Appendix 12-A
File Index (Part 1)

3597. Radon Results, July 1980-October 1981, *LOOW Radon Results and Reports*; documents dated from July 1, 1980 through October 14, 1981

3605. Radon Results, October 1977-March 1980, *LOOW Radon Results, Reports, and Correspondence*; documents and samples dated from October 6, 1977 through March 10, 1980

3745. Beck, 1981, *[Name Redacted1]: A Former Linde Worker*, correspondence with attachments; William L. Beck; April 2, 1981. pp. 37-39

3745. Dupree, 1981, *Interview with [Name Redacted3], A Former Linde Employee*, correspondence with attachments; E. A. Dupree; April 10, 1981, pp. 29-35

3745. Robie, 1981, *Conversation with [Name Redacted2] (NLO) Concerning Linde Air Products, Tonawanda, New York*, correspondence with attachments; D. M. Robie; April 10, 1981, pp. 2-28.

4413. Harris, 1956, *Open Field Burning of Low Level Radioactive Contaminated Combustible Wastes*; Willaim B. Harris and Martin S. Weinstein; 1956

4458. Roth, 1958, *Request for Analysis of Urine Samples*, correspondence; Herman M. Roth; May 5, 1958, p. 5

4458. Vessels, 1958, *Bioassay Results, Hooker Electrochemical Company, AEC Contract No. AT (30-1)-1524*, memorandum; R. D. Vessels; July 29, 1958, p. 3.

4597. NLC, 1980, *Review of Radon Monitoring at the DOE-Niagara Falls Storage Site*, NLCO-0004EV; National Lead Company (NLC) of Ohio; March 31, 1980

8949. Radon Results, April 1949-September 1951, *LOOW Radon Breath Sample and Radon Area Sample Results*; samples taken April 7, 1949 through September 24, 1951

8952. Radon Results, August 1949-March 1951, *LOOW Radon Air Sample Results*; samples taken August 17, 1949 through March 7, 1951

9074. Radon Results, October 1952, *LOOW Radon Results*; samples taken October 14, 1952

9078. Heatherton, 1950a, *Lake Ontario Ordnance Works Air Radon and Dust Survey August-September 1950*; R. C. Heatherton; November 6, 1950

9093. Unknown author, 1960, *Radiation and Radon Survey of Operations of K-65 Tower*; author's name is illegible; November 1960

3597

Radon Results, July 1980-October 1981, *LOOW Radon Results and Reports*
Documents dated from July 1, 1980 through October 14, 1981

Niagara Falls Radon Results
77-81

Ewm:

Copies to:
NLO - HES
BNI - OR - Phillips
NFSS - Kinchel
NLO - DED

TERRADEX

TERRADEX CORPORATION
460 N. Wiget Lane
Walnut Creek, CA 94598, U.S.A
(415) 938-2545 • Telex 33-7793

October 14, 1981

Mr. George L. Stukenbroeker
NLO, Inc.
P. O. Box 39158
Cincinnati, Ohio 45239

Dear Mr. Stukenbroeker:

Enclosed are two copies of the Track Etch results on your NLO-NFSS Program. Thirty two Type "F" detectors were exposed from 29 to 70 days. Results are given in average picoCuries per liter of Rn-222 (pCi/l) over the exposure period used and are ranked by serial number and reading.

Values ranged from 0.18 to 15.06 pCi/l. The lower readings are similar to the low to medium range of normal indoor environments, while the highest readings are very high for indoor environments.

It is a pleasure to be of service to you and we look forward to serving you in the future. Please let us know if you have any questions or comments about the data.

Sincerely,

Sara S. Hartwell
Office Manager

SSH/jl
Enclosures

NLO NFSS 10-14-81

SERIAL NUMBER	RADON EXP. RATE (PCI/LITER)	FIELD NOTES AND DATA
151.	1.36	NLONFSSLOCATION01
152.	0.40	NLONFSSLOCATION02
153.	0.50	NLONFSSLOCATION03
154.	0.61	NLONFSSLOCATION04
155.	0.29	NLONFSSLOCATION05
156.	0.40	NLONFSSLOCATION06
157.	0.61	NLONFSSLOCATION07
158.	3.07	NLONFSSLOCATION08
159.	5.11	NLONFSSLOCATION09
160.	10.03	NLONFSSLOCATION10
161.	0.50	NLONFSSLOCATION11
162.	0.50	NLONFSSLOCATION12
163.	3.61	NLONFSSLOCATION16
164.	11.21	NLONFSSLOCATION17
165.	10.78	NLONFSSLOCATION18
166.	0.72	NLONFSSLOCATION19
167.	0.50	NLONFSSLOCATION20
168.	6.28	NLONFSSLOCATION21
169.	15.06	NLONFSSLOCATION22
170.	10.24	NLONFSSLOCATION23
171.	4.68	NLONFSSLOCATION24
172.	0.40	NLONFSSLOCATION25
173.	2.86	NLONFSSLOCATION26
174.	0.72	NLONFSSLOCATION27
175.	0.29	NLONFSSLOCATION28
176.	0.83	NLONFSSLOCATION29 SHOTBYRIFLE
177.	0.40	NLONFSSLOCATION30
178.	1.36	NLONFSSLOCATIONQA25
179.	0.61	NLONFSSLOCATIONQA20
180.	0.18	NLONFSSLOCATIONQA02
53841.	0.74	TKLUKBEDROOM
53842.	1.05	TKLUKBASEMENT

NLO NFSS 10-14-81

RADON EXP. RATE (PCI/LITER)	SERIAL NUMBER	FIELD NOTES AND DATA
0.18	180.	NLONFSSLOCATION0A02
0.29	175.	NLONFSSLOCATION28
0.29	155.	NLONFSSLOCATION05
0.40	152.	NLONFSSLOCATION02
0.40	177.	NLONFSSLOCATION30
0.40	156.	NLONFSSLOCATION06
0.40	172.	NLONFSSLOCATION25
0.50	153.	NLONFSSLOCATION03
0.50	167.	NLONFSSLOCATION20
0.50	162.	NLONFSSLOCATION12
0.50	161.	NLONFSSLOCATION11
0.61	154.	NLONFSSLOCATION04
0.61	179.	NLONFSSLOCATION0A20
0.61	157.	NLONFSSLOCATION07
0.72	174.	NLONFSSLOCATION27
0.72	166.	NLONFSSLOCATION19
0.74	53841.	TKLUKBEDROOM
0.83	176.	NLONFSSLOCATION29 SHOTBYRIFLE
1.05	53842.	TKLUKBASEMENT
1.36	151.	NLONFSSLOCATION01
1.36	178.	NLONFSSLOCATION0A25
2.86	173.	NLONFSSLOCATION26
3.07	158.	NLONFSSLOCATION08
3.61	163.	NLONFSSLOCATION16
4.68	171.	NLONFSSLOCATION24
5.11	159.	NLONFSSLOCATION09
6.28	168.	NLONFSSLOCATION21
10.03	160.	NLONFSSLOCATION10
10.24	170.	NLONFSSLOCATION23
10.78	165.	NLONFSSLOCATION18
11.21	164.	NLONFSSLOCATION17
15.06	169.	NLONFSSLOCATION22

NLO NFSS 10-14-81

SERIAL NUMBER	RADON EXP. RATE (PCI/LITER)	FIELD NOTES AND DATA
151.	1.36	NLONFSSLOCATION01
152.	0.40	NLONFSSLOCATION02
153.	0.50	NLONFSSLOCATION03
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155.	0.29	NLONFSSLOCATION05
156.	0.40	NLONFSSLOCATION06
157.	0.61	NLONFSSLOCATION07
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179.	0.61	NLONFSSLOCATIONQA20
180.	0.18	NLONFSSLOCATIONQA02
53841.	0.74	TKLUKBEDROOM
53842.	1.05	TKLUKBASEMENT

NLO NFSS 10-14-81
RADON

EXP. RATE (PCI/LITER)	SERIAL NUMBER	FIELD NOTES AND DATA
0.18	180.	NLONFSSLOCATIONQA02
0.29	175.	NLONFSSLOCATION28
0.29	155.	NLONFSSLOCATION05
0.40	152.	NLONFSSLOCATION02
0.40	177.	NLONFSSLOCATION30
0.40	156.	NLONFSSLOCATION06
0.40	172.	NLONFSSLOCATION25
0.50	153.	NLONFSSLOCATION03
0.50	167.	NLONFSSLOCATION20
0.50	162.	NLONFSSLOCATION12
0.50	161.	NLONFSSLOCATION11
0.61	154.	NLONFSSLOCATION04
0.61	179.	NLONFSSLOCATIONQA20
0.61	157.	NLONFSSLOCATION07
0.72	174.	NLONFSSLOCATION27
0.72	166.	NLONFSSLOCATION19
0.74	53841.	TKLUKBEDROOM
0.83	176.	NLONFSSLOCATION29 SHOTBYRIFLE
1.05	53842.	TKLUKBASEMENT
1.36	151.	NLONFSSLOCATION01
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10.03	160.	NLONFSSLOCATION10
10.24	170.	NLONFSSLOCATION23
10.78	165.	NLONFSSLOCATION18
11.21	164.	NLONFSSLOCATION17
15.06	169.	NLONFSSLOCATION22

NATIONAL LEAD COMPANY OF OHIO

DOE CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
3/5/81	Bill Yates, Mound Lab Radon Program Manager	L. E. Green RCH / AWB

SUBJECT:

REPORTS ON RADON MONITORING - NFSS AND MIDDLESEX SITES

SUMMARY OF DISCUSSION:

Mr. Yates called to confirm several work start and stop dates I had provided on the 1980 Middlesex work. He also asked me to let John Cavendish know that he has submitted the first technical quarterly report covering on-and off-site radon monitoring at NFSS to W. E. Mott, DOE HQ. A similar report covering Middlesex radon monitoring during last year's project there will be submitted to Mott in a few days.

cc: J. H. Cavendish

INSTRUCTIONS:

1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 1/13/78)

NATIONAL LEAD COMPANY OF OHIO

DOE CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
11/7/80	Bill Yates, Mound Lab Radon Pgm. Mgr.	L. E. Green LEG

SUBJECT:

REPORT ON RADON MONITORING

SUMMARY OF DISCUSSION:

He is currently writing a report covering radon monitoring during the Middlesex work this year and wanted the dates that earthmoving started and stopped at the offsite locations (Rectory & 432 Williams Street) in order to correlate with his data.

Yates offered this information on his results so far:

Middlesex - Boundary levels at these offsite properties did show a decrease after the work and are now safely below the interim guideline of 3 pCi/L. Levels significantly decreased inside the rectory, with only the basement sump room which still fluctuates above 3 pCi/L. (NOTE: basement walls and floor will be sealed this week.) Monitoring continues there to further clarify the level and will continue indefinitely on the Marine Base boundary and area locations.

NFSS: - PERMs have been used for four weeks now, including 12 on the site boundary and 34 at offsite locations (less than 500 meters to about 8000 meters). These are serviced and TLDs changed weekly by Niagara University people. Highest boundary levels have been found at stations 7, 8, and 9 (west edge, near the spoils pile), and have ranged 13-20 pCi/L. All of this monitoring will continue indefinitely. Planned indoor monitoring at offsite locations has not yet begun.

Yates will send his completed report to Nott and Ramsey, who should forward copies to NLO. Mound is currently constructing their Rn-calibration chamber, but problems obtaining certain equipment will delay its completion to March (est.). Yates appreciated the information I provided on work planned at NFSS and asked me to keep him abreast.

cc: [illegible]
M. W. Green
H. W. [illegible]

INSTRUCTIONS:

1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 1/13/78)

NLO 10/13 LEG 10/9 MNW 10/8

OCT 8 11 05

NATIONAL LEAD COMPANY OF OHIO

~~DOE~~ CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
10/7/80	Joseph P. Kirchue	L. M. Devir

SUBJECT:

NLO - Niagara Falls

SUMMARY OF DISCUSSION:

Radon monitor #3 at the east perimeter fence line near the K-65 tower was found vandalized on the first patrol of the day. Incident occurred between 4:15 PM 10/6/80 and 8:15 AM 10/7/80. Indications are that someone with a rifle used the monitor as a target.

Representatives of Niagara University scheduled to service monitors this date were advised of the incident at 9:15 AM when they reported on site. (Niagara University personnel advised William Yates at Mound of incident)

cc: J. Cavendish
R. Heatherton - M. Boback

INSTRUCTIONS:

1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 1/13/78)

Department of Energy
Oak Ridge Operations
P.O. Box E
Oak Ridge, Tennessee 37830

OCT 7 1980

National Lead Company of Ohio
ATTN: Mr. S. F. Audia, Manager
PO Box 39158
Cincinnati, OH 45239

Gentlemen:

RADON MONITORING AT MIDDLESEX SAMPLING PLANT AND NIAGARA FALLS STORAGE SITES

Reference is made to your letter of September 29, 1980, subject as above.

We are asking DOE HQ to clarify Mound's role at these two sites and will redefine NLO's responsibilities with respect to the radon monitoring when such clarification is received. If Mound is to have a continuing role in this work, we will urge HQ to make arrangements to provide the Mound monitoring data to NLO.

Sincerely,

H. D. Hickman

H. D. Hickman, Director
Manufacturing Division

MS-35:JDM

cc: E. L. Keller

HWB 10/14 MWB
EG
SEP 29 11 38

NATIONAL LEAD COMPANY OF OHIO

A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

SEP 29 1980

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

RADON MONITORING AT MIDDLESEX SAMPLING PLANT AND NIAGARA FALLS STORAGE SITES

Reference: William G. Yates (Radon Program Manager, Monsanto Research Corporation, Mound Facility). Letter to Dr. William E. Mott (Director, Environmental Control Technology Division, USDOE). July 1, 1980.

The referenced letter requested NLO approval for access to the subject sites in relation to "comprehensive radon monitoring programs." NLO personnel have visited the Mound Facility and met Mr. Yates at other locations in recent months but have been unable to obtain a clear definition of the Mound program and responsibilities for radon monitoring and informational reporting.

As NLO's contractual responsibilities to DOE include radon monitoring at these sites, it is requested that we have (1) a restatement of our responsibilities, vis-a-vis the Mound effort so that all DOE requirements are met with a minimum of duplicated effort and (2) access to information regarding Mound's monitoring programs and data generated from these sites.

Sincerely,
Original Signed By
S. F. AUDIA
Manager
S. F. Audia
Manager

EWM;TAP/rlr

cc: J. H. Cavendish
E. H. Hardison, ORO
R. C. Heatherton
H. D. Hickman, ORO
E. L. Keller
R. C. Kispert
E. W. Mautz
T. A. Poff
G. L. Stukenbroeker

RCH-MWB
MWB
7/30

JUL 8 8 26

Monsanto

MOUND FACILITY
Operated for the United States
Department of Energy

July 1, 1980

Dr. William E. Mott, Director
U. S. Department of Energy
Environmental Control Technology Division
Washington, D. C. 20545

Dear Dr. Mott:

Commensurate with our comprehensive radon monitoring programs at Middlesex, N.J. and Lewiston, N.Y., it is intrinsic that accurate meteorological data be obtained. Pursuant to this end, I have made arrangements with Rutgers University and Weston Corporation to erect meteorological equipment at both of these sites.

Since these sites are maintained by National Lead of Ohio, their apprisement of the situations and consent is deemed appropriate.

Therefore, it is requested by copy of this letter to the appropriate authorities that permission be granted by NLO to Rutgers University and Weston Corporation to erect their equipment and have weekly ingress and egress to these sites to gather meteorological data and maintain their equipment.

If you need additional information, please contact me.

Sincerely,

William G. Yates

William G. Yates
Radon Program Manager

WGY:km

cc: R. Ramsey
E. Keller
E. Hardison
A. Whitman
J. Cavendish

Monsanto Research Corporation P. O. Box 32 Miamisburg, Ohio 45342 (513) 865-4020

a subsidiary of Monsanto Company

3605

Radon Results, October 1977-March 1980,
***LOOW Radon Results, Reports, and Correspondence*;**
Documents and samples dated from October 6, 1977 through March 10, 1980

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239
PHONE: AREA CODE: 513-738-1151

MAR 1 0 1980

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS RADON RESULTS, 1/2/80 TO 1/9/80

The attached table contains radon monitoring data obtained for the Niagara Falls fenceline positions during the period from January 2, 1980 to January 9, 1980.

At the end of this sampling period all monitors were returned to the FMPC for recalibration. Fenceline monitoring for radon-222 is now being done by the Environmental Measurements Laboratory and will continue until the recalibration is completed and our units are returned to the Niagara Falls site.

Sincerely yours,
Original Signed By
S. F. AUDIA
Manager

S. F. Audia
Manager

MWB/vvs

attach.

