
E_6	0	-4/8	36	-265/304	8	0	27	0	0/0	46	232/287
E_{6A}	1	0/12	39	-215/309	6	-2	56	0	0/0	39	116/273
F_6	1	0/12	37	-248/306	7	-1	57	0	0/0	31	-17/257
G_6	1	0/12	22	-498/279	7	-1	58	0	0/0	19	-215/232
H_6	0	-4/8	23	-480/281	5	-3	59	0	0/0	44	198/283
I_{6A}	0	-4/8	42	-165/314	9	1	60	0	0/0	32	0/259
J_6	0	-4/8	37	-248/306	8	0	83	0	0/0	28	-66/251
K_{6A}	0	-4/8	40	-198/311	7	-1	52	0	0/0	28	-66/251
I_{6B}	1	0/12	34	-298/301	6	-2	77	0	0/0	33	17/261
K_{6B}	2	4/15	42	-165/314	6	-2	85	0	0/0	36	66/267
C_7	0	-4/8	48	-66/324	13	5	5A	0	0/0	42	165/279
D_7	3	9/17	61	149/345	12	5	6A	0	0/0	20	-198/234
E_{7A}	1	0/12	31	-347/295	5	-3	65	0	0/0	30	-33/255
C_8	1	0/12	46	-99/321	9	1	7A	0	0/0	26	-99/247
D_8	1	0/12	41	-182/313	9	1	8A	0	0/0	39	116/273
E_{8A}	0	-4/8	43	-149/316	6	-2	66	0	0/0	28	-66/251
F_{8A}	0	-4/8	31	-347/295	7	-1	69	0	0/0	32	0/259
G_{8A}	3	9/17	37	-248/306	6	-2	71	0	0/0	34	33/263
H_{8A}	1	0/12	36	-265/304	7	-1	73	0	0/0	30	-33/255
I_{8A}	2	4/15	17	-579/269	6	-2	75	0	0/0	28	-66/251
J_{8A}	0	-4/8	40	-198/311	7	-1	1D	0	0/0	32	0/259
K_{8A}	2	4/15	44	-132/318	6	-2	54	0	0/0	45	215/285
F_{8B}	1	0/12	42	-165/314	7	-1	68	0	0/0	35	50/265
G_{8B}	0	-4/8	44	-132/318	6	-2	70	0	0/0	26	-99/247
H_{8B}	2	4/15	37	-248/306	7	-1	72	0	0/0	36	66/267
I_{8B}	3	9/17	42	-165/314	8	0	74	0	0/0	27	-83/249
I_{8C}	3	9/17	43	-149/316	6	-2	81	0	0/0	38	99/271
J_8	1	0/12	33	-314/299	6	-2	88	0	0/0	35	50/265
D_9	0	-4/8	39	-215/309	9	1	10	0	0/0	38	99/271

TABLE 4-2 CONTINUED			FINAL STATUS SURVEY					SURVEY UNIT 1			
GRID POINT	TOTAL ACTIVITY (dpm / 100 CM^2)(1) (3)						SMEAR #	REMOVABLE ACTIVITY (dpm/100 CM^2)			
	ALPHA		BETA		GAMMA IN uR/hr			ALPHA		BETA -GAMMA	
	COUNTS / M	ACT. / UNCERT(2)	COUNTS / M	ACT / UNCERT.	TOTAL	ABOVE bkg		COUNTS / M	ACT./ UNCERT.	COUNTS / M	ACT. / UNCERT.
E_9	0	-4/8	40	-198/311	9	1	12	0	0/0	38	99/271
F_9	2	4/15	40	-198/311	8	0	13	0	0/0	40	165/275
G_9	1	0/12	48	-66/324	8	0	14	0	0/0	31	-17/257
H_9	2	4/15	46	-99/321	8	0	15	0	0/0	34	33/263
I_9	0	-4/8	44	-132/318	6	-2	16	0	0/0	28	-66/251
J_9	0	-4/8	38	-232/308	8	0	17	0	0/0	29	-50/253
K_9	1	0/12	37	-248/306	7	-1	18	0	0/0	27	-83/249
D_{10}	1	0/12	49	-50/326	8	0	9	0	0/0	31	-17/257
E_{10}	0	-4/8	35	-281/302	7	-1	8	0	0/0	26	-99/247
F_{10}	0	-4/8	49	-50/326	8	0	7	0	0/0	28	-66/251
G_{10}	0	-4/8	45	-116/319	8	0	24	0	0/0	42	-99/247
H_{10}	3	9/17	47	-83/324	9	1	23	0	0/0	35	50/265
I_{10}	0	-4/8	54	33/334	9	1	21	0	0/0	40	165/275
J_{10}	1	0/12	43	-149/316	9	1	20	0	0/0	44	198/283
K_{10}	1	0/12	55	50/336	9	1	19	0	0/0	28	-66/251
E_{11}	0	-4/8	40	-198/311	5	-3	5	0	0/0	31	-17/257
F_{11}	0	-4/8	50	-33/327	9	1	6	0	0/0	25	-116/245
E_{12}	1	0/12	43	-149/316	8	0	4	0	0/0	29	-50/253
F_{12}	0	-4/8	40	-198/311	7	-1	3	0	0/0	45	215/285
E_{13}	1	0/12	42	-165/314	6	-2	1	0	0/0	26	-99/247
F_{13}	0	-4/8	42	-165/314	6	-2	2	0	0/0	28	-66/251
TANK											
1	1	0/12	28	-99/255	7	-1	89	0	0/0	37	83/269
2	0	-4/8	32	-33/263	6	-2	91	0	0/0	30	-33/255
3	3	9/17	33	-17/265	7	-1	92	0	0/0	20	-198/234
4	1	0/12	33	-17/265	7	-1	93	0	0/0	34	33/263
5	2	4/15	40	99/279	7	-1	94	0	0/0	20	-198/234
6	1	0/12	30	-66/259	6	-2	95	0	0/0	19	-215/232
7	2	4/15	38	66/275	5	-3	96	0	0/0	29	-50/253
8	2	4/15	34	0/267	7	-1	97	0	0/0	42	165/279
WALLS											
C1	4	4/23	48	232/294	9	3	30A	0	0/0	28	-66/251
D1	1	-9/17	37	50/273	9	3	29A	0	0/0	28	-66/251