M. W. Boback
J. H. Cavendish
A. C. George - EML
E. H. Hardison - ORO
R. C. Heatherton

H. D. Hickman
W. C. Hill
K. N. Ross

Central Files

Radon-222, pCi/L, Niagara Falls Site

Sampling Period	Monitoring Locations							
	1	2	3	4	6	7	8	9
1/2/80 - 1/9/80	0.4	0.3	0.2	0.4	0.3	0.5	2.2	0.8

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

JAN 14 1980

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS RADON RESULTS, 12/19/79 TO 1/2/80

Ref: Letter, S. F. Audia to H. D. Hickman, "Niagara Falls Radon Results," dated January 4, 1980

The attached table contains radon monitoring data obtained at the Niagara Falls site fenceline positions during the period from December 19, 1979 to January 2, 1980.

The duplicate monitor at station 9 (ref.) was returned to its original location at station 4 at the start of the sampling period which began December 19, 1979.

Sincerely yours,
Original Signed By
S. F. AUDIA
Manager

MWB/vvs

S. F. Audia
Manager

attach.

cc: M. W. Boback
A. J. Breslin - EML
J. H. Cavendish
E. H. Hardison - ORO
R. C. Heatherton
H. D. Hickman
W. C. Hill
K. N. Ross

Central Files

Radon-222, pCi/ℓ, Niagara Falls Site

Sampling Period	Monitoring Locations							
	1	2	3	4	6	7	8	9
12/19/79 – 12/26/79	1.2	<0.1	0.3	0.2	0.4	1.7	5.5	6.9
12/26/79 - 1/2/80	0.6	<0.1	0.3	0.1	0.4	0.3	0.5	0.2

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF NL INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239
PHONE: AREA CODE: 513-738-1151

JAN 4 1980

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS RADON RESULTS

Ref: Letter, S. F. Audia to H. D. Hickman, "Niagara Falls Radon Results, 10/17/79 to 12/4/79," dated December 19, 1979

In the reference letter, Niagara Falls radon results were reported for seven one-week sampling periods. Results for the last two periods, beginning November 21, 1979 and November 28, 1979, were listed incorrectly. In these two periods, and continuing since then, the monitor from location 5 was used as a duplicate at location 9. A correct listing is given in the attached table for those two sampling periods and for two additional periods.

The variation between duplicate results is greater than expected and we are attempting to identify the cause of the variation and to improve the monitoring precision. This problem has been discussed with personnel of the Environmental Measurements Laboratory and they have offered to assist in this effort.

Sincerely yours,
Original Signed By
S. F. AUDIA
Manager
S. F. Audia
Manager

MWB/vvs

attach.

cc: M. W. Boback
A. J. Breslin - EML
J. H. Cavendish
E. H. Hardison - ORO
R. C. Heatherton
H. D. Hickman
W. C. Hill
K. N. Ross

Central Files

Radon-222, pCi/ℓ, Niagara Falls Site

Sampling Period	Monitoring Locations						
	1	2	3	6	7	8	9*
11/21/79 - 11/28/79	0.7	<0.1	0.4	0.5	1.3	2.6	4.5, 1.8
11/28/79 - 12/4/79	0.1	0.2	0.2	0.2	0.2	0.2	0.3, <0.1
12/4/79 - 12/12/79	0.4	<0.1	0.3	0.4	0.3	0.2	0.4, <0.1
12/12/79 - 12/19/79	0.4	0.4	0.1	0.3	<0.1	0.6	2.1, 0.3

*Two monitors at location 9.

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239
PHONE: AREA CODE: 513-738-1151

DEC 19 1979

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS RADON RESULTS, 10/17/79 TO 12/4/79

The attached table contains radon monitoring data obtained at the Niagara Falls site fenceline positions during the period from October 17, 1979 to December 4, 1979.

Sincerely yours,

Original Signed By
S. F. AUDIA
Manager

S. F. Audia
Manager

MWB/vvs

attach.

cc: M. W. Boback
A. J. Breslin - EML
J. H. Cavendish
E. H. Hardison - ORO
R. C. Heatherton
H. D. Hickman
W. C. Hill
R. D. Ohlinger
K. N. Ross

Central Files

Radon-222, pCi/ℓ, Niagara Falls Site

Sampling Period	Monitoring Locations 1	2	3	4	6	7	8	9
10/17/79 - 10/24/79	0.9	0.4	0.3	0.1	0.6	1.2	3.6	3.8
10/24/79 - 10/31/79	0.4	0.4	0.5	0.2	0.5	0.6	0.6	0.8
10/31/79 - 11/7/79	1.5	0.1	0.4	0.4	0.7	4.0	2.5	2.4
11/7/79 - 11/14/79	0.7	<0.1	0.5	0.3	0.8	1.0	2.6	1.3
11/14/79 - 11/21/79	1.3	0.4	0.5	1.0	0.8	2.1	3.1	1.8
11/21/79 - 11/28/79	0.7	<0.1	0.4	0.5	1.3	2.6	4.5	1.8
11/28/79 - 12/4/79	0.1	0.2	0.2	0.2	0.2	0.2	<0.1	0.3

1979

LAST DAY OF SAMPLE

STATION	5-31	6-6	6-13	6-20	6-27	7-5	7-11	7-18	7-25	8-2	8-8	8-15	8-22	8-29	9-5	9-12	9-19	9-26	10-3	10-10	10-17	10-24	10-31	11-7	11-14	11-21	11-28
1	0.6	1.4	2.0	1.6	0.8	0.88	2.9	2.9	4.2	2.4	0.6	1.8	0.7	0.2	1.1	1.5	0.1	1.8	2.1	0.2	0.8	0.9	0.4	1.5	0.7	1.3	0.7
2	—	0.2	0.2	0	0.2	0.48	0.2	0.3	0.4	0.3	0.4	0.3	0.1	0.2	0.4	0.7	0.4	0.6	0.3	1.5	0.6	0.4	0.4	0.1	0.05	0.4	<0.1
3	0.2	0.5	0.9	0.4	0.3	0.60	0.7	0.5	0.9	0.7	0.6	0.8	0.6	0.1	0.6	0.7	0.2	0.4	0.7	0.1	0.3	0.3	0.5	0.4	0.5	0.5	0.4
4	0.05	0.3	0.4	0.4	<0.05	0.57	<0.1	0.2	0.5	0.3	0.9	0.5	1.2	0.4	1.0	0.7	0.6	0.9	0.7	0.6	0.4	0.1	0.2	0.4	0.3	1.0	—
6	0.8	1.5	1.7	1.2	1.3	1.91	1.8	3.1	0.1	1.8	—	0.5	2.1	1.5	1.2	1.7	0.5	1.1	2.5	0.2	0.5	0.6	0.5	0.7	0.8	0.8	0.5
7	—	3.5	2.1	2.8	3.2	1.52	3.2	5.4	4.3	3.5	1.2	0.5	7.6	3.0	3.9	6.1	0.7	5.9	4.8	0.4	2.7	1.2	0.6	4.0	1.0	2.1	1.3
8	3.3	4.1	2.9	10.7	0.5	1.22	0.9	8.0	16.6	9.6	6.6	1.4	5.4	4.9	4.1	9.6	5.5	45.4	10.5	0.3	13.3	3.6	0.6	2.5	2.6	3.1	2.6
9	2.7	6.1	6.9	21.5	1.9	9.67	6.2	7.3	27.3	6.6	6.7	6.9	7.6	6.7	1.0	2.8	1.5	25.3	80.2	0.9	1.2	3.8	0.8	2.4	1.3	1.8	1.8

ASPHALT EMULSION APPLIED

STATION	12-4	12-12	12-19	12-26	1-2-80	1-9
1	0.1	0.4	0.4	1.2	0.6	0.4
2	0.2	0	0.4	0.1	0	0.3
3	0.2	0.3	0.1	0.3	0.3	0.2
moved to 9 – 4	0.3	0	0.1	0.2	0.1	0.4
6	0.2	0.4	0.3	0.4	0.4	0.3
7	0.2	0.3	0	1.7	0.3	0.5
8	0.2	0.2	0.6	5.5	0.5	2.2
9	0.3	0.4	0.3	6.9	0.2	0.8

NLO-GEN-1378 (8/22/58)

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158

CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

NOV 16 1979

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS RADON RESULTS, 10/17/79 TO 11/7/79

The attached table contains radon monitoring data obtained at the Niagara Falls site fenceline positions during the period from October 17, 1979 to November 7, 1979.

Sincerely yours,

Original Signed By
S. F. AUDIA
Manager

S. F. Audia
Manager

MWB/vvs

attach.

cc: M. W. Boback
A. J. Breslin - EML
J. H. Cavendish
E. H. Hardison - ORO
R. C. Heatherton
H. D. Hickman
W. C. Hill
R. D. Ohlinger
K. N. Ross

Central Files

Radon-222, pCi/ℓ, Niagara Falls Site

Sampling Period	Monitoring Locations 1	2	3	4	6	7	8	9
10/17/79 - 10/24/79	0.9	0.4	0.3	0.1	0.6	1.2	3.6	3.8
10/24/79 - 10/31/79	0.4	0.4	0.5	0.2	0.5	0.6	0.6	0.8
10/31/79 - 11/7/79	1.5	0.1	0.4	0.4	0.7	4.0	2.5	2.4

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158

CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

OCT 25 1979

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS RADON RESULTS, 9/26/79 TO 10/17/79

The attached table contains radon monitoring data obtained at the Niagara Falls site fenceline positions during the period from September 26, 1979 to October 17, 1979.

Sincerely yours,
Original Signed By
S. F. AUDIA
Manager

S. F. Audia
Manager

MWB/vvs

attach.

cc: M. W. Boback
A. J. Breslin - EML
J. H. Cavendish
E. H. Hardison - ORO
✓R. C. Heatherton
H. D. Hickman
W. C. Hill
R. D. Ohlinger
K. N. Ross

Radon-222, pCi/ℓ, Niagara Falls Site

Sampling Period	Monitoring Locations 1	2	3	4	6	7	8	9
9/26/79 - 10/3/79	2.1	0.3	0.7	0.7	2.5	4.8	10.5	80.2
10/3/79 - 10/10/79	0.2	1.5	0.1	0.6	0.2	0.4	0.3	0.9
10/10/79 - 10/17/79	0.8	0.6	0.3	0.4	0.5	2.7	13.3	1.2

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

OCT 5 1979

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS RADON RESULTS

The attached table contains radon monitoring data obtained at the Niagara Falls site fenceline positions during the period from September 12, 1979 to September 26, 1979.

Sincerely yours,
Original Signed By
S. F. AUDIA
Manager

S. F. Audia
Manager

MWB/vvs

attach.

cc: M. W. Boback
A. J. Breslin - EML
J. H. Cavendish
E. H. Hardison - ORO
R. C. Heatherton
H. D. Hickman
W. C. Hill
R. D. Ohlinger
K. N. Ross

Central Files

Radon-222, pCi/ℓ, Niagara Falls Site

Sampling Period	Monitoring Locations 1	2	3	4	6	7	8	9
9/12/79 - 9/19/79	0.1	0.4	0.2	0.6	0.5	0.7	5.5	1.5
9/19/79 - 9/26/79	1.8	0.6	0.4	0.9	1.1	5.9	45.4	25.3

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239
PHONE: AREA CODE: 513-738-1151

SEP 25 1979

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS RADON RESULTS, 8/29/79 TO 9/12/79

The attached table contains radon monitoring data obtained at the Niagara Falls site fenceline positions during the period from August 29, 1979 to September 12, 1979.

Sincerely yours,

Original Signed By
S. F. AUDIA
Manager

S. F. Audia
Manager

MWB/vvs

attach.

cc: M. W. Boback
A. J. Breslin - EML
J. H. Cavendish
E. H. Hardison - ORO
R. C. Heatherton
H. D. Hickman - ORO
W. C. Hill
R. D. Ohlinger
K. N. Ross

Central Files

Radon-222, pCi/ℓ, Niagara Falls Site

Sampling Period	Monitoring Locations							
	1	2	3	4	6	7	8	9
8/29/79 - 9/5/79	1.1	0.4	0.6	1.0	1.2	3.9	4.1	1.0
9/5/79 - 9/12/79	1.5	0.7	0.7	0.7	1.7	6.1	9.6	2.8

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF NL INDUSTRIES, INC.

P. O. BOX 39158

CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

SEP 11 1979

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS RADON RESULTS, 8/15/79 TO 8/29/79

The attached table contains radon monitoring data obtained at the Niagara Falls site fenceline positions during the period from August 15, 1979 to August 29, 1979.

Sincerely yours,

Original Signed By
S. F. AUDIA
Manager

S. F. Audia
Manager

MWB/vvs

cc: M. W. Boback
A. J. Breslin - EML
J. H. Cavendish
E. H. Hardison - ORO
R. C. Heatherton
H. D. Hickman
W. C. Hill
R. D. Ohlinger
K. N. Ross

Central Files

Radon-222, pCi/ℓ, Niagara Falls Site

Sampling Period	Monitoring Locations 1	2	3	4	6	7	8	9
8/15/79 - 8/22/79	0.7	0.1	0.6	1.2	2.1	7.6	5.4	7.6
8/22/79 - 8/29/79	0.2	0.2	0.1	0.4	1.5	3.0	4.9	6.7

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239
PHONE: AREA CODE: 513-738-1151

AUG 24 1979

AUG 24 14 49

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS RADON RESULTS, 8/2/79 TO 8/15/79

The attached table contains radon monitoring data obtained at the Niagara Falls site fenceline positions during the period from August 2, 1979 to August 15, 1979.

Sincerely yours,

Original Signed By
S. F. AUDIA
Manager

S. F. Audia
Manager

MWB/vvs

attach.

cc: M. W. Boback
A. J. Breslin - EML
J. H. Cavendish
E. H. Hardison - ORO
R. C. Heatherton
H. D. Hickman
W. C. Hill
R. D. Ohlinger
K. N. Ross

Central Files

Radon-222, pCi/ℓ, Niagara Falls Site

Sampling Period	Monitoring Locations 1	2	3	4	6	7	8	9
8/2/79 - 8/8/79	0.6	0.4	0.6	0.9	Lost	1.2	6.6	6.7
8/8/79 - 8/15/79	1.8	0.3	0.8	0.5	0.5	0.5	1.4	6.9

KCH-LHW 8/31 8/31

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NATIONAL LEAD COMPANY OF OHIO

A SUBSIDIARY OF NL INDUSTRIES, INC.

CINCINNATI, OHIO 45239

August 16, 1979

SUBJECT RADON FLUX EMISSIONS - BLDGS. 413 and 414 - NIAGARA FALLS SITE

TO J. H. Cavendish

FROM F. W. Neblett

REFERENCE [1]F. W. Neblett. Letter to J. H. Cavendish, Evaluation of Asphaltic Sealants - Radon Reduction — Laboratory Tests. May 21, 1979.

[2]D. A. Fuchs. Letter to R. C. Heatherton, Trip Report to NLO-Niagara Falls Site, Lewiston, New York, August 14 to 17, 1978. September 1, 1978.

As requested, the projected level of radon flux emissions in Bldgs. 413 and 414, Niagara Falls site after an emulsion application have been calculated. The calculations are based on:

1) the radon flux measurements presented in references 1 and 2,

2) radon concentrations in the air presented in reference 2, and

3) the average percentage radon reduction for a 1/4 inch emulsion application presented in reference 1.

I. RADON FLUX EMISSION (RF) - UNITS - $pCi/m^2/sec.$

a. Reference 2 - measurements inside center of

Bldg. 413	1452	Avg. = 1454
Bldg. 415	1455	

b. Reference 1 - measurements on sample from

Bldg. 413	600	Avg. = 1050
Bldg. 414	1500	

c. Percent reduction of radon flux = 97.96% (Ref. 1)

d. Estimated radon flux emission (RF[1]) after emulsion application.

1) from reference 2 data:

$$1454 \times \begin{bmatrix} 1-0.9796 \\ 0.0204 \end{bmatrix} = 29.7$$

2) from reference 1 data:

$$1050 \times 0.0204 = 21.7$$

3) actual value from reference 1

average of 7 readings = 18.9

Note: units - pCi/m^2 sec.

II. RADON CONCENTRATION IN AIR (RL)

a. Bldg. 413 (no sealant) - reference 2.

8 ft. from entrance	403
Center	1474
Center	518.2
Average	798

b. Bldg. 414 (no sealant) - reference 2.

8 ft. from entrance	256 (low value)
Center	2247 (high value)
Center	287
Average	930

Average of both bldgs. 864

c. Estimated concentrate in air (RL^1)
Bldgs. 413 and 414 - after sealant application application - assuming:

1) same percentage of reduction of radon applies and

2) same ratio of ventilation and radon decay effect.

For average value -

$$864 \times 0.0204 = 16.3$$

Range -

high value $2247 \times 0.0204 = 45.8$
low value $256 \times 0.0204 = 5.2$

Note: units - pCi/ℓ

III. ESTIMATED CONCENTRATION OF RADON IN AIR OF BLDGS. 413 AND 414 BASED ON TOTAL RADON PRESENT

a. Equate total emission (RF) to total radon in air (RL) and solve for time.