TABLE 4-2 CONTINUED — FINAL STATUS SURVEY — SURVEY UNIT 1

GRID POINT	TOTAL ACTIVITY (dpm / 100 CM^2)[(1)(3)]						SMEAR #	REMOVABLE ACTIVITY (dpm/100 CM^2)			
	ALPHA		BETA		GAMMA IN uR/hr			ALPHA		BETA -GAMMA	
	COUNTS / M	ACT. / UNCERT[(2)]	COUNTS / M	ACT / UNCERT.	TOTAL	ABOVE bkg		COUNTS / M	ACT./ UNCERT.	COUNTS / M	ACT. / UNCERT.
E_1	2	-4/20	48	232/294	8	2	34A	0	0/0	25	-116/245
F_1	0	-13/15	29	-66/257	7	1	36A	0	0/0	27	-83/249
G_1	2	-4/20	42	132/283	7	1	38A	0	0/0	32	0/259
H_1	2	-4/20	36	33/271	7	1	40A	0	0/0	26	-99/247
I_1	3	0/21	30	-66/259	6	0	42A	0	0/0	30	-33/255
J_1	3	0/21	46	198/290	6	0	45A	0	0/0	32	0/259
**K_1	3	0/20	26	-132/251	7	1	47A	0	0/0	33	17/261
C_2	3	0/21	36	33/271	8	2	31A	0	0/0	28	-66/251
D_2	2	-4/20	36	33/271	7	1	32A	0	0/0	30	-33/255
E_2	2	-4/20	27	-116/253	7	1	35A	0	0/0	27	-83/249
F_2	3	0/20	29	-83/257	8	2	37A	0	0/0	24	-132/243
G_2	3	0/21	36	33/271	5	-1	39A	0	0/0	28	-66/251
H_2	1	-9/17	24	-165/247	7	1	41A	0	0/0	32	0/259
I_2	5	9/25	29	-83/257	6	0	43A	0	0/0	25	-116/245
J_2	3	0/21	28	-99/255	7	1	46A	0	0/0	39	116/273
**K_2	3	0/21	28	-99/255	8	2	48A	0	0/0	36	66/267
A_3	5	19/23	95	198/434	10	2	28A	0	0/0	32	0/259
B_3	2	-4/20	34	0/267	9	3	27A	0	0/0	41	149/277
L_3	5	9/25	28	-99/255	5	-1	50A	0	0/0	30	-33/255
M_3	2	-4/20	30	-66/259	5	-1	49A	0	0/0	32	0/259
*A_4	3	4/20	93	149/431	9	1	26A	0	0/0	36	66/267
B_4	1	-9/17	49	248/296	7	1	25A	0	0/0	32	0/259
A_5	2	-4/20	38	66/275	8	2	24A	0	0/0	36	66/267
B_5	2	-4/20	43	149/285	8	2	18A	0	0/0	28	-66/251
D_{5A}	4	4/23	40	99/279	8	2	23A	0	0/0	40	132/275
L_5	3	0/21	32	-33/263	5	-1	54A	0	0/0	36	66/267
M_5	2	-4/20	33	-17/265	6	0	53A	0	0/0	29	-50/253
B_6	2	-4/20	33	-17/265	9	3	17A	0	0/0	22	-165/238
A_6	5	9/23	41	116/281	7	1	1C	0	0/0	32	0/259
D_{6A}	0	-13/15	49	248/296	10	4	21A	0	0/0	48	265/291

TABLE 4-2 CONTINUED — FINAL STATUS SURVEY — SURVEY UNIT 1

GRID POINT	TOTAL ACTIVITY (dpm / 100 CM^2)(1) (3)						SMEAR #	REMOVABLE ACTIVITY (dpm/100 CM^2)			
	ALPHA		BETA		GAMMA IN uR/hr			ALPHA		BETA -GAMMA	
	COUNTS / M	ACT. / UNCERT(2)	COUNTS / M	ACT / UNCERT.	TOTAL	ABOVE bkg		COUNTS / M	ACT./ UNCERT.	COUNTS / M	ACT. / UNCERT.
D_{6B}	2	-4/20	40	99/279	8	2	22A	0	0/0	30	-33/255
L_6	5	9/25	34	0/267	4	-2	56A	0	0/0	20	-198/234
M_6	2	-4/20	39	83/277	5	-1	55A	0	0/0	32	0/259
D_{7A}	3	0/21	40	99/279	11	5	19A	0	0/0	38	99/271
D_{7B}	5	9/25	53	314/302	9	3	20A	0	0/0	38	99/271
L_7	2	-4/20	20	-232/238	5	-1	59A	0	0/0	28	-66/251
M_7	2	-4/20	32	-33/263	6	0	58A	0	0/0	30	-33/255
D_{8A}	4	4/23	55	347/304	9	3	15A	0	0/0	26	-99/247
D_{8B}	1	-9/17	37	50/273	7	1	16A	0	0/0	40	132/275
L_8	2	-4/20	29	-83/257	6	0	61A	0	0/0	31	-17/257
M_8	3	0/21	39	83/277	7	1	60A	0	0/0	34	33/263
*A_9	2	0/17	79	-83/414	11	3	100A	0	0/0	30	-33/255
C_9	1	-9/17	51	281/300	7	1	10A	0	0/0	30	-33/255
D_9	2	-4/20	44	165/287	7	1	13A	0	0/0	36	66/267
L_9	4	4/23	41	116/281	7	1	63A	0	0/0	30	-33/255
M_9	4	4/23	38	66/275	7	1	62A	0	0/0	24	-132/243
*B_{10}	2	-4/20	81	99/416	10	4	98A	0	0/0	28	-66/251
*C_{10}	2	0/17	62	-198/392	12	4	12A	0	0/0	37	83/269
D_{10}	0	-13/15	43	182/285	6	0	14A	0	0/0	30	-33/255
L_{10}	2	-4/20	59	413/313	9	3	65A	0	0/0	40	132/275
M_{10}	3	0/21	43	149/285	9	3	64A	0	0/0	42	165/279
C_{11}	1	-9/17	44	165/287	8	2	95A	0	0/0	42	165/279
D_{11}	2	-4/20	35	17/269	9	3	96A	0	0/0	24	-132/243
**E_{11A}	0	-9/17	39	83/277	6	0	93A	0	0/0	32	0/259
**E_{11B}	2	-4/20	35	17/269	7	1	94A	0	0/0	40	132/275
F_{11A}	3	0/21	34	0/267	7	1	78A	0	0/0	29	-50/253
F_{11B}	1	-9/17	48	232/294	7	1	79A	0	0/0	26	-99/247
*G_{11}	0	-9/12	104	331/445	10	2	75A	0	0/0	26	-99/247
*H_{11}	1	-4/15	70	-232/402	11	3	73A	0	0/0	29	-50/253
*I_{11}	4	9/21	110	430/452	11	3	71A	0	0/0	37	83/269
*J_{11}	2	0/17	74	-165/408	11	3	69A	0	0/0	24	-132/243

TABLE 4-2 CONTINUED — FINAL STATUS SURVEY — SURVEY UNIT 1

GRID POINT	TOTAL ACTIVITY (dpm / 100 CM²)(1)(3)						SMEAR #	REMOVABLE ACTIVITY (dpm/100 CM²)			
	ALPHA		BETA		GAMMA IN uR/hr			ALPHA		BETA -GAMMA	
	COUNTS / M	ACT. / UNCERT(2)	COUNTS / M	ACT / UNCERT.	TOTAL	ABOVE bkg		COUNTS / M	ACT./ UNCERT.	COUNTS / M	ACT. / UNCERT.
*K_{11}	4	9/21	80	-66/415	13	5	67A	0	0/0	29	-50/253
E_{12A}	1	-9/17	39	83/277	4	-2	91A	0	0/0	28	-66/251
E_{12B}	4	4/23	42	132/283	5	-1	92A	0	0/0	33	17/261
F_{12A}	4	4/23	40	99/279	6	0	80A	0	0/0	32	0/259
F_{12B}	2	-4/20	30	-66/259	6	0	81A	0	0/0	46	232/287
*G_{12}	0	-9/12	87	50/424	12	4	76A	0	0/0	28	-66/251
*H_{12}	2	0/17	73	-182/407	13	5	74A	0	0/0	32	0/259
*I_{12}	2	0/17	90	99/428	12	4	72A	0	0/0	26	-99/247
*J_{12}	3	4/20	69	-248/401	12	4	70A	0	0/0	32	0/259
*K_{12}	2	0/17	101	-281/441	12	4	68A	0	0/0	32	0/259
E_{13A}	1	-9/17	41	116/281	6	0	89A	0	0/0	28	-66/251
E_{13B}	1	-9/17	40	99/279	7	1	90A	0	0/0	26	-99/247
**E_{14}	2	-4/20	40	99/279	7	1	86A	0	0/0	36	66/267
F_{15}	1	-9/17	29	-83/257	7	1	84A	0	0/0	30	-33/255
**E_{15}	0	-9/17	40	99/279	9	3	88A	0	0/0	32	0/259
F_{15}	3	0/21	34	0/267	7	1	85A	0	0/0	40	132/275
**DOWN-STAIRS	4	4/23	40	99/279	7	1	1D			36	66/267

* Painted brick walls (all others cinder block)

** Painted metal doors

(1) Columns containing values in dpm/100cm² are reported with background subtracted

(2) Uncertainties are caclulated at the 95% confidence level (1.96x standard deviation)

(3) See Table 4-1 for background values (B) used and calculated M.D.A.S.

(4) See Table 3-1 for detection efficiencies (E) of instruments

TABLE 4-3 FINAL STATUS SURVEY SURVEY UNIT 2

GRID POINT	TOTAL ACTIVITY (dpm / 100 CM²)(1) (3)						SMEAR #	REMOVABLE ACTIVITY (dpm/100 CM²)			
	ALPHA		BETA		GAMMA IN uR/hr			ALPHA		BETA -GAMMA	
	COUNTS / M	ACT. / UNCERT(2)	COUNTS / M	ACT / UNCERT.	TOTAL	ABOVE bkg		COUNTS / M	ACT./ UNCERT.	COUNTS / M	ACT. / UNCERT.
CONCRETE FLOOR											
H_3	2	4/15	44	-132/318	7	-1	27	0	0/0	36	66/267
H_4	2	4/15	43	-149/316	5	-3	26	0	0/0	34	33/263
H_5	2	4/15	47	-83/324	6	-2	25	0	0/0	30	-33/255
H_6	0	-4/8	48	-66/324	5	-3	23	0	0/0	34	33/263
H_7	1	0/12	32	-331/297	5	-3	22	0	0/0	38	99/271
H_8	2	4/15	32	-331/297	8	0	21	0	0/0	33	17/261
I_3	3	9/17	40	-198/311	6	-2	15	0	0/0	26	-99/247
I_4	2	4/15	34	-298/301	6	-2	16	0	0/0	30	-33/255
I_5	2	4/15	48	-66/324	5	-3	17	0	0/0	40	132/275
I_6	2	4/15	42	-165/314	7	-1	18	0	0/0	43	182/281
I_7	2	4/15	46	-99/321	7	-1	19	0	0/0	39	116/273
I_8	1	0/12	45	-116/319	6	-2	20	0	0/0	28	-66/251
J_3	1	0/12	61	149/345	6	-2	14	0	0/0	21	-182/236
J_4	2	4/15	50	-33/327	7	-1	12	0	0/0	38	99/271
J_5	0	-4/8	46	-99/321	5	-3	11	0	0/0	30	-33/255
J_6	3	9/17	45	-116/319	6	-2	10	0	0/0	32	0/259
J_7	0	-4/8	51	-17/329	7	-1	9	0	0/0	28	-66/251
J_8	1	0/12	35	-281/302	7	-1	8	0	0/0	34	33/263
K_3	1	0/12	53	17/332	5	-3	2	0	0/0	30	-33/255
K_4	0	-4/8	54	33/334	6	-2	3	0	0/0	26	-99/247
K_5	0	-4/8	38	-232/308	6	-2	4	0	0/0	31	-17/257
K_6	0	-4/8	31	-347/295	7	-1	5	0	0/0	36	66/267
K_7	0	-4/8	42	-165/314	6	-2	6	0	0/0	42	165/279
K_8	0	-4/8	47	-83/324	7	-1	7	0	0/0	32	0/259
METAL PLATFORM											
C_3	2	4/15	41	-182/313	10	2	52	0	0/0	24	-132/243
C_4	2	4/15	54	33/334	10	2	53	0	0/0	50	298/295
C_5	6	22/23	46	-99/321	8	0	54	0	0/0	32	0/259
C_6	4	13/20	45	-116/319	9	1	55	0	0/0	28	-66/251
C_7	2	4/15	34	-298/301	7	-1	56	0	0/0	36	66/267