RL = Volume x radon concentration

$$= \left[\frac{2826\ ft^2 \times 17\ ft \times 28.32\ \ell/ft^3}{1.36 \times 10^6\ \ell}\right] \times 864^*\ pCi/\ell$$

$$= 1.18 \times 10^9\ pCi.$$

*Assumed to account for ventilation and radon decay effect.

$$RF = \text{Area} \times \text{emission}$$

$$= [2826\ ft^2 \times 0.0529\ m^2/ft^2] \times 1454\ pCi/m^2\ sec.$$

or

$$262.54\ m^2$$

$$= 0.382 \times 10^6\ pCi/sec.$$

$$\text{Time (sec.)} = \frac{1.18 \times 10^9\ pCi}{0.382 \times 10^6\ pCi} = 3.09 \times 10^3\ sec.$$

$$\text{Time (min.)} = \frac{3090\ sec.}{60\ sec./min.} = 51\ 1/2\ min.$$

b. Radon concentration in air after sealant application (RL^1) then equals:

$$RL^1\ (pCi/\ell) = \frac{RF^1\ (pCi/m^2 sec.) \times area\ (m^2) \times 0.309 \times 10^4\ sec.}{Volume\ (\ell)}$$

and for the RF^1 of 29.7 pCi/m^2 sec.

from Section I, d, 1), RL^1 is:

$$RL^1 = \frac{29.7 \times 262.54 \times 0.309 \times 10^4}{1.36 \times 10^6}$$

$$= 17.7\ pCi/\ell$$

for the RF^1 of 21.4 pCi/m^2 sec.

from Section I, d, 2), RL^1 is:

$$RL^1 = \frac{21.4 \times 262.54 \times 0.309 \times 10^4}{1.36 \times 10^6}$$

$$= 12.8\ pCi/\ell$$

IV. COMMENTS

a. The radon concentration in the air in Bldgs. 413 and 414 projected after sealant application would be somewhere around 17 pCi/ℓ based on the values estimated (17.6, 17.7 and 12.8 pCi/ℓ). The estimated values for radon concentration should be somewhat in agreement since all three values are based on the 97.96% reduction obtained in the lab test.[1]

b. The time of 51 1/2 minutes (Section III, a.) should be, depending on the accuracy of the measurements, the algebraic sum of the time for a complete air change and the distintegration of radon gas in the air during that same period.

F. W. Neblett

FWN/rlr

cc: S. F. Audia-R. M. Spenceley
L. M. Devir
E. H. Hardison (3X)
R. C. Heatherton-M. W. Boback
W. C. Hill
E. W. Mautz
N. R. Leist
A. F. Pennak
C. E. Polson

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239
PHONE: AREA CODE: 513-738-1151

AUG 13 1979

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS RADON RESULTS, 7/18/79 TO 8/2/79

The attached table contains radon monitoring data obtained at the Niagara Falls site fenceline positions during the period from July 18, 1979 to August 2, 1979.

Sincerely yours,
Original Signed By
S. F. AUDIA
Manager

S. F. Audia,
Manager

MWB/vvs

cc: M. W. Boback
A. J. Breslin - EML
J. H. Cavendish
E. H. Hardison - ORO
R. C. Heatherton
H. D. Hickman
W. C. Hill
R. D. Ohlinger
K. N. Ross

Central Files

Radon-222, pCi/ℓ, Niagara Falls Site

Sampling Period	Monitoring Locations 1	2	3	4	6	7	8	9
7/18/79 - 7/25/79	4.2	0.4	0.9	0.5	0.1	4.3	16.6	27.3
7/25/79 - 8/2/79	2.4	0.3	0.7	0.3	1.8	3.5	9.6	6.6

~~RCH~~ ~~MWB~~ 8/11 8/11

AUG 15 11 33

NATIONAL LEAD COMPANY OF OHIO

A SUBSIDIARY OF N L INDUSTRIES, INC.

CINCINNATI, OHIO 45239

August 8, 1979

SUBJECT EVALUATION OF NON-WOVEN POLYETHYLENE MAT (PETROMAT) IN CONJUNCTION WITH ASPHALTIC SEALANTS FOR RADON CONTROL FROM DOE-NF RESIDUES - LABORATORY TESTS

TO J. H. Cavendish

FROM E. W. Mautz and F. W. Neblett

REFERENCE [1]F. W. Neblett. Letter to J. H. Cavendish, Evaluation of Asphaltic Sealants - Radon Reduction - Laboratory Tests. May 21, 1979.

INTRODUCTION

Asphaltic sealants have been found to be effective in the suppression of radon exhalation from uranium mill tailings and refining residues. Recent laboratory work was done at NLO to evaluate the effectiveness of Armak asphalt emulsion for radon suppression from samples of L-50 residue from the DOE-Niagara Falls site and K-65 residues in storage at FMPC. It was determined that the radon flux above the surface of the residues was reduced 84.5-99.9% by the application of the asphaltic sealant.

The present test extended the study concept to the use of a nonwoven polyethylene mat coupled with the asphaltic emulsion treatment of residues.

SUMMARY OF RESULTS

Application of Petromat-asphalt coatings to samples of L-50 residues from Buildings 413 and 414 at the DOE-NF site showed radon flux reductions ranging from 95.7% to 99.9%. There appeared to be no effect attributable to the asphalt emulsion application rate, the number of Petromat layers used (one or two) or small deformations in the residues under the Petromat. The migration of salt (probably sodium carbonates) from the residue through the coating in one test apparently did not result in significant radium transport; weathering action under outdoor field conditions could result in some compromising of the effectiveness of the coating (roofs cover Buildings 413 and 414).

EXPERIMENTAL

This laboratory test was conducted using the techniques reported earlier.[1] The same L-50 residue samples from the DOE-NF site were transferred to new metal cans, excluding as much adhering asphalt as possible; other techniques were simiarly employed in the present test except that sand was not added to the top residue layer before coating.

A large panel of Petromat (Phillips) was obtained by A. F. Pennak (consultant). The required number of six-inch diameter test pieces was cut from the sample panel (1/16-inch thick) using a diagonal pattern to sample the panel; the test pieces were randomly mixed for placement (fuzzy side up) on top of the residues in the test cans (Figure 1). The Petromat material was developed for highway resurfacing where the Petromat is machine-applied from rolls onto a thin asphaltic emulsion layer; a thick layer of asphaltic hot mix is then used to pave the Petromat surface. The Petromat reinforces the bonding surface between the old pavement and the new asphalt layer; disruption of the asphalt integrity is reduced in such service. This reinforcing effect is of interest for use with the asphaltic emulsion being considered for coating DOE-NF site residues, particularly the outdoor, on-grade R-10 residue and contiguous spoil pile.

The present scoping test was performed to evaluate the effectiveness of one or two layers of Petromat coupled with various asphaltic emulsion (Armak E-63) application rates for radon suppression. Twelve radon canisters were obtained from the Environmental Measurements Laboratory (DOE-New York) for use in the test with radon analysis also being done by EML. The test conditions and radon flux results are summarized in Table I. Each asphalt emulsion coating was allowed to cure for 72 hours at an ambient temperature of about 80°F, with a 2-inch high, 4-inch diameter aluminum adapter sleeve* being placed at the time of the final emulsion layer to accommodate the radon canister (Figure 1).

The radon collection canisters were exposed for 48 hours as recommended by EML (short by 15 to 29 minutes with exact times reported to EML for their consideration in interpreting radon results. See Appendix).

---

*Recovered from earlier tests with thorough cleaning for removal of asphalt and residues.

TABLE I

SUMMARY OF RESULTS

Test	Residue[1]	Petromat Layers (No.)	E63M (ml)	Application Rate (gal/ft^2)	Total Application Rate (gal/ft^2)	Radon Flux pCi/m^2 sec. Base L-50	Radon Flux pCi/m^2 sec. After Treatment	Flux Reduction (%) [4]	RA Factor[5]
A-1	4A	1	70	0.0942	0.1346	1500	1.3	99.9	1154
-2		1	30	0.0404					
B-1	2-3	1	100	0.1346	0.2154	533	23	95.7	23
-2		1	60	0.0808					
C-1[2]	10	1	70	0.0942	0.1346	1500	5.5	99.6	273
-2		1	30	0.0404					
D-1[2]	1	1	100	0.1346	0.2154	533	7.5	98.6	71
-2		1	60	0.0808					
E	4	1	70	0.0942	0.0942	1500	16	98.9	94
F[3]	5	1	100	0.1346	0.1346	1500	6.2	99.6	242
G	12	1	190	0.2557	0.2557	533	5.3	99.0	101
H	6	2	70	0.0942	0.0942	1500	11.9	99.2	126
I	14	2	100	0.1346	0.1346	533	10.7	98.0	50
J[3]	7	2	190	0.2557	0.2557	533	0.30	99.9	1777
K[2]	11	1	190	0.2557	0.2557	533	0.21	99.9	2538
L[2]	15	2	190	0.2557	0.2557	533	0.21	99.9	2538

(1) Residues from reference[1] test (L-50 from Bldg. 413 = 533 pCi/m^2 sec; others from Bldg. 414).

(2) Depression deliberately formed in the residue surface (about 2" dia., 1/2" deep) to simulate irregular terrain.

(3) These residues did not absorb water to the same extent as others; see text.

(4) Flux reduction, % = $\frac{(\text{Base} - \text{Treatment})\ 100}{\text{Base}}$

(5) RA Factor = $\frac{\text{Base (as-is) Material Radon Flux}}{\text{After Treatment Material Radon Flux}}$

APPENDIX I

NATIONAL LEAD COMPANY OF OHIO

A SUBSIDIARY OF NL INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

July 25, 1979

Mr. A. C. George
Environmental Measurements Laboratory
376 Hudson Street
New York, New York 10014

Dear Mr. George:

Per your request, the following exposure times are given for charcoal adsorption radon canisters (being returned today by Express mail) in the laboratory test for Petromat-Asphaltic emulsion treatment of DOE-Niagara Falls L-50 residues:

Canister No.	July 23, 1979 Time On	July 25, 1979 Time Off
Z11-7	0815	0800
Z8-1	0816	0800
E12-1	0817	0801
D14-1	0820	0801
D3-3	0822	0802
B11-3	0824	0802
B10-3	0826	0803
A8-3	0827	0803
A8-2	0829	0804
78-17	0830	0804
78-5	0832	0805
14A	0834	0805

Thank you for your assistance. We will be awaiting your results with interest.

Sincerely,

J. H. Cavendish

J. H. Cavendish
Project Manager, D & D Programs

EWM/rlr

8/7/79

Copy to S. F. Audia for his information. Extra copy sent in case one is needed for Mr. Hickman.

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N.L. INDUSTRIES, INC.
CINCINNATI, OHIO 45239

August 3, 1979

SUBJECT RADON EMANATION TESTS

TO R. C. Heatherton

FROM M. W. Boback

REFERENCE

1. M. Wilkening, "Measurement of Radon Flux By The Accumulation Method," pp. 131-8 in Workshop On Methods For Measuring Radiation In And Around Uranium Mills, Atomic Industrial Forum Program Report, Vol. 3, No. 9, August 1977

2. A. J. Breslin, DOE Environmental Measurements Laboratory, New York, Private communication, December 1, 1978

3. Report GJT-21, "Laboratory Research On Tailings Stabilization Methods And Their Effectiveness In Radiation Containment," Ford, Bacon & Davis Utah, Inc., April 1978

Summary

Tests were carried out to determine the effect of water on the rate of radon emanation from a layer of K-65 residues. Radon flux is significantly affected by the amount of moisture in the residues and by the depth of a water cover.

At the Niagara Falls site, water in the west bin of building 411 significantly reduces the flux from the covered residues.

Methods

All tests were made with residue removed from the FMPC north concrete K-65 storage tank. After removal from the tank the residue was blended and samples were submitted to the Technical Division for analysis. The radium-226 content was 17,000 d/m/g. Analytical data are given in Table 1.

After initial tests were made to check the flux measurement technique, a six-inch layer of residue was placed in a clean 55-gallon drum. Except for positioning the flux measuring equipment, the layer of residues was not disturbed until the testing was completed three months later.

Radon flux was measured using an "accumulator can"[1] and scintillation flasks. The original design of the can was altered to eliminate unnecessary features.[2] For flux measurements, the open end of a 10.9-liter can is placed on the test surface. Then a 0.5-liter sample of the can air is withdrawn through valved ports into a scintillation flask. After a 10-minute accumulation period, a second 0.5-liter air sample is withdrawn into a second scintillation flask. After a three-hour delay for the buildup of radon daughters, the amount of radon-222 in the flasks is determined in a calibrated counting system. The radon flux is calculated from the difference in concentration in the two flasks, the size of the accumulator can and the length of the accumulation period.

On dry residues, the can was lightly pushed into the surface to form a seal. When a water layer was present, the can was suspended in a manner that permitted the can edge to be well under the water surface to provide a seal.

Flux rates were calculated in units of picocuries per square meter per second ($pCi/m^2/sec$).

Results

Flux data are plotted in Fig. 1. Initially, the flux from the dry material was 2920 $pCi/m^2/sec$. On subsequent days, the flux dropped to 2800 and then 2640 $pCi/m^2/sec$. Similar results have been reported for laboratory studies of the relationship between radon flux levels and tailings moisture content.[3] In the three-day period during which the "dry" flux was determined, drying of the residues was evident from the progressively lighter appearance of the surface material.

An additional flux decrease occurred after the dry residues were saturated. Water was slowly added to the 55-gallon drum until there was about a half-inch layer above the residue surface. Two days later, the water had completely soaked into the residues. In this condition the radon-222 flux was 2060 $pCi/m^2/sec$. It is likely that sufficient interstitial water was present to impede radon diffusion through the residues to the material surface.

Water was again added to the 55-gallon drum to get a half-inch layer over the residues. On the following day the flux was 550 $pCi/m^2/sec$. After this measurement, water was added to a depth of six inches.

From this point on, flux measurements were made several days apart until equilibrium conditions were reached and the flux was constant. Then additional water was added and the measurements were repeated. This schedule continued until the drum was almost filled.

When the tests ended, the water depth was 26¾ inches and the radon-222 flux from the water surface was 50 pCi/m^2/sec.

At one point during the tests when the water depth was 16 inches, the water layer was carefully transferred to another drum. A sample was analyzed for radium-226. Measurement of the flux at the surface of this transferred water showed that only a small part of the total flux was due to the dissolved radium-226 which was at a concentration of 0.8 picocuries per milliliter (pCi/mℓ). Results given in Table 2 show that the flux decreased over an eight-day period. Initially, most of the flux was due to dissolved radon and the diffusion of radon from the water continued at a greater rate than the generation of radon from the dissolved radium-226. It is possible that a continued flux decline would have been observed if additional measurements were made every few days. There was, however, no reason to continue once it was clear that the dissolved radium-226 did not contribute significantly to the radon-222 flux from the water surface. Therefore, after eight days, the water was returned to the original drum so that the measurement of flux versus water depth could be resumed.

Radon flux from water in building 411, Niagara Falls Site.

During the time that the flux tests were being made, measurements were also made of the radon flux from the water covering the residues in building 411 at the Niagara Falls site.

Charcoal canisters provided by EML were used to determine the flux. The canisters were positioned on metal collars which were held in pieces of expanded foam. The collars extended below the water surface to provide the necessary seal. Each foam block was tethered to maintain the canister location during the exposure period. Canister readouts and flux calculations were made by EML. The canister exposures were made by the Niagara Falls site personnel.

Figure 2 is a diagram of the west bin in building 411. Flux levels and water depths are given. The radon-222 flux at ten locations varied from 25 to 74 pCi/m^2/sec.

Previous measurements in this building showed that the flux from the surface of exposed residues is about 510 $pCi/m^2/sec$. Radium-226 concentration in the residues is 730,000 d/m/g. Dissolved radium-226 in the water was 0.9 pCi/mℓ.

Several points must be considered when comparing these flux results with data from the drum tests. Water depth was greater in building 411 and the residue layer was of greater thickness. The building residues were dumped into the bin from one side, causing a slope which is only partially covered. Building 411 flux levels were measured in cold weather, soon after an ice layer had melted. The drum tests were made in a heated building in which the air temperature did not drop below 60°F.

Despite the differences, the results of the drum tests and the building 411 measurements both show that a water layer will significantly reduce the radon flux.

M. W. Boback

M. W. Boback

MWB/vvs

attach.

cc: A. J. Breslin - EML
J. H. Cavendish
E. Hardison - ORO

Table 1. Laboratory Data, K65 Residue

Radium-226, d/m/g	17,000
Radium-228, d/m/g	<10
Uranium, %	0.30
Thorium, ppm	153
SiO_2, %	45.32
H_2O, %	10.28
CO_2, %	19.30
Loss on ignition at 110°, %	2.82
Loss on ignition at 950°, %	29.79

Size Distribution, after drying at 110°C

Sieve No.	% Retained
4	11.0
6	3.6
16	16.0
30	16.2
50	15.2
100	10.3
200	8.6
325	4.4
Pan.	14.7

Water from 2%, weight-volume slurry

pH	9.2
Cl, mg/ℓ	3
NO_3, mg/ℓ	24
SO_4, mg/ℓ	316

Table 2. Radon Flux from Transferred Water Layer

Days after transfer from residue drum	Radon-222, pCi/ℓ[1] Test 1	Test 2
1	28	27
6	5	6
8	3	3

(1) Two flux measurements, less than 15 min apart, were made each day.