TABLE 4-3 CONTINUED — FINAL STATUS SURVEY — SURVEY UNIT 2

GRID POINT	TOTAL ACTIVITY (dpm / 100 CM^2)[(1)(3)] ALPHA COUNTS / M	ALPHA ACT. / UNCERT[(2)]	BETA COUNTS / M	BETA ACT / UNCERT.	GAMMA IN uR/hr TOTAL	GAMMA IN uR/hr ABOVE bkg	SMEAR #	REMOVABLE ACTIVITY (dpm/100 CM^2) ALPHA COUNTS / M	ALPHA ACT./ UNCERT.	BETA -GAMMA COUNTS / M	BETA -GAMMA ACT. / UNCERT.
C_8	2	4/15	43	-149/316	9	1	58	0	0/0	22	-165/238
D_3	1	0/12	36	-265/304	9	1	51	0	0/0	39	116/273
D_4	2	4/15	49	-50/326	9	1	50	0	0/0	26	-99/247
D_5	1	0/12	35	-281/302	9	1	49	0	0/0	28	-66/251
D_6	2	4/15	44	-116/318	9	1	48	0	0/0	32	0/259
D_7	2	4/15	35	-281/302	9	1	46	0	0/0	35	50/265
D_8	2	4/15	37	-248/306	6	-2	45	0	0/0	30	-33/255
E_3	2	4/15	43	-149/316	8	0	40	0	0/0	32	0/259
E_4	0	-4/8	44	-132/318	8	0	41	0	0/0	26	-99/247
E_5	2	4/15	54	33/334	8	0	42	0	0/0	34	33/263
E_7	3	9/17	44	-132/318	8	0	43	0	0/0	40	132/275
E_8	2	4/15	32	-331/297	7	-1	44	0	0/0	35	50/265
F_3	1	0/12	38	-232/308	7	-1	39	0	0/0	30	-33/255
F_4	1	0/12	50	-33/327	8	0	38	0	0/0	36	66/267
F_6	2	4/15	41	-182/313	10	2	37	0	0/0	44	198/283
F_8	1	0/12	33	-314/299	8	0	34	0	0/0	28	-66/251
G_3	1	0/12	29	-380/292	6	-2	28	0	0/0	40	132/275
G_4	3	9/17	44	-132/318	8	0	29	0	0/0	32	0/259
G_5	2	4/15	37	-248/306	8	0	30	0	0/0	24	-132/243
G_6	2	4/15	38	-232/308	9	1	31	0	0/0	28	-66/251
G_7	1	0/12	20	-529/277	8	0	32	0	0/0	37	83/269
G_8	4	13/20	22	-496/279	7	-1	33	0	0/0	41	149/277
WALL											
*A_3	1	-4/15	83	-17/419	11	3	2A	0	0/0	29	-50/253
*A_4	1	-4/15	92	132/430	13	5	100	0	0/0	32	0/259
*A_5	2	0/17	82	-33/418	13	5	98	0	0/0	36	66/267
*A_6	4	9/21	80	-66/415	12	4	96	0	0/0	44	198/283
*A_7	4	9/21	83	-17/419	12	4	94	0	0/0	40	132/275
*A_8	6	18/25	80	-66/415	11	3	92	0	0/0	32	0/259
B_3	4	4/23	35	17/269	11	3	3A	0	0/0	37	83/269
B_4	2	-4/20	39	83/277	13	5	1A	0	0/0	26	-99/247

TABLE 4-3 CONTINUED — FINAL STATUS SURVEY — SURVEY UNIT 2

GRID POINT	TOTAL ACTIVITY (dpm / 100 CM^2)(1) (3)						SMEAR #	REMOVABLE ACTIVITY (dpm/100 CM^2)			
	ALPHA		BETA		GAMMA IN uR/hr			ALPHA		BETA -GAMMA	
	COUNTS / M	ACT. / UNCERT.(2)	COUNTS / M	ACT / UNCERT.	TOTAL	ABOVE bkg		COUNTS / M	ACT./ UNCERT.	COUNTS / M	ACT. / UNCERT.
B_5	1	-9/17	39	83/277	12	4	99	0	0/0	32	0/259
B_6	1	-9/17	40	99/279	13	5	97	0	0/0	18	-232/230
B_7	2	-4/20	36	33/271	11	3	95	0	0/0	21	-182/236
B_8	1	-9/17	41	116/281	11	3	36A	0	0/0	34	33/263
C_1	3	0/21	51	281/300	11	5	4A	0	0/0	36	66/267
C_2	1	-9/17	36	33/271	7	1	5A	0	0/0	39	116/273
C_9	4	4/23	34	0/267	10	4	89	0	0/0	28	-66/251
C_{10}	3	0/21	46	198/290	12	5	91	0	0/0	24	-132/243
D_1	0	-13/15	50	265/298	7	1	6A	0	0/0	24	-132/243
D_2	2	-4/20	46	198/290	8	2	7A	0	0/0		66/287
D_9	4	4/23	42	132/283	7	1	87	0	0/0	42	165/279
D_{10}	2	-4/20	40	99/279	8	2	88	0	0/0	30	-33/255
E_1	3	0/21	42	132/283	8	2	8A	0	0/0	34	33/263
E_2	1	-9/17	37	50/273	8	2	9A	0	0/0	22	-165/238
E_9	3	0/21	36	33/271	9	3	85	0	0/0	24	-132/243
E_{10}	1	-9/17	44	165/287	8	2	86	0	0/0	22	-165/238
F_1	2	-4/20	38	66/275	7	1	10A	0	0/0	32	0/259
F_2	2	-4/20	34	0/267	6	0	12A	0	0/0	40	132/275
F_9	4	4/23	46	198/290	10	4	83	0	0/0	34	33/263
F_{10}	2	-4/20	34	0/267	9	3	84	0	0/0	26	-99/247
G_1	1	-9/17	32	-33/263	7	1	13A	0	0/0	36	66/267
G_2	0	-13/15	39	83/277	7	1	14A	0	0/0	38	99/271
G_9	1	-9/17	29	-83/257	11	5	81	0	0/0	41	149/277
G_{10}	2	-4/20	40	99/279	10	4	82	0	0/0	32	0/259
H_1	1	-9/17	34	0/267	6	0	15A	0	0/0	30	-33/255
H_2	3	0/21	46	198/290	6	0	16A	0	0/0	22	-165/238
H_9	2	-4/20	41	116/281	8	2	78	0	0/0	32	0/259
H_{10}	3	0/21	31	-50/261	9	3	80	0	0/0	35	50/265
I_1	2	-4/20	46	198/290	7	1	17A	0	0/0	36	66/267
I_2	2	-4/20	50	265/298	8	2	18A	0	0/0	38	99/271
I_9	0	-13/15	33	-17/265	9	3	76	0	0/0	30	-33/255