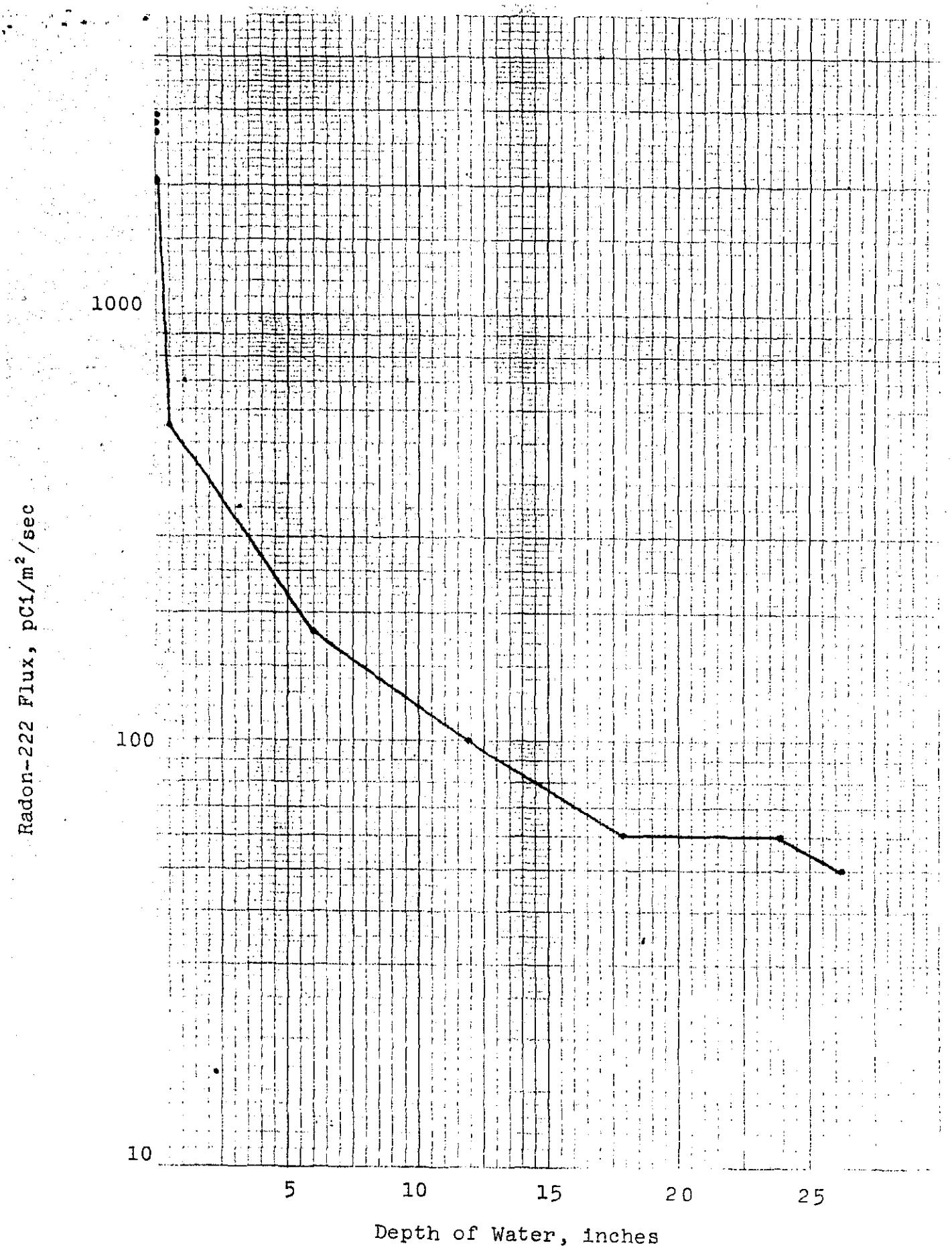
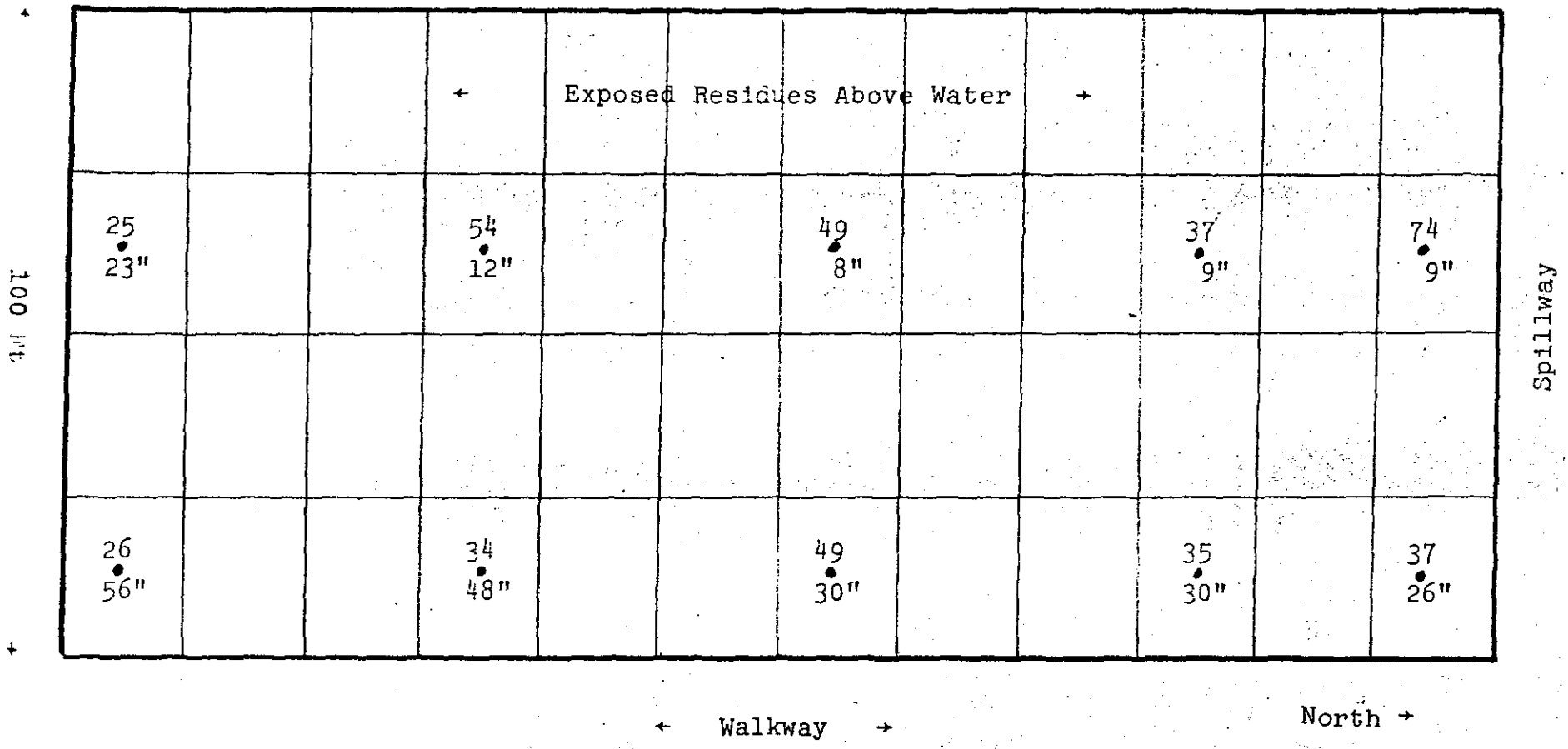


Fig. 1. Variation in radon flux due to depth of water layer.

Fig. 2. West Bin, Bldg. 411, Niagara Falls Site



● Locations where radon-222 flux, at the water surface, was measured using floating charcoal canisters, April 16, 1979.

Radon flux, pCi/m^2/sec, is given above each symbol.
Water depth, in inches, is given below each symbol.

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

AUG 1 1979

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS RADON RESULTS, 7/5/79 - 7/18/79

The attached table contains radon monitoring data obtained at the Niagara Falls site fenceline positions during the period from July 5, 1979 to July 18, 1979.

Sincerely yours,

Original Signed By
R. M. SPENCELEY
Assistant Manager
for S. F. Audia
Manager

MWB/vvs

attach.

cc: M. W. Boback
A. J. Breslin - EML
J. H. Cavendish
E. H. Hardison - ORO
R. C. Heatherton
H. D. Hickman
W. C. Hill
R. D. Ohlinger
K. N. Ross

Central Files

Radon-222, pCi/ℓ, Niagara Falls Site

Sampling Period	Monitoring Locations 1	2	3	4	6	7	8	9
7/5/79 - 7/11/79	3.0	0.2	0.7	<0.1	1.8	3.2	0.9	6.2
7/11/79 - 7/18/79	2.9	0.3	0.5	0.2	3.1	5.4	8.0	7.3

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

JUL 30 9 23

JUL 16 1979

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS RADON RESULTS, 6/20/79 - 7/5/79

The attached table contains radon monitoring data obtained at the Niagara Falls site fenceline positions during the period from June 20, 1979 to July 5, 1979.

Sincerely yours,
Original Signed By
S. F. AUDIA
Manager
S. F. Audia
Manager

MWB/vvs

attach.

cc: M. W. Boback
A. J. Breslin - EML
J. H. Cavendish
E. H. Hardison
R. C. Heatherton
H. D. Hickman
W. C. Hill
R. D. Ohlinger
K. N. Ross

Central Files

Radon-222, pCi/ℓ, Niagara Falls Site

Sampling Period	Monitoring Locations 1	2	3	4	6	7	8	9
6/20/79 - 6/27/79	0.8	0.2	0.3	<0.05	1.3	3.2	0.5	1.9
6/27/79 - 7/5/79	0.9	0.5	0.6	0.6	1.9	1.5	1.2	9.7

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239
PHONE: AREA CODE: 513-738-1151

JUL 3 1979

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS RADON RESULTS, 5/17/79 - 6/20/79

The attached table contains radon monitoring data obtained at the Niagara Falls site fenceline positions during the period from May 17, 1979 to June 20, 1979.

Now that eight NLO radon monitors have been returned to the fence positions, monitoring results will be reported to you every two weeks.

Sincerely yours,

Original Signed By
S. F. AUDIA

S. F. Audia
Manager

MWB/vvs

attach.

cc: M. W. Boback
A. J. Breslin - EML
J. H. Cavendish
E. H. Hardison
✓R. C. Heatherton
H. D. Hickman
W. C. Hill
R. D. Ohlinger
K. N. Ross

Central Files

Radon-222, pCi/ℓ, Niagara Falls Site

Sampling Period	Monitoring Locations							
	1	2	3	4	6	7	8	9
5/17/79 - 5/24/79	1.0	---	0.3	---	---	---	9.5	---
5/24/79 - 5/31/79	0.6	---	0.2	0.05	0.8	---	3.3	2.7
5/31/79 - 6/6/79	1.4	0.2	0.5	0.3	1.5	3.5	4.1	6.1
6/6/79 - 6/13/79	2.0	0.2	0.9	0.4	1.7	2.1	2.9	6.9
6/13/79 - 6/20/79	1.6	<0.05	0.4	0.4	1.2	2.8	10.7	21.5

NATIONAL LEAD COMPANY OF OHIO

INTER-OFFICE ROUTING SLIP

Date 7/16/79

TO: R. C. Heatherton 7/30

M. W. Bobeck 7/31

FROM: D. M. Dexter 369 for our files per LMD

The attached papers are referred for the purpose indicated by the check marks:

- [ ] Please prepare reply for my signature
- [ ] Submitted for signature or approval.
- [ ] Please note and file.
- [ ] Please note and return to me.
- [ ] Please answer, sending me a copy of your letter.
- [ ] Please follow up.
- [x] For your information.
- [ ] Your comments, please.

Remarks:

Department of Energy
Washington, D.C. 20585

JUL 30 9 21

JUN 27 1979

Mr. Joe Kirschue
National Lead of Ohio
P. O. Box 306
Lewiston, New York 14092

Dear Mr. Kirschue:

Enclosed are tabulations of both onsite and offsite radon concentration measurements for the former Lake Ontario Ordnance Works as compiled by the Department of Energy's (DOE) Environmental Measurements Laboratory for the periods ending April 5, 1979, April 24, 1979, May 17, 1979, and May 31, 1979.

Readings at locations on the fencline near the residue storage areas remain at or slightly above the DOE offsite radon concentration guide (3.0 picocuries/liter). All offsite measurements continue to be well below the concentration guide. Please note that an additional offsite monitoring location has been established at the J.and T Junkyard.

We are continuing to assess alternative radon reduction techniques for the uranium residues stored at the site and plan to complete our radon reduction program by August 1, 1979.

We will keep you informed of our progress at the site in the near future.

Sincerely,

William E. Mott

William E. Mott, Acting Director
Environmental Control Technology Division

4 Enclosures

Radon Concentration Measurements at Niagara Falls Site: April 16, 1979

Location	Weekly Average Radon Concentration, pCi/ℓ This Reporting Period+	All Measurements to Date Range	Average
On Site			
Fence Line No. 1	-	0.2 - 2.3	0.9
2	0.3	0.05 - 1.0	0.3
3	0.3	0.04 - 1.1	0.5
4	-	0.01 - 0.8	0.4
5	-	0.2 - 1.0	0.4
6	-	0.05 - 1.6	0.6
7	1.0	0.06 - 15	1.3
8	3.9	0.2 - 23	5.4
9	1.1	0.1 - 5.7	2.3
"O" Street	-	0.05 - 2.1	0.7
Boiler Plant	-	0.1 - 1.9	0.7
Off Site, Outdoors			
F. Guard Property	-	0.2 - 0.6	0.4
F. Monroe Property	0.3	0.05 - 0.8	0.4
Chemtrol "A"	0.2	< 0.03 - 0.5	0.3
Chemtrol "B"	0.2	< 0.03 - 0.8	0.3
Lew Port School	-	0.1 - 0.4	0.3
Nike Site	-	0.1 - 0.4	0.2
Radar Station	-	0.2 - 1.6	0.6
Ransomville	-	0.1 - 0.6	0.2
Gannon Residence	-	0.1 - 0.3	0.2
Oliphant Residence	-	0.2 - 0.4	0.2
W. Schultz Residence	0.1	0.1 - 0.5	0.2
A. Schultz Residence	0.2	0.1 - 0.6	0.2
Jackson Residence	0.2	0.06 - 0.4	0.2
Jowdy Residence	-	0.2 - 0.4	0.3
Daul Residence	-	0.2 - 0.3	0.3
[illegible]	-	0.2 - [illegible]	[illegible]
[illegible] ence		0.09	[illegible]
Lom[illegible] Dairy	.0	0.08	.0
Off S[illegible] Indoors			
Kruge[illegible] rolet (Ranso[illegible]e)		0.4 - [illegible]	[illegible].6
Gannon [illegible]idence		.0.3 - [illegible]	1.0
Oliphant Residence		0.4 - 0.5	0.5
W. Schultz Residence	.4	0.2 - 0.6	0.4
A. Schultz Residence	-	0.4 - 0.9	0.6
Jackson Residence	0.7	0.5 - 1.4	0.8
Jowdy Residence	-	0.4 - 0.9	0.6
Daul Residence	-	0.3 - 0.6	0.4
Lew [illegible] School	0.7	0.2 - 0.7	0.4

+ Latest measurement ending 4/5/79

Radon Concentration Measurements at Niagara Falls Site: April 30, 1979

Location	Weekly Average Radon Concentration, pCi/l		
	This Reporting Period+	All Measurements to Date	
		Range	Average
On Site			
Fence Line No. 1	1.9	0.2 - 2.3	1.0
2	0.5	0.05 - 1.0	0.3
3	-	0.04 - 1.1	0.5
4	-	0.01 - 0.8	0.4
5	-	0.2 - 1.0	0.4
6	0.4	0.05 - 1.6	0.6
7	-	0.06 - 1.5	1.9
8	1.2	0.2 - 23	5.3
9	-	0.1 - 5.7	2.3
"O" Street	0.4	0.05 - 2.1	0.7
Boiler Plant	-	0.1 - 1.9	0.7
Off Site, Outdoors			
F. Guard Property	0.1	0.1 - 0.6	0.3
F. Monroe Property	0.6	0.03 - 0.8	0.4
Chemtrol "A"	0.3	< 0.03 - 0.5	0.3
Chemtrol "B"	0.2	< 0.03 - 0.8	0.2
Lew Port School	0.2	0.1 - 0.4	0.3
Nike Site	0.2	0.1 - 0.4	0.2
Radar Station	-	0.2 - 1.6	0.6
Ransomville	0.08	0.1 - 0.6	0.2
Ganon Residence	0.08	0.1 - 0.3	0.2
Oliphant Residence	0.07	0.07 - 0.4	0.2
W. Schultz Residence	0.2	0.1 - 0.5	0.2
A. Schultz Residence	0.2	0.1 - 0.6	0.2
Jackson Residence	0.2	0.08 - 0.4	0.2
Jowdy Residence	0.2	0.2 - 0.4	0.3
Daul Residence	0.2	0.2 - 0.3	0.2
Bell Aircraft	0.2	0.2 - 0.4	0.3
Hanns Residence	0.1	0.09 - 0.1	0.1
Lombardi's Dairy	0.08	0.08 - 0.1	0.1
J and T Junk Yard	0.1	-	0.1
Off Site, Indoors			
Kruger Chevrolet (Ransomville)	0.3	0.3 - 1.0	0.6
Gannon Residence	0.4	0.3 - 1.6	1.0
Oliphant Residence	0.5	0.4 - 0.6	0.5
W. Schultz Residence	0.3	0.2 - 0.6	0.4
A. Schultz Residence	0.4	0.4 - 0.9	0.4
Jackson Residence	-	0.5 - 1.4	0.8
Jowdy Residence	0.5	0.4 - 0.9	0.6
Daul Residence	0.3	0.3 - 0.6	0.4
Lew Port School	0.2	0.2 - 0.7	0.4

+ Latest measurement ending 4/24/79

Radon Concentration Measurements at Niagara Falls Site: May 21, 1979

Location	Weekly Average Radon Concentration, pCi/ℓ		
	This Reporting Period+	All Measurements to Date	
		Range	Average
On Site			
Fence Line No. 1	2.5	0.2 - 2.5	1.0
2	0.5,0.2,0.2,0.3++	0.05 - 1.0	0.3
3	-	0.04 - 1.1	0.5
4	-	0.01 - 0.8	0.4
5	-	0.2 - 1.0	0.4
6	-	0.05 - 1.6	0.6
7	0.5,1.0,1.6++	0.06 - 1.6	1.8
8	4.7,2.6,4.3,4.6++	0.2 - 23	5.1
9	-	0.1 - 5.7	2.3
"O" Street	0.8	0.05 - 2.1	0.7
Boiler Plant	1.0	0.1 - 1.9	0.8
Off Site, Outdoors			
F. Guard Property	0.2	0.1 - 0.6	0.3
F. Monroe Property	0.4	0.03 - 0.8	0.4
Chemtrol "A"	0.4	<0.03 - 0.5	0.3
Chemtrol "B"	0.1	<0.03 - 0.8	0.2
Lew Port School	0.2	0.1 - 0.4	0.3
Nike Site	0.2	0.1 - 0.4	0.2
Radar Station	0.3	0.2 - 1.6	0.6
Ransomville	0.1	0.1 - 0.6	0.2
Ganon Residence	0.1	0.1 - 0.3	0.2
Oliphant Residence	0.09	0.07 - 0.4	0.2
W. Schultz Residence	0.2	0.1 - 0.5	0.2
A. Schultz Residence	0.1	0.1 - 0.6	0.2
Jackson Residence	0.2	0.08 - 0.4	0.2
Jowdy Residence	0.2	0.2 - 0.4	0.3
Daul Residence	0.1	0.1 - 0.3	0.2
Bell Aircraft	0.09	0.09 - 0.4	0.3
Hanns Residence	0.2,0.06,0.1,0.1++	0.09 - 0.2	0.1
Lombardi's Dairy	0.1,0.1,0.1,0.09++	0.08 - 0.1	0.1
J & T Junkyard	0.4, 0.2++	0.1 - 0.4	0.2
Off Site, Indoors			
Kruger Chevrolet (Ransomville)	-	0.3 - 1.0	0.6
Gannon Residence	0.5	0.3 - 1.6	0.9
Oliphant Residence	0.3	0.3 - 0.6	0.5
W. Schultz Residence	0.4	0.2 - 0.6	0.4
A. Schultz Residence	0.3	0.3 - 0.9	0.4
Jackson Residence	0.5	0.5 - 1.4	0.8
Jowdy Residence	0.4	0.4 - 0.9	0.6
Daul Residence	0.5	0.3 - 0.6	0.4
Lew Port School	0.3,0.4,0.4,0.5++	0.2 - 0.7	0.4

+ Latest measurement ending 5/17/79

++ Concentrations obtained in successive weeks

Radon Concentration Measurements at Niagara Falls Site: June 4, 1979

Location	Weekly Average Radon Concentration, pCi/ℓ: This Reporting Period+	All Measurements to Date: Range	All Measurements to Date: Average
On Site			
Fence Line No. 1	-	0.2 - 2.5	1.0
2	0.2,0.2++	0.05 - 1.0	0.3
3	-	0.04 - 1.1	0.5
4	0.3	0.01 - 0.8	0.4
5	-	0.2 - 1.0	0.4
6	-	0.05 - 1.6	0.6
7	4.6,1.5++	0.06 - 4.6	1.9
8	-	0.2 - 23	5.1
9	-	0.1 - 5.7	2.3
"O" Street	0.4	0.05 - 2.1	0.7
Boiler Plant	0.6	0.1 - 1.9	0.7
Off Site, Outdoors			
F. Guard Property	0.2	0.1 - 0.6	0.3
F. Monroe Property	-	0.03 - 0.8	0.4
Chemtrol "A"	-	<0.03 - 0.5	0.3
Chemtrol "B"	-	<0.03 - 0.8	0.2
Lew Port School	0.2	0.1 - 0.4	0.2
Nike Site	-	0.1 - 0.4	0.2
Radar Station	0.3	0.2 - 1.6	0.6
Ransomville	-	0.1 - 0.6	0.2
Ganon Residence	0.2	0.1 - 0.3	0.2
Oliphant Residence	0.1	0.07 - 0.4	0.2
W. Schultz Residence	-	0.1 - 0.5	0.2
A. Schultz Residence	-	0.1 - 0.6	0.2
Jackson Residence	-	0.08 - 0.4	0.2
Jowdy Residence	-	0.2 - 0.4	0.3
Daul Residence	-	0.1 - 0.3	0.2
Bell Aircraft	-	0.09 - 0.4	0.3
Hanns Residence	0.09	0.09 - 0.2	0.1
Lombardi's Dairy	0.3,0.1	0.08 - 0.3	0.1
J&T Junkyard	0.3,0.1	0.1 - 0.4	0.2
Off Site, Indoors			
Kruger Chevrolet (Ransomville)	-	0.3 - 1.0	0.6
Gannon Residence	0.7	0.3 - 1.6	0.9
Oliphant Residence	0.5	0.3 - 0.6	0.5
W. Schultz Residence	-	0.2 - 0.6	0.4
A. Schultz Residence	-	0.3 - 0.9	0.4
Jackson Residence	-	0.5 - 1.4	0.8
Jowdy Residence	-	0.4 - 0.9	0.6
Daul Residence	-	0.3 - 0.6	0.4
Lew Port School	0.2	0.2 - 0.7	0.4

+ latest measurement ending 5/31/79

++ Concentrations obtained in successive weeks

MAR 22 11 16

J.C. G.P.
3/23 3/22
J.C. S. Fred
M.R.R.

Department of Energy
Oak Ridge Operations
P.O. Box E
Oak Ridge, Tennessee 37830

March 19, 1979

Dr. William E. Mott, Jr., Acting Director of Environmental Control Technology Division, Mail Stop E201, Germantown

This is to confirm our concern that no definitive information on off-site radon monitoring at the DOE Lake Ontario Ordnance Works site is being provided the occupants of homes where radon monitoring equipment has been in place since the Fall of 1978.

Despite verbal assurances some time ago that such information would be assembled by members of your staff for distribution to the occupants, such has not occurred to date.

Beginning in November of 1978 we have advised you and your staff that the occupants were becoming increasingly uneasy over the lack of information being provided them on the results of our monitoring in their homes. The situation continues to worsen. I have just been advised by National Lead that some of the occupants are becoming hostile in their attitude toward NLO personnel who make routine changeout of samples in the homes. They cite as the source of their anger, frustration and growing distrust, a lack of information on what DOE is finding in their analysis of the sampling.

While I understand a copy of A. J. Breslen's summary of the status of the off-site monitoring was dispatched to the Oversight Committee, the Committee has not passed this information along to the occupants. This report would do much to allay concerns that the residents have, and we believe it should be included in the information given to the individuals.

It was my understanding several weeks ago that your staff was to prepare a package of information on the monitoring results for distribution by NLO personnel to the occupants. I fear to delay further will irreparably impair our already strained relations in the Lewiston area and likely jeopardize the continuation of our monitoring program. If it is not possible for your staff to prepare and distribute this information we will be happy to do so.

Charles A. Keller
Charles A. Keller, Assistant Manager
for Manufacturing & Support

COPY

Mr. Alexander

AFRICAN METALS CORPORATION
"AFRIMET"
123 WILLIAM STREET
NEW YORK, N.Y. 10038

TELEPHONE:
AREA CODE (212) 962-6911

CABLE ADDRESS
AFRIMET-NEW YORK

J.J.C.
~~R.C.H.~~ 3/23
W.C.H.
W.J.G.
R.R.S.
~~MWB~~
MWB
3/23

MAR 22 11 34

March 16, 1979

National Lead Company of Ohio
P.O. Box 39158
Cincinnati, Ohio 45239

Attention: Mr. S. F. Audia, Manager

Dear Mr. Audia:

U Tailings
Notice of Inspection Findings
Lewiston, New York

This will acknowledge receipt and thank you for your letter dated March 9, 1979.

With the information contained therein we have written today to Mr. Robert F. Kelly, New York State, Department of Labor, requesting an extension be given for remedial action at such time as the weather permits.

Very truly yours,

AFRICAN METALS CORPORATION

R. Sorum
President

RS:hfg

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF NL INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

MAR 8 1979

Mr. R. Sorum, President
African Metals Corporation
123 William Street
New York, New York 10038

Dear Mr. Sorum:

NOTICE OF INSPECTION FINDINGS

Ref: 1. Letter, R. Sorum to S. F. Audia, "U Tailings. Notice of Inspection Findings, Lewiston, New York," February 26, 1979

2. Letter, W. R. Hott to Frank W. Luscher, January 17, 1979

African Metals Corporation should request the State of New York to extend the 30-day limit imposed for remedial action at the Fletcher Road, Lewiston, facility. The letter requesting the extension should include the following information as justification:

(1) Monitoring results cited in the State notice were being obtained to assess the need for radon control. Continuous monitoring along the fence line began in May, 1978. The results of this monitoring do not indicate any need for immediate action.

(2) Although State Code Rule 38 permits averaging air concentrations over a one-year period, monitoring data obtained during 1978 led to plans for reducing the radon emanation from stored residues. Several control methods are being investigated and remedial action is expected during 1979. Additional necessary surveys cannot be conducted until the snow and ice are gone and the ground returns to the condition at which radon emanation is at a maximum.

(3) Radon concentrations above the State limit for uncontrolled areas occur along the west fence but off-site monitoring shows

only background radon concentrations at nearby residential locations. A report is attached which shows the average concentrations found at the site fence and in the surrounding area up to December, 1978 (ref. 2).

(4) The radon concentrations cited in the State notice were those obtained through November 14, 1978. Since that time, the weekly concentration and long-term average concentrations at position 8 have declined. This general decline is expected to continue as long as there is snow and ice cover. Cold, wet spring weather will also retard radon emanation. Therefore, the year-long average radon concentration at position 8 is expected to be lower than that cited in the notice.

Two copies of the DOE report mentioned in paragraph 3 are attached. A copy should be included in your formal reply to the State notice. A copy has been sent directly to Mr. Kelly from Oak Ridge.

Please do not hesitate to contact us if we can be of further assistance in drafting your reply.

Sincerely yours,

Original Signed By
S. F. AUDIA
Manager

S. F. Audia
Manager

MMB/vvs

attach.

cc: W. J. Brannen
E. K. Hardisen - OR
R. C. Heatherton
M. D. Hickman - OR
W. G. Hill
H. R. Leist
C. E. Polsen - J. H. Cavendish
G. C. Smith - L. M. Devir

FROM THE DESK OF:

S. F. AUDIA

MAR 1 11 69

RCH

Need to get DOE reaction to this + the action they want us to take. Please keep us informed.

2/28

Mike?

AFRICAN METALS CORPORATION
"AFRIMET"
123 WILLIAM STREET
NEW YORK, N. Y. 10038

TELEPHONE:
AREA CODE (212) 962-6911

CABLE ADDRESS
AFRIMET-NEW YORK

MAR 1 11 AM

February 26, 1979

National Lead Company of Ohio
P.O. Box 39158
Cincinnati, Ohio 45239

Attention: Mr. S. F. Audia
Manager

Dear Mr. Audia:

U Tailings
Notice of Inspection Findings
Lewiston, New York

Enclosed please find photostatic copy of Notice of Inspection Findings issued by Mr. Robert F. Kelly, State of New York, Department of Labor, Division of Safety and Health, Radiological Health Unit, covering Mr. Kelly's visit of December 20, 1978 at the above site. This report was sent to us on February 22 and received here today.

You will note that the report concerns radon concentrations at fence line #8 not within the specified limits of New York State code rule 38 as amended on July 10, 1978.

The report also indicates that the above violation should be removed within 30 days of this notice.

Your early comments regarding the above will be greatly appreciated.

Very truly yours,

AFRICAN METALS CORPORATION

R. Sorum
President

RS:hfg
Enclosure

cc: - Mr. E.L. Keller, Director
Technical Services Division
- Mr. Ervin H. Hardison
Technical Services Division
Department of Energy, P.O. Box E, Oak Ridge, Tennessee 37830

FILE NO 1079

STATE OF NEW YORK - DEPARTMENT OF LABOR
DIVISION OF SAFETY AND HEALTH
RADIOLOGICAL HEALTH UNIT
Two World Trade Center
New York, N.Y. 10047

NOTICE OF INSPECTION FINDINGS

2. DATE OF VISIT: 20 DEC 78
3. REGISTRATION NO.: 2218
4. LICENSE NO. (S): 2107-2218
5. IND. CLASSIFICATION: 99
6. TYPE OF VISIT: ☐ REGULAR ☐ SPECIAL ☐ OTHER *
7. R. S. O.: J. L. LINDSEY JR
8. PERSON(S) CONTACTED: —
9. EMPLOYEES EXPOSED: MALE — FEMALE —

NAME, ADDRESS, TELEPHONE NO. OF ESTABLISHMENT

AFRICAN METALS CORPORATION
123 WILLIAM ST.
NYC 10038

SITE:
FLETCHER RD
LEWISTON

FINDINGS

☐ a. No violations found

☑ b. The following paragraphs of Code Rule 38 were found to be violated. (You will be notified if violations are found based on completion of lab. tests of samples collected.)

CODE RULE 38	N.R.C. CODE	EXPLANATION
		Radon concentrations at fence line #8 contained in report of 24 NOV 78 from A. J. Breslin not within specified limits of New York St. Code rule 38 (amended 10 JUL 78).
		* Supplement to Notice of Inspection Findings resulting from inspection by this department on 20 DEC 78 of your Lewiston NY facility

REMARKS

Notice sent 22 FEB 79

The above violations should be removed within 30 days. of this notice

This is Notice 1 of 1 issued.

14. By Robert F. Kelly
RADIOPHYSICIST

NATIONAL LEAD COMPANY OF OHIO

ERDA CONTACT REPORT

FEB 18 1 27

DATE:	ORIGINATOR:	TALKED TO:
Feb. 15, 1979	J. H. Cavendish	E. H. Hardison, ORO

SUBJECT:

Radon Monitoring of Private Homes in Lewiston, N.Y. Area.

SUMMARY OF DISCUSSION:

Erv, said the program of monitoring radon concentration in private homes near the Niagara Falls site had been completed. W. Mott, DOE Headquarters was writing a letter summarizing the results, pointing out that no hazard exists and expressing appreciation to the people for their co-operation. Copies of the letter were to go to each of the homeowners. The plan was to send the letter copies to Joe Kershue for personal distribution to the the homeowners.

KNR

Copies: ~~M. W. Boback~~ MWB 2/20 - ~~R. C. Heatherton~~ 2/16
W. G. Grammer.
L. M. Devir.
W. C. Hill

INSTRUCTIONS:

1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 2/7/75)

Niagara Falls

NATIONAL LEAD COMPANY OF OHIO

DOE CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
2/1/79	M. W. Boback MWB	J. N. Hartley, Battelle NW Lab

SUBJECT:

REDUCTION OF RADON EMANATION

SUMMARY OF DISCUSSION:

At Erv Hardison's suggestion, I called Ford, Bacon & Davis Utah, Inc. two weeks ago to learn if Armak E-63 emulsion was commercially available. I was promised an answer but never got it despite follow-up calls. Today, I called Mr. Hartley who has published a report on tests with the emulsion.