TABLE 4-3 CONTINUED				FINAL STATUS SURVEY					SURVEY UNIT 2		
GRID POINT	TOTAL ACTIVITY (dpm / 100 CM^2)(1) (3)						SMEAR #	REMOVABLE ACTIVITY (dpm/100 CM^2)			
	ALPHA		BETA		GAMMA IN uR/hr			ALPHA		BETA -GAMMA	
	COUNTS / M	ACT. / UNCERT(2)	COUNTS / M	ACT / UNCERT.	TOTAL	ABOVE bkg		COUNTS / M	ACT./ UNCERT.	COUNTS / M	ACT. / UNCERT.
I_{10}	3	0/21	38	66/275	9	3	77	0	0/0	32	0/259
*J_1	4	9/21	70	-232/402	9	1	19A	0	0/0	28	-66/251
J_2	2	-4/20	36	33/271	6	0	20A	0	0/0	26	-99/247
J_9	1	-9/17	36	33/271	9	3	74	0	0/0	40	132/275
J_{10}	0	-13/15	40	99/279	8	2	75	0	0/0	30	-33/255
K_1	6	13/25	46	198/290	7	1	21A	0	0/0	44	198/283
K_2	1	-9/17	52	298/300	6	0	23A	0	0/0	22	-165/238
**K_9	3	0/21	26	-132/251	7	1	72	0	0/0	44	198/283
**K_{10}	2	-4/20	44	165/287	10	4	73	0	0/0	21	-182/236
L_1	3	0/21	44	165/287	6	0	24A	0	0/0	36	66/267
L_2	1	-9/17	40	99/279	6	0	25A	0	0/0	38	99/271
L_3	6	13/25	31	-50/261	7	1	59	0	0/0	46	232/287
L_4	4	4/23	36	33/271	5	-1	61	0	0/0	34	33/263
L_5	3	0/21	36	33/271	6	0	63	0	0/0	30	-33/255
L_6	3	0/21	37	50/273	6	0	65	0	0/0	24	-132/243
L_7	4	4/23	26	-132/251	7	1	67	0	0/0	20	-198/234
L_8	1	-9/17	32	-33/263	10	4	70	0	0/0	28	-66/251
M_3	2	-4/20	44	165/287	7	1	60	0	0/0	48	265/291
M_4	2	-4/20	36	33/271	7	1	62	0	0/0	22	-165/238
M_5	2	-4/20	32	-33/263	7	1	64	0	0/0	27	-83/249
M_6	4	-4/23	31	-50/261	7	1	66	0	0/0	28	-66/251
M_7	2	-4/20	39	83/277	8	2	69	0	0/0	34	33/263
M_8	2	-4/20	32	-33/263	9	3	71	0	0/0	25	-116/245
REACTOR TANK INTERIOR											
BASE-PLATE CORNER	1	-9/17	29	-83/257	6	0	26A	0	0/0	24	-132/243
BASE-PLATE CENTER	1	-9/17	16	-298/229	5	-1	27A	0	0/0	24	-132/243
BOTTOM 4	1	-9/17	30	-66/259	6	0	31A	0	0/0	38	99/271

TABLE 4-3 CONTINUED				FINAL STATUS SURVEY						SURVEY UNIT 2	
GRID POINT	TOTAL ACTIVITY (dpm / 100 CM^2)(1) (3)						SMEAR #	REMOVABLE ACTIVITY (dpm/100 CM^2)			
	ALPHA		BETA		GAMMA IN uR/hr			ALPHA		BETA -GAMMA	
	COUNTS / M	ACT. / UNCERT(2)	COUNTS / M	ACT / UNCERT.	TOTAL	ABOVE bkg		COUNTS / M	ACT./ UNCERT.	COUNTS / M	ACT. / UNCERT.
BOTTOM 5	2	-4/20	24	-165/247	6	0	28A	0	0/0	30	-33/255
BOTTOM 6	2	-4/20	32	-33/263	6	0	29A	0	0/0	22	-165/238
BOTTOM 7	0	-13/15	24	-165/247	6	0	30A	0	0/0	40	132/275
SIDE 2	5	9/25	23	-182/245	5	-1	32A	0	0/0	29	-50/253
SIDE 10	2	-4/20	24	-165/247	8	2	34A	0	0/0	32	0/259
SIDE WEST 2	2	-4/20	26	-132/251	5	-1	35A	0	0/0	32	0/259
CONSOLE											
FRONT	4	4/23	31	-50/261	5	-1		0	0/0	28	-66/251
RT. SIDE	0	-13/15	27	-116/253	6	0		0	0/0	34	33/263
LT. SIDE	4	4/23	33	-17/265	6	0		0	0/0	29	-50/253
REAR	5	9/25	22	-198/243	6	0		0	0/0	32	0/259

* Painted brick walls (all others cinder block)

** Painted metal doors

(1) Columns containing values in dpm/100cm^2 are reported with background subtracted

(2) Uncertainties are caclulated at the 95% confidence level (1.96 x standard deviation)

(3) See Table 4-1 for background values (B) used and calculated M.D.A.S.

(4) See Table 3-1 for detection efficiencies (E) of instruments

TABLE 4-4 FINAL STATUS SURVEY SURVEY UNIT 3

GRID POINT	TOTAL ACTIVITY (dpm / 100 CM²)[(1)(3)]						SMEAR #	REMOVABLE ACTIVITY (dpm/100 CM²)			
	ALPHA		BETA		GAMMA IN uR/hr			ALPHA		BETA -GAMMA	
	COUNTS / M	ACT. / UNCERT[(2)]	COUNTS / M	ACT / UNCERT.	TOTAL	ABOVE bkg		COUNTS / M	ACT./ UNCERT.	COUNTS / M	ACT. / UNCERT.
A_3	1	0/12	45	-116/319	6	1	49	0	0/0	39	116/273
A_4	2	4/15	37	-248/306	5	0	50	0	0/0	32	0/259
A_5	1	0/12	28	-397/290	7	2	51	0	0/0	28	-66/251
A_6	1	0/12	28	-397/290	5	0	77	0	0/0	26	-99/247
A_7	1	0/12	46	-99/321	5	0	78	0	0/0	35	50/265
A_8	0	-4/8	52	0/331	4	-1	79	0	0/0	38	99/271
B_3	0	-4/8	30	-364/294	6	1	80	0	0/0	28	-66/251
B_4	0	-4/8	35	-281/302	4	-1	81	0	0/0	39	116/273
B_5	3	9/17	34	-298/301	5	0	52	0	0/0	30	-33/255
B_6	0	-4/8	45	-116/319	7	2	53	0	0/0	40	132/275
B_7	0	-4/8	38	-232/308	6	1	54	0	0/0	36	66/267
B_8	1	0/12	34	-298/304	5	0	82	0	0/0	38	99/271
C_3	3	9/17	30	-364/294	5	0	83	0	0/0	28	-66/251
C_4	1	0/12	49	-50/326	6	1	84	0	0/0	32	0/259
C_5	2	4/15	47	-83/324	5	0	85	0	0/0	27	-83/249
C_6	1	0/12	32	-331/297	7	2	86	0	0/0	36	66/267
C_7	3	9/17	42	-165/314	6	1	55	0	0/0	31	-17/257
C_8	2	4/15	44	-132/318	5	0	56	0	0/0	37	83/289
D_3	0	-4/8	41	-182/313	6	1	87	0	0/0	35	50/265
D_4	4	13/20	41	-182/313	4	-1	57	0	0/0	23	-149/240
D_5	2	4/15	37	-248/306	6	1	58	0	0/0	38	99/271
D_6	0	-4/8	42	-165/314	4	-1	88	0	0/0	26	-99/247
D_7	0	-4/8	41	-182/313	4	-1	89	0	0/0	28	-66/251
D_8	2	4/15	36	-265/304	4	-1	90	0	0/0	32	0/259
E_3	2	4/15	48	-66/324	6	1	91	0	0/0	30	-33/255
E_4	1	0/12	36	-265/304	4	-1	59	0	0/0	37	83/269
E_5	0	-4/8	40	-198/311	4	-1	60	0	0/0	24	-132/243
E_6	1	0/12	41	-182/313	5	0	92	0	0/0	34	33/263
E_7	0	-4/8	30	-364/294	6	1	93	0	0/0	28	-66/251
E_8	0	-4/8	40	-198/311	5	0	94	0	0/0	38	99/271
F_3	1	0/12	44	-132/318	6	1	95	0	0/0	40	132/275

TABLE 4-4 CONTINUED				FINAL STATUS SURVEY					SURVEY UNIT 3		
GRID POINT	TOTAL ACTIVITY (dpm / 100 CM^2)(1) (3)						SMEAR #	REMOVABLE ACTIVITY (dpm/100 CM^2)			
	ALPHA		BETA		GAMMA IN uR/hr			ALPHA		BETA -GAMMA	
	COUNTS / M	ACT. / UNCERT(2)	COUNTS / M	ACT / UNCERT.	TOTAL	ABOVE bkg		COUNTS / M	ACT./ UNCERT.	COUNTS / M	ACT. / UNCERT.
F_4	0	-4/8	49	-50/326	6	0	96	0	0/0	34	33/263
F_5	1	0/12	54	33/334	5	0	97	0	0/0	30	-33/255
F_6	1	0/12	34	-298/301	6	1	98	0	0/0	24	-132/243
F_7	1	0/12	33	-314/299	6	1	99	0	0/0	30	-33/255
F_8	1	0/12	43	-149/316	6	1	99	0	0/0	30	-33/255
G_5	2	4/15	49	-50/326	5	0	100	0	0/0	26	-99/247
G_6	1	0/12	31	-347/295	6	1	1A	0	0/0	38	99/271
G_7	0	-4/8	33	-314/299	5	0	2A	0	0/0	32	0/259
G_8	1	0/12	43	-149/316	5	0	3A	0	0/0	40	132/275
H_5	0	-4/8	35	-281/302	4	-1	61	0	0/0	34	33/263
H_6	0	-4/8	53	17/332	5	0	62	0	0/0	35	50/265
H_{6A}	3	9/17	33	-314/299	5	0	12A	0	0/0	40	132/275
H_{6B}	3	9/17	30	-364/294	6	1	72	0	0/0	39	116/273
H_7	0	-4/8	46	-99/321	6	1	4A	0	0/0	38	99/271
H_8	1	0/12	41	-182/313	6	1	5A	0	0/0	30	-33/255
I_{3A}	3	9/17	32	-331/297	5	0	6A	0	0/0	24	-132/243
I_{3B}	2	4/15	35	-281/302	5	0	7A	0	0/0	26	-99/247
I_4	0	-4/8	38	-232/308	4	-1	8A	0	0/0	32	0/259
I_{4A}	2	4/15	39	-215/309	6	1	17A	0	0/0	26	-99/247
I_{4B}	2	4/15	32	-331/297	6	1	18A	0	0/0	32	0/259
I_5	3	9/17	28	-397/290	5	0	9A	0	0/0	32	0/259
I_{5A}	1	0/12	39	-215/309	4	-1	10A	0	0/0	28	-66/251
I_{5B}	1	0/12	32	-331/297	5	0	73	0	0/0	26	-99/247
I_6	1	0/12	34	-298/301	5	0	11A	0	0/0	38	99/271
I_{6A}	4	13/20	38	-232/308	5	0	13A	0	0/0	36	66/267
I_{6B}	2	4/15	35	-281/302	4	-1	14A	0	0/0	32	0/259
J_{6A}	4	13/20	40	-198/311	5	0	15A	0	0/0	24	-132/243
J_{6B}	3	9/17	44	-132/318	5	0	16A	0	0/0	28	-66/251
SLOPING CONCRETE WALL											
A_1	3	0/21	46	-99/321	7	2	50A	0	0/0	32	0/259
A_2	1	-9/17	40	-198/311	6	1	63	0	0/0	40	132/275

TABLE 4-4 CONTINUED — FINAL STATUS SURVEY — SURVEY UNIT 3

GRID POINT	TOTAL ACTIVITY (dpm / 100 CM^2)(1) (3)						SMEAR #	REMOVABLE ACTIVITY (dpm/100 CM^2)			
	ALPHA		BETA		GAMMA IN uR/hr			ALPHA		BETA -GAMMA	
	COUNTS / M	ACT. / UNCERT(2)	COUNTS / M	ACT / UNCERT.	TOTAL	ABOVE bkg		COUNTS / M	ACT./ UNCERT.	COUNTS / M	ACT. / UNCERT.
B_1	1	-9/17	38	-232/308	6	1	51A	0	0/0	34	33/263
B_2	1	-9/17	42	-165/314	6	1	64	0	0/0	39	116/273
C_1	0	-13/15	46	-99/321	6	1	52A	0	0/0	30	-33/255
C_2	1	-9/17	46	-99/321	5	0	53A	0	0/0	38	99/271
D_1	1	-9/17	40	-198/311	5	0	54A	0	0/0	28	-66/251
D_2	0	-13/15	36	-265/304	6	1	65	0	0/0	37	83/269
E_1	2	-4/20	34	-298/301	6	1	55A	0	0/0	26	-99/247
E_2	2	-4/20	39	-215/309	6	1	56A	0	0/0	42	165/279
CONCRETE COLUMNS											
E_{3A}	3	0/21	39	-215/309	5	0	19A	0	0/0	34	33/263
E_{3B}	2	-4/20	43	-149/316	6	1	20A	0	0/0	29	-50/253
E_{4A}	1	-9/17	35	-281/302	6	1	21A	0	0/0	27	-83/249
E_{4B}	2	-4/20	33	-314/299	5	0	22A	0	0/0	31	-17/257
F_{8A}	4	4/23	37	-248/306	4	-1	23A	0	0/0	28	-66/251
F_{8B}	2	-4/20	37	-248/306	5	0	24A	0	0/0	32	0/259
G_{8A}	0	-13/15	34	-298/301	6	1	25A	0	0/0	26	-99/247
G_{8B}	2	-4/20	42	-165/314	5	0	71	0	0/0	24	-132/243
H_{6A1}	1	-9/17	39	-215/309	7	2	26A	0	0/0	38	99/271
H_{6B2}	3	0/21	41	-182/313	5	0	27A	0	0/0	34	33/263
CONCRETE BEAM											
B_{E1}	2	-4/20	43	-149/316	5	0	28A	0	0/0	27	-83/249
B_{E2}	2	-4/20	40	-198/311	6	1	29A	0	0/0	30	-33/255
B_{E3}	3	0/21	48	-66/324	5	0	30A	0	0/0	24	-132/243
B_{E4}	4	4/23	44	-132/318	4	-1	31A	0	0/0	29	-50/253
B_{E5}	1	-9/17	44	-132/318	6	1	32A	0	0/0	33	17/261
METAL WALL											
A_{1A}	2	-4/20	36	33/271	5	0	33A	0	0/0	32	0/259
A_{2A}	4	4/23	30	-66/259	4	-1	34A	0	0/0	28	-66/251
A_{2B}	2	-4/20	35	17/269	5	0	35A	0	0/0	34	33/263
A_{3A}	0	-13/15	38	66/275	5	0	36A	0	0/0	26	-99/247
A_{3B}	1	-9/17	35	17/269	4	-1	37A	0	0/0	22	-165/238