Mr. Hartley said Armak E-63 is available - it is a highway paving material. He gave me the information I requested and also talked about the Battelle test work which was done for DOE. Different emulsions were tested by spraying over residues in five-gallon containers. They found that Armak E-63 reduced the radon flux by >99.9%. FEDU also tested this emulsion and got a 95% flux reduction but Mr. Hartley questions their technique.

Apparently, residue particle size and acidity can affect the degree of flux reduction and can affect the stability of the emulsion seal. Armak E-63 may work well with one type of residue but not with another. Spraying the emulsion on a layer of plastic instead of directly on the residue could also cause undesirable results.

Mr. Hartley was eager to hear details of the NLO radon reduction project and thought that Battelle would like the opportunity to carry out a test on stored residues such as the L-50 material. I said the NLO project coordinator would be informed of the Battelle interest in participating in the work. Mr. Hartley's phone number is 946-2701; calls must go via the Battelle FTS operator, 444-7511.

cc: J. R. Cavendish
W. C. Hill

INSTRUCTIONS:

1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 1/13/78)

NATIONAL LEAD COMPANY OF OHIO

DOE CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
1/18/79	E. Hardison	M. W. Boback

SUBJECT:

RADON SUPPRESSION IN BUILDINGS 413 AND 414, NIAGARA FALLS SITE

SUMMARY OF DISCUSSION:

Erv Hardison said he told African Metals that the residues in buildings 413 and 414 at Niagara Falls should be treated with a covering as NLO has recommended. African Metals has written to Hardison, giving approval to spend "less than $3,000."

OR will soon send NLO a request to proceed with the work.

cc: W. C. Hill

INSTRUCTIONS:

1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 1/13/78)

MHB 1/25.

Department of Energy
Washington, D.C. 20545

JAN 17 1979

Mr. Frank W. Luscher
Rowe Products, Inc.
P. O. Box 218
Niagara Falls, NY 13402

Dear Mr. Luscher:

Enclosed are tabulations of both onsite and offsite radon concentration measurements for the former Lake Ontario Ordnance Works as compiled by the Department of Energy (DOE), Environmental Measurements Laboratory for the periods ending November 14, 1978, December 6, 1978, and December 15, 1978.

As in our previous report of November 30, 1978, the radon concentration for Fenceline Location No. 8 is somewhat above DOE's offsite radon concentration guide (3.0 picocuries per liter). Additional measurements will be required to establish the annual average radon concentration at this location. Based on the interpretations of the data contained in the enclosed report entitled "Status of Environmental Radon Monitoring at the DOE Niagara Falls Site: December 1978," we do not believe that the uranium residues that are stored at the site represent any offsite hazard.

We will continue to provide you with monitoring data as it becomes available.

Sincerely,

William E. Mott

William E. Mott, Director
Division of Environmental
Control Technology

Enclosures:
As stated

cc w/encl: Congressman John J. LaFalce
Paul A. Giardina, EPA
H. G. Fish, EML
Joe Kirschue, NLO

cc w/o encl: E. H. Hardison, OR
Al Breslin, EML

Location	Weekly Average Radon Concentration, pCi/l: This Reporting Period+	All Measurements to Date: Range	All Measurements to Date: Average
On Site			
Fence Line No. 1	*	0.2 - 2.3	1.1
2	*	0.06 - 1.0	0.3
3	0.3	0.04 - 1.1	0.5
4	*	0.01 - 0.8	0.4
5	*	0.2 - 1.0	0.4
6	*	0.05 - 1.6	0.8
7	*	0.06 - 15	2.8
8	6.1	0.2 - 23	6.9
"O" Street	-	0.8 - 1.0	0.9
Boiler Plant	-	0.8 - 1.9	1.4
Off Site, Outdoors			
F. Guard property	-	0.4 - 0.5	0.4
F. Monroe property	0.8	0.03 - 0.8	0.4
Chemtrol "A"	0.5	< 0.03 - 0.5	0.2
Chemtrol "B"	0.8	< 0.03 - 0.8	0.4
Lew-Port School	0.4	0.1 - 0.4	0.3
Nike Site	0.4	0.2 - 0.4	0.3
Radar Station	-	0.4 - 1.6	0.8
Ransomville	0.4	0.1 - 0.6	0.3
Gannon Residence	-	0.3 - 0.3	0.3
Oliphant Residence	-	0.2 - 0.2	0.2
W. Schultz Residence	0.5	0.4 - 0.5	0.4
A. Schultz Residence	0.6	-	0.6
Jackson Residence	0.4	0.4 - 0.4	0.4
Jowdy Residence	0.3	0.3 - 0.3	0.3
Daul Residence**	0.3	-	0.3
Bell Aircraft	0.4	0.3 - 0.4	0.4
Off Site, Indoors			
Kruger Chevrolet (Ransomville)	0.6	0.6 - 1.0	0.8
Gannon Residence	-	0.3 - 0.6	0.4
Oliphant Residence	-	0.6 - 0.6	0.6
W. Schultz Residence	0.6	0.4 - 0.6	0.5
A. Schultz Residence	0.9	-	0.9
Jackson Residence	-	-	1.4
Jowdy Residence	0.7	0.6 - 0.7	0.6
Daul Residence**	0.6	-	0.6

+ Latest measurement ending 11/14/78

*Monitors diverted from fenceline positions for intercalibration

**Substituted for Lewiston DPW

Location	Weekly Average Radon Concentration, pCi/ℓ This Reporting Period+	All Measurements to Date Range	Average
On Site			
Fence Line No. 1	0.4	0.2 - 2.3	1.0
2	<0.5	0.06 - 1.0	0.3
3	<0.5	0.04 - 1.1	0.5
4	0.6	0.01 - 0.8	0.4
5	<0.5	0.2 - 1.0	0.4
6	<0.5	0.05 - 1.6	0.7
7	2.0	0.06 - 15	2.5
8	14	0.2 - 23	7.3
"O" Street	0.3	0.3 - 1.0	0.7
Boiler Plant	0.4	0.4 - 1.9	1.0
Off Site, Outdoors			
F. Guard Property	0.3	0.3 - 0.5	0.4
F. Monroe Property	0.4	0.03 - 0.8	0.4
Chemtrol "A"	0.5	<0.03 - 0.5	0.3
Chemtrol "B"	0.2	<0.03 - 0.8	0.3
Lew-Port School	-	0.1 - 0.4	0.3
Nike Site	-	0.2 - 0.4	0.3
Radar Station	0.3	0.3 - 1.6	0.7
Ransomville	-	0.1 - 0.6	0.3
Gannon Residence	0.2	0.2 - 0.3	0.2
Oliphant Residence	0.2	0.2 - 0.2	0.2
W. Schultz Residence	0.2	0.2 - 0.5	0.3
A. Schultz Residence	0.1	0.1 - 0.6	0.3
Jackson Residence	0.3	0.3 - 0.4	0.4
Jowdy Residence	-	0.3 - 0.3	0.3
Daul Residence	-	-	0.3
Bell Aircraft	-	0.3 - 0.4	0.4
Off Site, Indoors			
Kruger Chevrolet (Ransomville)	-	0.6 - 1.0	0.8
Gannon Residence	1.5	0.3 - 1.5	0.8
Oliphant Residence	0.5	0.5 - 0.6	0.6
W. Schultz Residence	0.5	0.4 - 0.6	0.5
A. Schultz Residence	0.6	0.6 - 0.9	0.7
Jackson Residence	0.9	0.9 - 1.4	1.2
Jowdy Residence	-	0.6 - 0.7	0.6
Daul Residence	-	-	0.6

+ Latest measurement ending 12/6/78

Location	Weekly Average Radon Concentration, pCi/ℓ This Reporting Period+	All Measurements to Date Range	Average
On Site			
Fence Line No. 1	*	0.2 - 2.3	1.0
2	*	0.06 - 1.0	0.3
3	*	0.04 - 1.1	0.5
4	*	0.01 - 0.8	0.4
5	*	0.2 - 1.0	0.4
6	*	0.05 - 1.6	0.7
7	*	0.06 - 15	2.5
8	0.7	0.2 - 23	6.8
"O" Street	-	0.3 - 1.0	0.7
Boiler Plant	-	0.4 - 1.9	1.0
Off Site, Outdoors			
F. Guard property	-	0.3 - 0.5	0.4
F. Monroe property	-	0.03 - 0.8	0.4
Chemtrol "A"	-	< 0.03 - 0.5	0.3
Chemtrol "B"	-	< 0.03 - 0.8	0.3
Lew Port School	0.2	0.1 - 0.4	0.2
Nike Site	0.2	0.2 - 0.4	0.3
Radar Station	-	0.3 - 1.6	0.7
Ransomville	0.1	0.1 - 0.6	0.3
Gannon Residence	-	0.2 - 0.3	0.2
Oliphant Residence	-	0.2 - 0.2	0.2
W. Schultz Residence	-	0.2 - 0.5	0.3
A. Schultz Residence	-	0.1 - 0.6	0.3
Jackson Residence	-	0.3 - 0.4	0.4
Jowdy Residence	0.3	0.3 - 0.3	0.3
Daul Residence	0.3	0.3 - 0.3	0.3
Bell Aircraft	0.3	0.3 - 0.4	0.4
Off Site, Indoors			
Kruger Chevrolet (Ransomville)	0.5	0.5 - 1.0	0.7
Gannon Residence	-	0.3 - 1.5	0.8
Oliphant Residence	-	0.5 - 0.6	0.6
W. Schultz Residence	-	0.4 - 0.6	0.5
A. Schultz Residence	-	0.6 - 0.9	0.7
Jackson Residence	-	0.9 - 1.4	1.2
Jowdy Residence	0.4	0.4 - 0.7	0.6
Daul Residence	0.4	0.4 - 0.6	0.5

+Latest measurement ending 12/15/78

*Monitors diverted from fence line positions for intercalibration

Status of Environmental Radon Monitoring at the DOE Niagara Falls Site: Dec. 1978

A. J. Breslin
Environmental Measurements Laboratory
Department of Energy

Introduction

The Department of Energy Niagara Falls Site is a storage area for residues from the processing of uranium from 1944 to 1953. A major radioactive contaminant of these residues is radium which releases radon, a radioactive gas which can be a health hazard at high concentrations. The present radon monitoring study is designed to check whether an immediate hazard exists and what clean-up measures might be required at the site.

Routine measurements of radon along the fence line of the DOE Site were initiated in May 1978; the monitoring network was expanded to include off site locations in August 1978. The monitoring instruments are installed at fixed locations for one week periods, yielding average concentrations of radon for that week. Measurements are repeated at intervals depending on the locations, and are expected to continue for at least a year. Because atmospheric radon exhibits wide fluctuations with time, the accurate average concentrations needed to gauge the significance of exposures will not be available until the completion of the program. Sufficient data are on hand to indicate general trends, and are presented here along with an interpretation of their significance.

Description of the Monitoring Program

Air is being monitored in the neighborhood of the site to determine if radon concentrations are higher than normal and particularly, if radon concentrations exceed the standard specified by New York State for areas beyond the site boundary. The standard is 3 picocuries per liter (pCi/l)[1], a concentration expressed in units of radioactivity per unit volume of air. (A picocurie is one-trillionth of a curie and a curie represents 37 billion nuclear disintegrations per second.)

The most direct indications of the spread of radon from the site are measurements of radon in air at locations near the site because radon, just like other gases and smoke, is dispersed by local winds. One would expect to find that concentrations are highest on site and that they diminish with increasing distance from the area of release. No increase of concentration is expected to occur inside off site buildings without a corresponding increase outdoors, so outdoor measurements are being emphasized in the current program. Monitoring locations have been selected in several directions with most being located in the downwind quadrant from northeast to southeast.

---

(1) New York Department of Environmental Conservation, Part 380, Rules and Regulations Relating to the Prevention and Control of Environmental Pollution by Radioactive Materials, October 1974.

The natural radon in air from background levels of radium in soil can interfere with monitoring around local sources because of its high degree of variability with time and location. Background concentrations typically range from 0.05 to 0.13 pCi/l but can occasionally be higher or lower. Establishing reliable background values is complicated since local concentrations fluctuate hourly, daily, and seasonally. Figure 1 shows the radon concentrations observed during one week and during one year at Chester, NJ.* These regional and temporal variations require that the background be established by repeated measurements over a long period. In the present case, Ransomville, one of the monitoring locations, is at a sufficient distance to represent background. A second monitoring location which is about two miles upwind (west) from the site is also, in all probability, far enough away to represent background.

Radon concentrations are being monitored in residences around the site to obtain estimates of occupant exposures. It should be noted that radon concentrations indoors almost always are higher than outdoors, often by substantial amounts. This phenomenon is natural and entirely unrelated to any neighboring sources such as the DOE site.

Concentrations of natural radon in buildings are just as variable as those in outside air. In a study of 21 houses in New York City and vicinity [2], annual average concentrations were found to be from 0.2 to 3.1 pCi/l on first floors and from 0.4 to 4.4 pCi/l in cellars; outdoor concentrations averaged 0.2 pCi/l. At any given indoor location, weekly average concentrations varied as much as five-fold over a year and three to four-fold variations were common. Consequently, indoor as well as outdoor measurements must be continued at Lewiston for a year to obtain accurate averages.

Monitoring Results

Monitoring locations with corresponding radon concentrations are shown in Figure 2. There are ten locations on and within the site boundary and 16 locations off site, including Ransomville which is beyond the range of the figure. Each concentration is the average of all weekly measurements obtained to date. The values in parentheses are indoor concentrations; the other values are outdoor concentrations.

---

*Chester, NJ is the site of a regional monitoring station operated by the DOE Environmental Measurements Laboratory.

(2) George, A.C. and Breslin, A.J., The Distribution of Ambient Radon and Radon Daughters in Residential Buildings in the New Jersey-New York Area, presented at the DOE/UT Symp. on the Natural Radiaiton Environment III, Houston, Texas, April 23-28, 1978.

It is important to note that the New York State standard is exceeded at only one location, along the boundary in the southwest corner of the site which borders on an open field. The high concentration at that location is indicative of radium residues that are stored in that area. No member of the public is being exposed for any length of time. At monitoring locations only short distances away from that corner of the site, concentrations are small fractions of the standard.

To evaluate the significance of concentrations at any location, the natural background must be subtracted. At Ransomville, the outdoor concentration is 0.3 pCi/l and at the residence 2 miles upwind at the corner of Creek and Pletcher Roads it is 0.2 pCi/l. These two values are approximate indications of background.

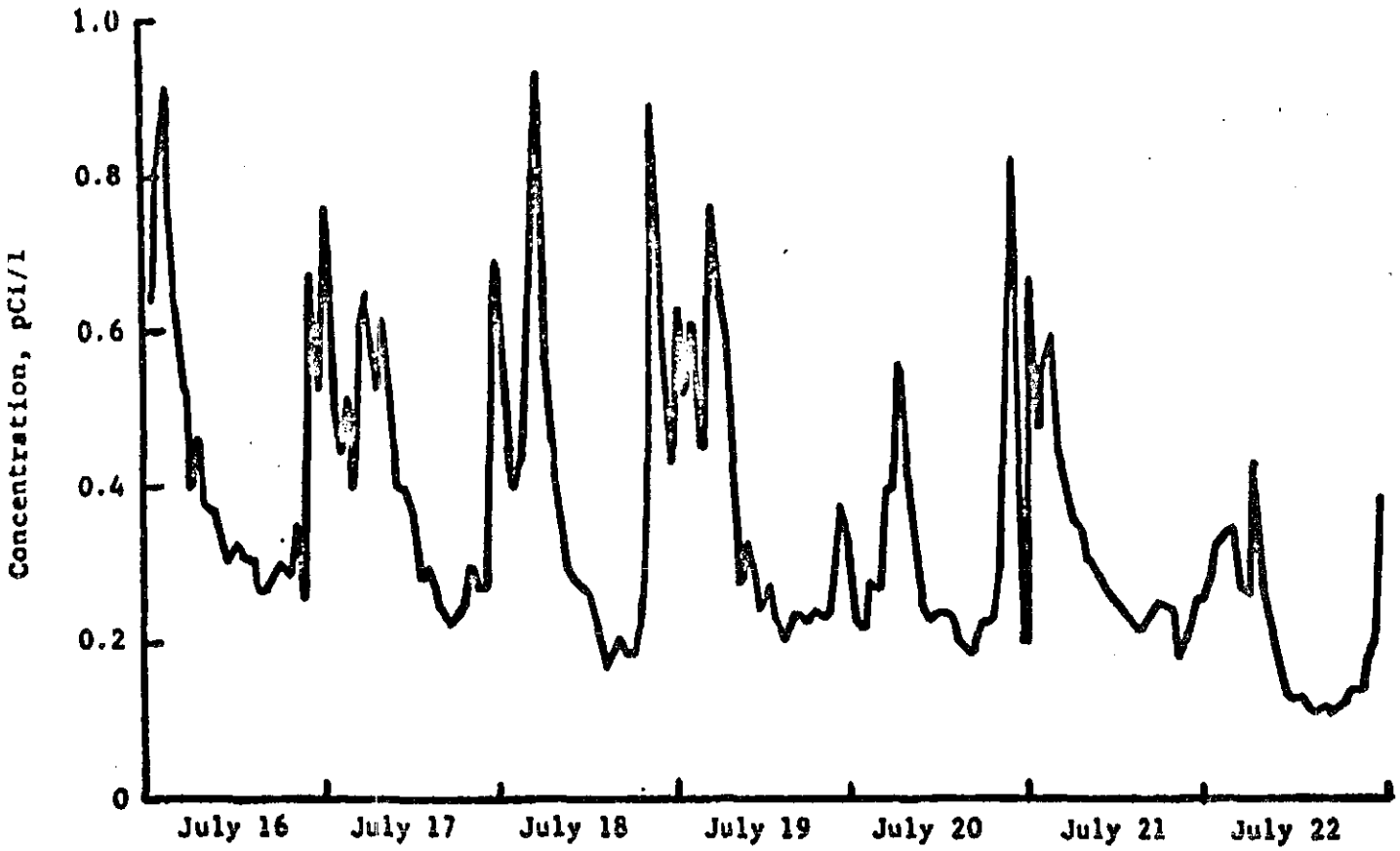
Most of the concentrations on site and along the boundary do exceed background, indicating a continuous release of radon from the residues. Off site, the only location where background is definitely exceeded is near an unoccupied military structure about midway between the southern site boundary and Pletcher Road.

All other concentrations approximate background. It might reasonably be inferred that 0.4 pCi/l, which appears at several outdoor locations, represents some excess over background and further measurements should clarify the point.

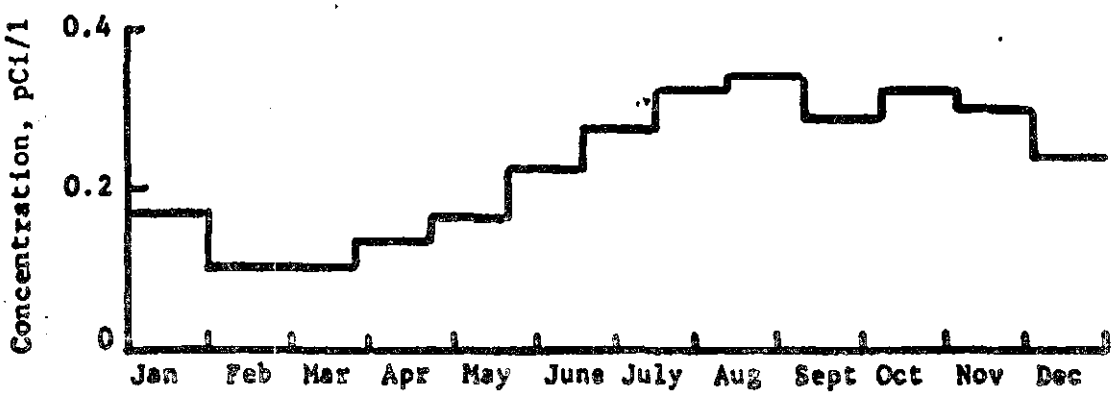
Indoor radon concentrations are greater than the corresponding outdoor concentrations, as expected. However, all are within the range of normal values found in the New York study mentioned previously.

Conclusion

It should be kept in mind that these are interim data and subject to change as additional measurements accrue. However, according to present evidence, exposure to residents in the neighborhood of the DOE site do not exceed those that result from natural background. While abnormal quantities of radon are being emitted from radium residues on the site, the radon is being diluted to background concentrations within short distances from the boundary.



Variation of Radon Concentrations During One Week in 1977



Variation of Radon Concentrations During 1978

Figure 1. Environmental Radon Concentrations at Chester, NJ.

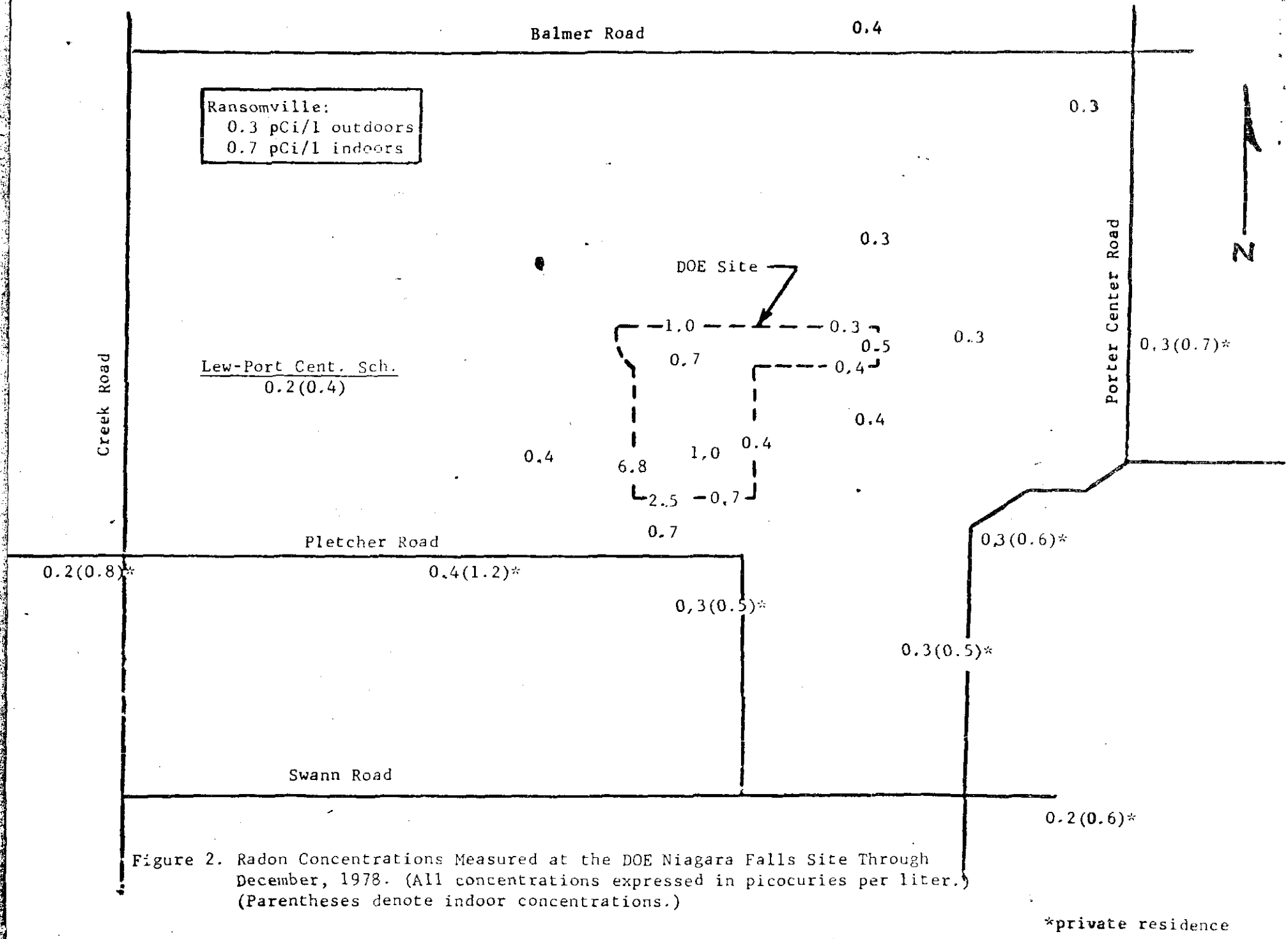


Figure 2. Radon Concentrations Measured at the DOE Niagara Falls Site Through December, 1978. (All concentrations expressed in picocuries per liter.) (Parentheses denote indoor concentrations.)

*private residence

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF NL INDUSTRIES, INC.

P. O. BOX 39158

CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-733-1151

JAN 10 1979

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS RADON RESULTS, 11/22/78 - 12/28/78

The attached table contains radon monitoring data obtained at the Niagara Falls site during the period from November 22, 1978 to December 28, 1978.

On November 30, 1978, the radon monitor at location 5 was moved to a new position along the fence west of the spoil pile. This move was made because of the high radon concentrations found at location 8, the initial west fence sampling location. Except for special tests, we expect to keep the monitor at this new position which is identified as sampling location 9 in the attached table and figure. Location 5 will no longer be used for routine monitoring. This move is justified by the relatively low radon concentrations found at location 5 since the long-term monitoring began in May, 1978.

Sincerely yours,
Original Signed By
S. F. AUDIA
Manager

S. F. Audia
Manager

MWB/vvs

attach.

cc: M. W. Boback
A. J. Breslin - ERL
E. H. Hardison
R. C. Heatherton
H. D. Hickman
W. C. Hill
Central Files

Radon-222, pCi/ℓ, Niagara Falls Site

Period	Monitoring Locations 1	2	3	4	5	6	7	8	9
11/22/78 - 11/30/78	0.27	0.63	0.59	0.58	0.21	0.35	(1)	0.22	
11/30/78 - 12/7/78	(1)	(1)	(1)	(1)	(2)	(1)	0.35	2.48	0.12
12/7/78 - 12/15/78 (3)									
12/15/78 - 12/28/78	0.48	0.05	0.75	0.08	(2)	0.12	1.0	0.11	<0.5

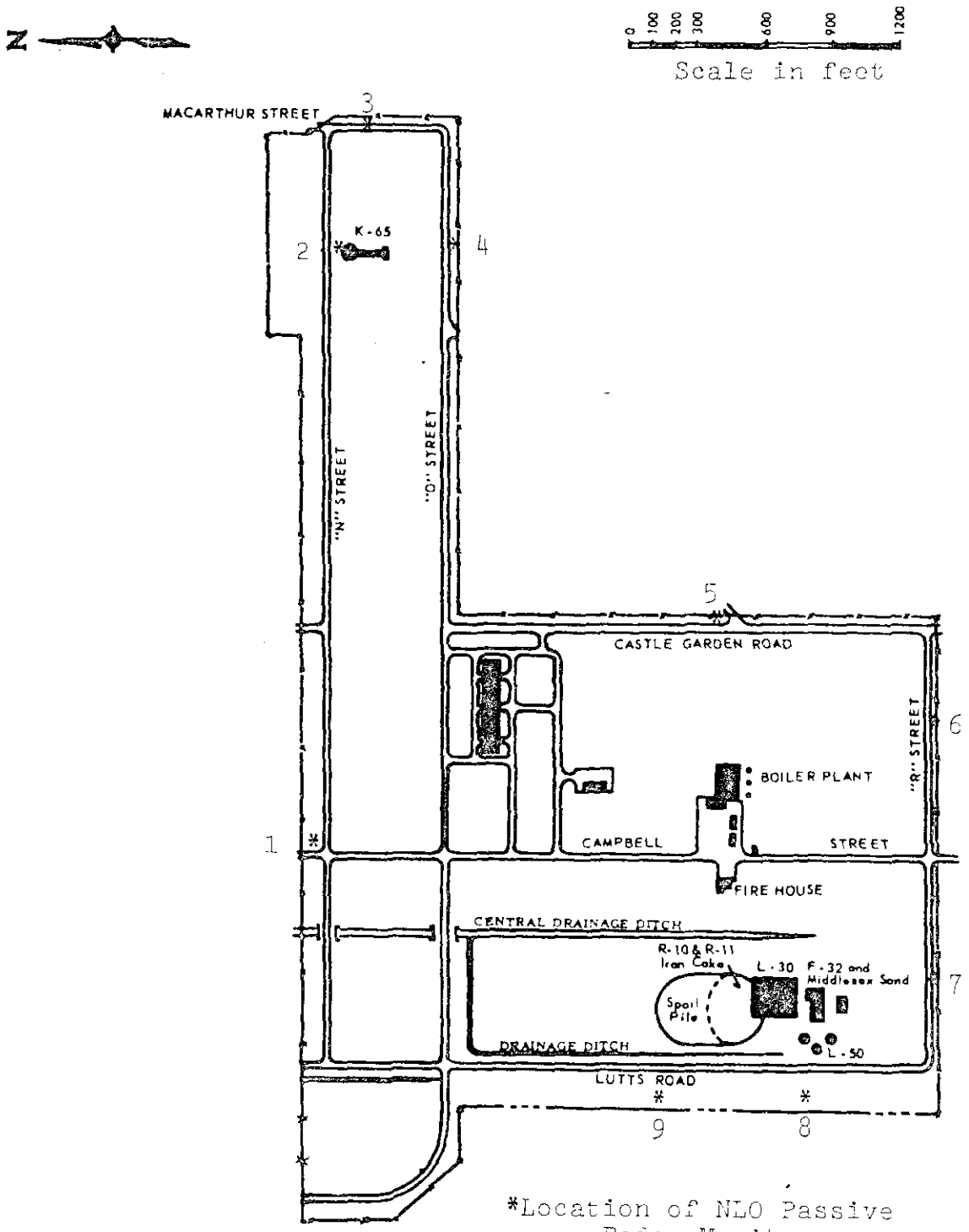
(1) TLD chip lost, broken or fell out of position during exposure period.

(2) Monitor moved from location 5 to location 9.

(3) All monitors placed at location 8 during these periods and all TLD chips sent to EML for readout. EML reported these results:

Monitor No.	Radon-222 pCi/ℓ
1	1.4
2	0.38
3	*
4	*
5	0.53
6	0.76
7	0.47
8	*

* See footnote (1).



Radioactive Waste Storage Locations

Niagara Falls Site

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF NL INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

DEC 6 1978

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

REVISED AND ADDITIONAL NIAGARA FALLS RADON RESULTS

Ref: Letter, S. F. Audia to H. D. Hickman, "Niagara Falls Radon Results, 10/19/78 - 11/9/78," dated November 27, 1978

In the reference letter, incorrect radon concentrations were reported for the period 10/26/78 - 11/2/78. Correct results are reported in the table attached to this letter. The error was not due to equipment malfunction but resulted when the overnight exposure time of a calibration test was mistakenly used for the week-long exposure time of the radon monitors. In the future, calculations will be reviewed to prevent any similar recurrence. We regret any inconvenience this error may have caused.

Also reported in the attached table are results for the periods 11/9/78 - 11/16/78 and 11/16/78 - 11/22/78.

Sincerely yours,

Original Signed By

S. F. Audia
Manager

NWB/vvs

attach.

cc: H. W. Doback
A. J. Breslin - EML
E. H. Hardison
H. D. Hickman
H. C. Heatherton
W. C. Hill

Central Files

Niagara Falls Site

Radon-222 Concentrations, pCi/L

Period	Monitoring Locations							
	1	2	3	4	5	6	7	8
10/26/78-11/2/78	0.66	0.28	0.68	0.21	(1)	0.33	0.58	(1)
11/9/78-11/16/78	0.45	<0.5	<0.5	0.63	<0.5	<0.5	2.04	14.32
11/16/78-11/22/78	1.18	0.70	0.82	0.14	0.74	0.29	<0.5	3.25

(1) TLD ship lost, broken or fell out of position during the exposure period.

NATIONAL LEAD COMPANY OF OHIO

DOE CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
11/30/78	Erv Hardison	M. W. Boback mwB

SUBJECT:

NIAGARA FALLS AND WELDON SPRING SITES

SUMMARY OF DISCUSSION:

Ref: Letter, Fennak and Boback to Audia and Heatherton, "Report of Trip to Niagara Falls, November 2, 1978," dated November 16, 1978

Mr. Hardison asked about the special radon sampling that was planned during the November meeting at the Niagara Falls site (ref.). I gave him information about these items:

(1) Sampling for radon in air downwind from building 411 and the outdoor pile. This was done November 13 and the results show the DOE outdoor pile to be no less important a radon source than the African Metals residue in buildings 411, 413, and 414.

(2) North-south sampling traverse across the pile using EML charcoal canisters to determine the rate of radon emanation from the pile surface. This traverse was made November 13-14.

(3) East-west traverse across the pile. This was done November 20-21.

(4) Determining the rate of radon emanation from water surfaces.

When this call was made, results for items 2 and 3 had not been received from EML. I said a report on items 1-3 would be made to DR after all results were received and studied, probably about mid-December.

In regard to the emanation from water surfaces, it is likely that we will measure the rate at the water-covered residues in building 411 and also do some lab type tests. In order to do lab tests, we will need material from the FMPC K-65 tanks. Mr. Hardison said he would contact African Metals for approval to remove what is needed.

On the subject of Weldon Spring, Mr. Hardison said Oak Ridge would want NLO to have someone remain at the Weldon Spring site to check on health protection and environmental matters while Cotter is removing the pit residues. This thought seemed to have occurred at that moment and was not a possibility that had been previously considered at OR. We should, nevertheless, be prepared for such a request when details of the Cotter work begin to receive OR attention.

cc: D. A. Fuchs
W. C. Hill

INSTRUCTIONS:

1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 1/13/78)

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

NOV 27 1978

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS RADON RESULTS, 10/19/78 - 11/9/78

Ref: Letter, S. F. Audia to H. D. Hickman, "Niagara Falls Radon Results, 9/28/78 - 10/19/78," dated 10/30/78

The attached table contains radon monitoring data for the Niagara Falls site obtained during the period from October 19, 1978 to November 9, 1978. The most recent previous data were reported in the reference letter.