TABLE 4-4 CONTINUED — FINAL STATUS SURVEY — SURVEY UNIT 3

GRID POINT	TOTAL ACTIVITY (dpm / 100 CM²)(1) (3)						SMEAR #	REMOVABLE ACTIVITY (dpm/100 CM²)			
	ALPHA		BETA		GAMMA IN uR/hr			ALPHA		BETA -GAMMA	
	COUNTS / M	ACT. / UNCERT(2)	COUNTS / M	ACT / UNCERT.	TOTAL	ABOVE bkg		COUNTS / M	ACT./ UNCERT.	COUNTS / M	ACT. / UNCERT.
A_{4A}	2	-4/20	31	-50/261	6	1	38A	0	0/0	30	-33/255
A_{4B}	3	0/21	27	-16/253	5	0	67	0	0/0	32	0/259
A_{5A}	2	-4/20	34	0/267	5	0	39A	0	0/0	39	116/273
A_{5B}	3	0/21	24	-165/247	4	-1	40A	0	0/0	26	-99/247
A_{6A}	2	-4/20	32	-33/263	4	-1	67	0	0/0	37	83/269
A_{6B}	2	-4/20	27	-116/253	4	-1	41A	0	0/0	32	0/259
A_{7A}	4	4/23	31	-50/261	5	0	42A	0	0/0	35	50/265
A_{7B}	1	-9/17	26	-132/251	5	0	43A	0	0/0	23	-149/240
A_{8A}	3	0/21	35	17/269	5	0	44A	0	0/0	32	0/259
A_{8B}	3	0/21	31	-50/261	5	0	45A	0	0/0	28	-66/251
METAL CEILING DUCT											
1	2	-4/20	26	-132/251	5	0	68	0	0/0	30	-33/255
2	3	0/21	29	-83/257	4	-1	46A	0	0/0	24	-132/243
3	2	-4/20	23	-182/245	4	-1	69	0	0/0	18	-232/230
4	2	-4/20	37	50/273	4	-1	47A	0	0/0	26	-99/247
5	0	-13/15	42	132/283	5	0	70	0	0/0	29	-50/253
REACTOR TANK EXTERIOR											
T1	3	0/21	30	-66/259	5	0	74	0	0/0	29	-50/253
T2	0	-13/15	27	-116/253	6	1	48A	0	0/0	30	-33/255
T3	3	0/21	30	-66/259	6	1	75	0	0/0	29	-50/253
T4	4	4/23	32	-33/263	7	2	76	0	0/0	32	0/259
T5	3	0/21	35	17/269	6	1	49A	0	0/0	24	-132/243

(1) Columns containing values in dpm/100cm² are reportred with background subtracted

(2) Uncertainties are calculated at the 95% confidence level (1.96 x standard deviation)

(3) See Table 4-1 for background values and calculated MDAs.

(4) See Table 3-1 for detection efficiencies (E) of instruments

TABLE 4-5
QUALITY CONTROL REPORT
SURVEY UNIT 1

ALPHA GRID POINT	DIRECT PROBE MEASUREMENTS				BETA GRID POINT	SMEAR # ORIG / DUP	REMOVABLE CONTAMINATION			
	ALPHA (dpm / 100 CM²)		BETA (dpm / 100 CM²)				ALPHA (dpm/100 CM²)		BETA -GAMMA (dpm/100 CM²)	
	ORIGINAL (1)	DUPLICATE (1)	ORIGINAL	DUPLICATE			ORIGINAL	DUPLICATE	ORIGINAL	DUPLICATE
K_4	-4/8	-4/8	-182/313	-66/324	K4	10/11	0/0	0/0	99/271	-33/255
D_5	9/17	18/20	248/354	66/338	D5	21/22	0/0	0/0	165/275	-66/251
E_6	-4/8	-4/8	-215/305	-298/301	H5	32/32	0/0	0/0	99/271	-66/251
K_9	0/12	0/12	-298/301	-380/292	I6B	42/44	0/0	0/0	-99/247	-165/238
F_{12}	-4/8	4/5	-99/321	-314/299	G7	54/55	0/0	0/0	215/285	116/273
I_{8C}	9/17	4/15	-165/314	-66/324	I8B	65/67	0/0	0/0	-33/255	66/267
G_{8B}	-4/8	4/15	-248/306	-165/314	K9	76/79	0/0	0/0	-33/255	-66/251
G_{8A}	9/17	0/12	-83/324	-50/326	H10	89/90	0/0	0/0	83/269	265/324
E_{15}	-9/17	-4/20	-215/309	-50/326	D9	99/100	0/0	0/0	-17/257	33/269
C_{10}	0/17	0/17	165/287	99/279	C11	10A/11A	0/0	0/0	-33/255	-33/255
L_{10}	-4/20	4/23	-66/259	132/283	F12B	21A/22A	0/0	0/0	265/291	-33/255
H_2	-9/17	-4/20	-165/408	132/430	J11	32A/33A	0/0	0/0	-33/255	17/261
C_1	4/23	-4/20	-33/263	99/279	M7	43A/44A	0/0	0/0	-116/245	-116/245
C_9	-9/17	9/25	-132/251	-99/255	K1	54A/57A	0/0	0/0	66/267	0/259
D_{5A}	4/23	4/23	-66/257	232/294	F1	65A/68A	0/0	0/0	132/275	-116/245

(1) Original and duplicate values are given as activity / uncertainty

TABLE 4-6
QUALITY CONTROL REPORT
SURVEY UNIT 2

ALPHA GRID POINT	DIRECT PROBE MEASUREMENTS				BETA GRID POINT	SMEAR # ORIG / DUP	REMOVABLE CONTAMINATION			
	ALPHA (dpm / 100 CM²)		BETA (dpm / 100 CM²)				ALPHA (dpm/100 CM²)		BETA -GAMMA (dpm/100 CM²)	
	ORIGINAL (1)	DUPLICATE (1)	ORIGINAL	DUPLICATE			ORIGINAL	DUPLICATE	ORIGINAL	DUPLICATE
D_5	0/12	-4/8	-281/302	-314/299	D5	11/13	0/0	0/0	-33/255	-66/251
F_4	0/12	4/15	-33/327	-314/289	F4	23/24	0/0	0/0	33/263	-182/236
H_6	-4/8	4/15	-66/324	-98/321	H6	34/35	0/0	0/0	-66/251	0/259
J_8	0/12	-4/8	-281/302	-248/306	J8	45/47	0/0	0/0	-33/255	50/265
K_7	-4/8	13/20	-165/314	-182/313	K7	56/57	0/0	0/0	66/267	-33/255
B_7	-4/20	-13/15	33/271	-38/263	B7	67/68	0/0	0/0	-198/234	-66/251
F_9	4/23	-9/17	198/290	-83/257	F9	78/79	0/0	0/0	0/259	99/271
K_9	0/21	0/21	-132/251	-182/245	K9	89/90	0/0	0/0	-66/251	33/263
L_4	4/23	-9/17	33/271	0/267	L4	100/41A	0/0	0/0	0/259	66/267
I_2	-4/20	0/21	265/298	116/281	I2	10A/11A	0/0	0/0	0/259	-33/255
D_2	-4/20	4/23	198/290	116/281	D2	21A/22A	0/0	0/0	198/283	-17/257
Tank Bottom	-4/20	-4/20	-132/251	-50/261	Tank Bottom	32A/33A	0/0	0/0	-50/253	149/277

(1) Original and Duplicate values are given as Activity / Uncertainty

TABLE 4-7

QUALITY CONTROL REPORT

SURVEY UNIT 3

ALPHA GRID POINT	DIRECT PROBE MEASUREMENTS				BETA GRID POINT	SMEAR # ORIG / DUP	REMOVABLE CONTAMINATION			
	ALPHA (dpm / 100 CM²)		BETA (dpm / 100 CM²)				ALPHA (dpm/100 CM²)		BETA -GAMMA (dpm/100 CM²)	
	ORIGINAL (1)	DUPLICATE (1)	ORIGINAL	DUPLICATE			ORIGINAL	DUPLICATE	ORIGINAL	DUPLICATE
B_5	9/17	4/15	-298/301	-314/299	B5	52/57A	0/0	0/0	-33/255	66/267
D_7	-4/8	0/12	-182/313	-198/311	D7	58/58A	0/0	0/0	99/271	0/259
E_8	-4/8	-4/8	-198/311	-232/308	E8	60/59A	0/0	0/0	-132/243	-66/251
G_8	0/12	0/12	-149/316	-298/301	G8	62/60A	0/0	0/0	50/265	-33/255
A_{1A}	-4/20	0/21	33/271	-83/257	A1A	67/61A	0/0	0/0	83/269	-66/251
A_{7B}	-9/17	-9/17	-132/251	-66/259	A7B	69/62A	0/0	0/0	-232/230	-99/247
T_3	0/21	-4/20	-66/259	-116/253	T3	75/63A	0/0	0/0	-50/253	50/265
I_{6B}	4/15	0/12	-281/302	-281/302	I6B	73/64A	0/0	0/0	-99/247	-33/255
F_{8B}	-4/20	0/21	-248/306	-281/302	F8B	71/65A	0/0	0/0	-132/243	0/259
A_{3A}	-13/15	-9/17	66/275	17/269	A3A	36A/66A	0/0	0/0	-99/247	-66/251

(1) Original and Duplicate values are given as Activity / Uncertainty

APPENDIX 1

SAMPLE SURVEY FORMS

Final Status Survey: Gamma Dose Rate

Manhattan College Survey Data

Leo Engineering Building

Date:____________

Room Number:__________ Surfaces Surveyed:____________________________

Name of Surveyor:____________________________

Instrument Type and Model:____

Instrument Serial Number:______________________ Calibration Date:__________

Background Level:_____________

Grid Location	Gamma Dose Rate, (w/ background) µR/hr	Gamma Dose Rate, (w/out background) µR/hr

Final Status Survey

Manhattan College Survey Data

Leo Engineering Building

Date:____________ Survey Type: Alpha or Beta / Direct or Removable

Room Number:_____________ Surfaces Surveyed:______________________________

Name of Surveyor:__________________________________

Instrument Type and Model:____________________________ Probe:______________

Instrument Serial Number:___________________ Probe Serial Number:____________

Calibration Date:______________________ Efficiency (c/d):______________________

Background (CPM):_____________________ Count Time:__________________________

Minimum Detectable Activity (dpm/100 sq. cm):_________________

Grid Location	Measured Counts	Measured Activity, dpm/100 sq. cm	Effective Activity, dpm/100 sq. cm	1.96*Standard Deviation

MANHATTAN COLLEGE ZERO POWER REACTOR
HEALTH PHYSICS SURVEY
WIPE TEST

ANALYSIS DATE: [ ] TYPE: ALPHA BETA

Instrument: ____________________ Probe:
Serial #: ____________________ Serial #:
Calibration:

BACKGROUND

Background (counts) [ ] Count Time (min) [ ]
Background Rate ERR cpm

EFFICENCY

Source Strength		dpm	Standard
Source Counts			
Source Count Time		min	
Average	ERR		
Efficiency	ERR		

SAMPLE #	SAMPLE LOCATION	SAMPLE DATE	GROSS COUNTS	Count Time (min)	Average Rate (cpm)	Net Rate (cpm)	Removable Activity (dpm/100 cm2)
					ERR	ERR	ERR

APPENDIX 2

CALCULATIONAL APPROACH

CALCULATIONAL APPROACH [1]

1. Background Determinations

$X_B = (1/N) \sum^N X_i$

$S_B = \sqrt{\dfrac{\sum^N (X_B - X_i)^2}{N-1}}$

$N_B = \left[\dfrac{t_{95.5\%,\,df} \cdot S_B}{0.2 \cdot X_B}\right]^2$

Where

X_B = mean of the individual background measurements (X_i)

N = total number of measurements

S_B = standard deviation of background Measurements

N_B = total number of background measurements needed to assure that average background measured is representative of true background averages to within ± 20% at a 95% confidence level.

t95.5%, df = t statistic for 95.5% confidence at N-1 degrees of freedom

2. Surface Activity

$$\frac{dpm}{100\ cm^2} = \frac{(c/m - B/m)}{E} \cdot \frac{100}{A}$$

$\frac{dpm}{100\ cm^2}$ = Surface activity in disintegrations per 100 cm^2

E = Instrument efficiency

A = Active surface area of detector

C/m = Total counts per minute

B/m = Average background counts per minute = X_B

(1) Methodology from NUREG / CR-5849, Sections 5 and 8

3. Minimum Detectable Activity (MDA)

$$MDA = \frac{2.71 + 4.65\sqrt{B/m \cdot t}}{t \cdot E \cdot \frac{A}{100}}$$

MDA in $dpm/100cm^2$
t = Count time = 1 minute

4. Measurement Uncertainty (2 sigma error)

$$1.96\ S_r = \frac{1.96\sqrt{C/t^2 + B/t_B^2}}{E \cdot \frac{A}{100}}$$

$t = t_B = 1$
Sr = standard deviation in count rate in $dpm/100cm^2$