Sincerely yours,

Original Signed By
S. F. AUDIA
Manager

S. F. Audia
Manager

MWB/vvs
attach.
cc: M. W. Boback
A. J. Breslin - EML
E. H. Hardison
H. C. Heatherton
H. D. Hickman
A. F. Pennak

Central Files

Radon-222 Concentrations, Niagara Falls Site(3)

Period	Monitoring Locations 1	2	3	4	5	6	7	8
10/19/78 10/26/78 (2)								
10/26/78 - 11/2/78	4.85	2.02	5.00	1.51	(1)	2.40	4.23	(1)
11/2/78 11/9/78 (2)								

(1) TLD chip lost, broken, or fell out of position during the exposure period.

(2) All monitors were placed at location 8 during these sampling periods and all TLD chips were sent to EML for readout. EML reported these results:

10/19/78 - 10/26/78 Monitor	Radon-222 pCi/ℓ
NLO-1	1.64
-2	0.56
-3	0.57
-4	0.81
-6	1.13
-7	2.4
-9	Lost
-10	Lost

10/26/78 - 11/2/78 Monitor	Radon-222 pCi/ℓ
NLO-1	5.8
-2	6.7
-3	6.0
-4	8.0
-6	3.2
-7	6.8
-9	6.3
-10	5.3
EML Unit	6.1

(3) Concentrations are reported in picocuries per liter (pCi/ℓ).

NATIONAL LEAD COMPANY OF OHIO

DOE CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
11/17/78	E. Hardison	D. Fuchs DAF/MWB

SUBJECT:

NIAGARA FALLS SITE MONITORING

SUMMARY OF DISCUSSION:

Erv Hardison of OR called requesting information concerning the progress of the special monitoring at Niagara Falls. I informed him that two 420' N-S rows of charcoal canisters had been laid out and exposed 11/13-14 (60 canisters in all), and had been shipped to EML for analysis; that these analyses would probably be reported next week; and that 60 more canisters were scheduled to be exposed 11/20-21 in another trip to the Niagara Falls site.

He stated that a contract was being finalized with Cotter Corp. to move material out of the Weldon Spring, Mo. site but that preliminary work must be completed and removal probably will be done in the spring.

cc: A. F. Pennak

INSTRUCTIONS:

1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 1/13/78)

11/20
MWB 11/21

NOV 17 14 48

NATIONAL LEAD COMPANY OF OHIO

A SUBSIDIARY OF N.L. INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

NOV 17 1978

Mr. H. D. Hickman, Director
Manufacturing Division
Department of Energy
Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS SITE

Reference: Letter, H. D. Fletcher to S. F. Audia, "Radon And Associated Monitoring," 10/10/78

As requested in the reference letter, NLO has investigated sources of water in Buildings 410 and 411 at the Niagara Falls site, the degrees of contamination present in the waters, flow between buildings, and other liquid effluent problems at the site that may affect onsite and offsite radiological contamination from radioactive materials stored at the site.

The attached Trip Report presents data and conclusions relative to the above points. If there are any questions please contact us.

Sincerely yours,

Original Signed By
S. F. AUDIA
Manager

S. F. Audia
Manager

AFP:wfk

Att.

cc: E. Hardison, ORO
R. C. Heatherton - M. W. Beback
H. W. Hibbitts, ORO
H. D. Hickman
A. F. Pennak
G. C. Smith - L. M. Devir

RCH-MWB

November 16, 1978

TRIP REPORT ON INSPECTION OF OLD WATER TREATMENT FACILITY AT LOOK ON OCTOBER 12-13, 1978
A. F. Pennak

E. A. Huey

OBJECTIVE OF TRIP:

To inspect the old water treatment facility which is and/or has been used for the storage of contaminated residues in order to determine the source of water in the buildings and to obtain water samples at this facility to determine if the water in these buildings is contaminated and the degree of contamination. See attachment for a facilities plan which depicts water sampling points and analyses of water samples.

BACKGROUND FOR TRIP:

H. Doran Fletcher, in his letter "Radon and Associated Monitoring" dated October 10, 1978 to S. F. Audis, requested in addition to radon monitoring that:

1. Water in Building 410 be monitored for uranium and radium content.

2. Determine source of water in Buildings 410 and 411.

3. Determine if water is being lost to the environment from these buildings, and if so, can the water be contained?

PERSONS VISITED:

Joseph P. Kirchue, National Lead Company of Ohio

DISCUSSION:

A visual inspection of the facilities and drawings was made to determine the source of the water which is in the buildings and that which is flowing into Building 410.

As for water in Building 410, some of it enters through roof openings in Buildings 410 and 415. The water flowing into Building 410 through pipes which penetrate the foundation wall where sample #6 was taken is apparently ground water. The ground water level is high because surface drainage is nil between Buildings 410 and 411 and around the reservoir (Building 411). There appears to be a pipe running between the west chamber of the Recarbonation Basin where sample #3A was taken and Building 415 where sample #4 was taken. This pipe had been sealed but portions of the pipe seal have corroded. The analyses of samples 3A and 4 indicate that there is no significant flow if any at all from the Recarbonation Basin to Building 415.

As for the source of water in the recarbonation basin, it can only be direct rainfall with possibly some run-off from the reservoir roof which is flowing behind the gutter which was originally installed to prevent this run-off from entering the recarbonation basin. The water level in this basin, the east chamber of this basin and the trough in Building 411 extending from the recarbonation basin to the north-south divider wall in Building 411 is above ground level (top of embankment around Building 411). The water in the west chamber of the Recarbonation Basin where sample 3A was taken was approximately 12 feet lower than the level in the basin. Water in the west half of the reservoir (Building 411) is about 2 feet below that in the basin and the trough. Water in the east half of the reservoir is approximately 15 feet below the water level in the west half.

In relationship to the surrounding area ground level at the bottom of the embankment around Building 411, water in the west half is approximately seven feet above this ground level and about eight feet below this ground level in the east half.

The source of water in the reservoir is difficult to determine. There are signs of some roof leakage but this leakage would not produce the amount of water that does exist. The water in the trough apparently comes from the recarbonation basin. There were openings in each end of this trough which have been sealed.

Rain which falls on the reservoir roof flows over the east and west edges of the roof and drops into open troughs which are laid on the ground. These troughs are apparently connected to a drainage system which discharges into the central drainage ditch. Water no longer flows in these troughs which are clogged

with earth and vegetation. As a result the troughs overflow onto the ground. This water is trapped around the reservoir since ground elevation at the reservoir perimeter fence (which is approximately ten feet from the reservoir) is about one foot higher than the ground elevation at the reservoir. This water could enter the reservoir if there were cracks or penetrations in the 24 inch thick reservoir wall. From visual observation of the interior of the east half on October 13, 1978 after a substantial rainfall, it would appear that this source is doubtful.

Water at Buildings 410, 411, 415 and the recarbonation basin escapes to the environment primarily through evaporation. As for Building 410, water apparently flows through wall penetrations after heavy rainfalls to the central drainage ditch. The analyses of water samples 4, 5 and 6 taken at Building 410 indicate that the degree of contamination is insignificant.

CONCLUSIONS:

1. The contamination in the water in various areas of Building 410 is minimaland indicates the source of the water is ground water and rain water.

2. There are no indications of flow of water between the various buildings, with the exception of seepage communication between the recarbonation basin and a trough along the south wall in Building 411.

3. The source of water in the recarbonation basin is direct rainfall plus possibly some run-off from the Building 411 roof.

4. The source of water in Building 411 cannot be stated with certainty. Roof leakage is a contributor but in no way can produce the quantity of water present. Additional investigations are underway to determine possible contributions from roof drainage onto the adjacent ground entering the building.

5. Water from Building 410 apparently escapes to the central drainage ditch through wall penetrations after heavy rainfall. There are no signs of water escape from Building 411. Since the water in Building 410 is concluded to be ground water the existing ground water sampling system appears to be adequate control.

RECOMMENDATIONS:

In regard to possible leakage to the environment via the ground water, the current quarterly sampling program at test wells around the water treatment facility and the central drainage ditch provides adequate surveillance.

COMMITMENTS:

None.

E. A. Huey

E. A. Huey

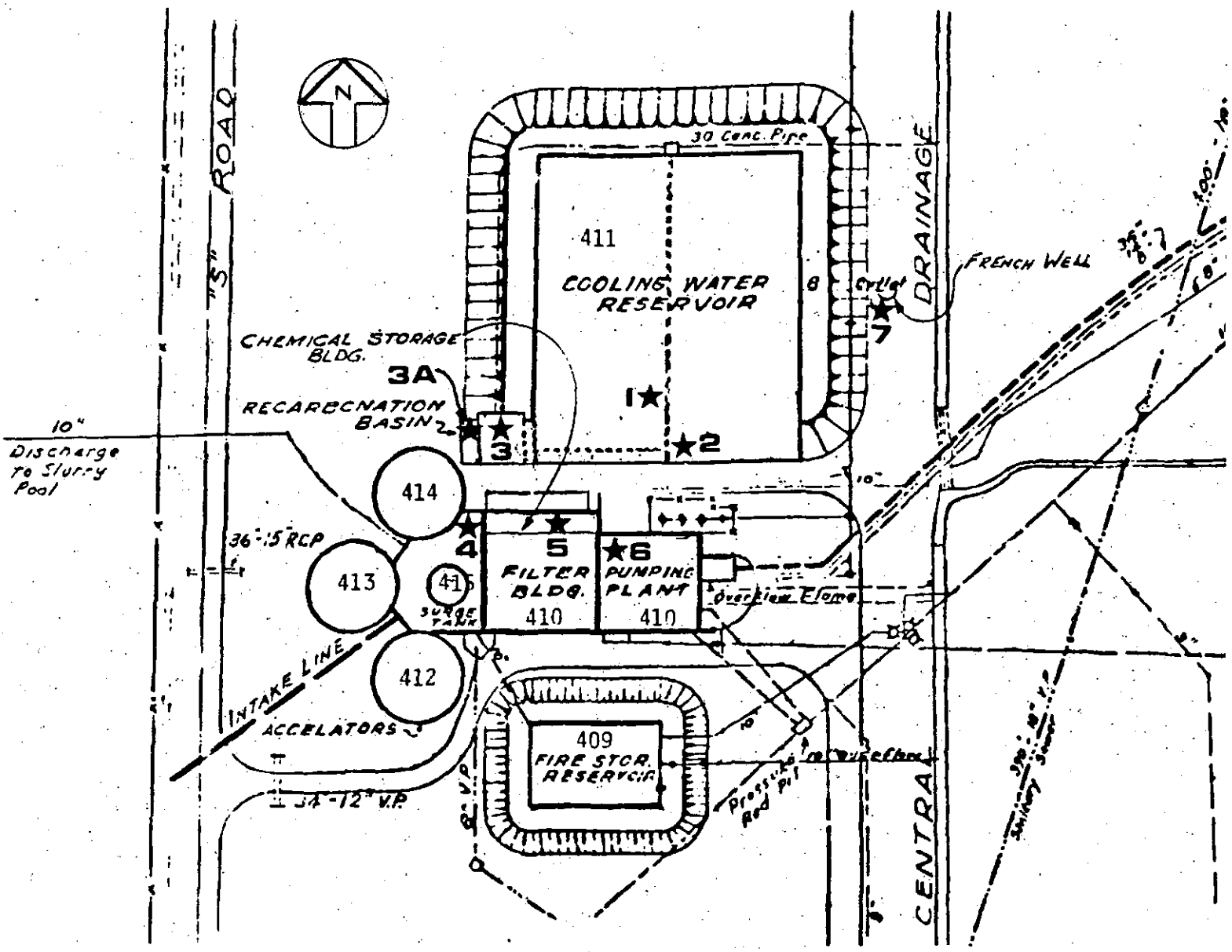
EAH:wfk

Att.

cc: S. F. Audia
J. W. DeDapper
R. C. Heatherton - M. W. Boback
J. P. Kirchue
G. C. Smith - L. M. Devir

Central Files

Attachment



ANALYSES OF WATER SAMPLES					
Sample No.	Date Collected	pH	Uranium ppm	Radium-226 d/m/ml	
1	10/12/78	9.8	90	1.5	
2	"	9.8	100	1.5	
3	"	8.0	0.4	5.0	
3A	"	9.0	6.8	0.26	
4	10/13/78	7.9	1.3	0.041	
5	"	8.0	1.4	0.043	
6	"	8.2	1.6	0.067	
7	"	7.2	0.8	0.007	

KNKM
~~DAF~~ DAF
10/16

RC H. M. W. B. Pum
G. J. P.
GC S. Rm. D.
NRL

OCT 16 11 27

Department of Energy
Oak Ridge Operations
P.O. Box E
Oak Ridge, Tennessee 37830

October 10, 1978

National Lead Company of Ohio
ATTN: Mr. S. F. Audia
Manager
Post Office Box 39158
Cincinnati, Ohio 45239

Gentlemen:

RADON AND ASSOCIATED MONITORING

As discussed informally on October 2, 1978 between Messrs. Hibbitts of ORO and Boback of your staff, we would like to request additional monitoring and associated efforts at the LOOW, Fernald, and Weldon Spring sites.

It was our original intent, as well as Mr. Boback's, that additional radon monitoring at Fernald and Weldon Spring would be performed when some of the passive monitors in use at LOOW became available. With the level of effort now foreseen for LOOW, this plan no longer appears reasonable. We would request then that NLO initiate a radon monitoring program at those two sites as soon as practicable. The program should be designed to determine average levels of ambient radon at the DOE property boundaries and should take into consideration such factors as seasonal and diurnal variations. Background concentrations should also be obtained.

As a result of a recent visit to LOOW by Messrs. Hibbitts and Davis of ORO, the following efforts are requested:

1. Radon should be monitored at the fence line north of Station 8 and west of the R-10 storage area.

2. Water in the 410 Building should be monitored for uranium and radium content.

ORIGINAL

3. Attempts should be made to determine/verify the source of water in the 411 building, as well as 410. Also, if the 410 water is contaminated, it should be verified that it is not being lost to the environment, that it can be contained by corrective action, or that it is monitored and determined to be insignificant. (We are particularly concerned that water may be leaking from 411 to 410.)

4. A radon source term should be determined for the DOE stored materials. External radiation levels are considerably higher on the average north of the spoil pile than on the south end of the pile where the R-10 is reportedly located.

Since some of the above efforts will require access to African Metals facilities, we will need to notify them of your plans when they become firmed up. African Metals permission must be obtained for access to their facilities for any work not covered under the lease.

Your attention to this request will be appreciated. Questions should be directed to either Wayne Hibbitts or Doyle Williams.

Sincerely,

H. Doran Fletcher

H. Doran Fletcher, Director
Uranium Enrichment Operations Division

OSE:HWH

CC: C. A. Keller
J. L. Foutch
W. H. Travis

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

OCT 3 0 1978

Mr. H. D. Hickman, Director
Manufacturing Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Hickman:

NIAGARA FALLS SITE RADON RESULTS, 9/28/78 - 10/19/78

Ref: Letter, S. F. Audia to H. D. Fletcher, "Niagara Falls Radon Results, 9/7/78 - 9/28/78," dated 10/9/78

The attached table contains the results of Niagara Falls radon monitoring during the period from September 28, 1978 to October 19, 1978. The most recent previous data were reported in the reference letter.

Sincerely yours,

Original Signed By
S. F. AUDIA
Manager

S. F. Audia
Manager

MWB/vvs

attach.

cc: M. W. Beback
A. J. Breslin - EML
R. C. Heatherton
H. D. Hickman
C. A. Keller
A. F. Pennak

Central Files

Radon-222 Concentrations, Niagara Falls Site

Period	Monitoring Locations 1	2	3	4	5	6	7	8
9/28/78 - 10/5/78(2)	---	(1)	(1)	(1)	0.48	0.81	1.0	4.3 16.7
10/5/78 - 10/12/78	0.23	<0.5	(1)	<0.5	<0.5	0.05	0.06	1.29
10/12/78 - 10/19/78	0.60	<0.5	0.04	<0.5	<0.5	0.46	4.81	22.79

(1) TLD chip lost, broken, or fell out of position during the exposure period.

(2) During this sampling period the monitor from location 1 was used at location 8 and all TLDs were sent to EML for readout.

NATIONAL LEAD COMPANY OF OHIO

DOE CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
10/26/78	Doyle Williams	M. W. Rohrbaugh MWB

SUBJECT:

REPORTING NIAGARA FALLS RADON RESULTS

SUMMARY OF DISCUSSION:

Williams said OR received a teletype from Dr. Mott regarding the reporting of Niagara Falls radon results. He read a portion of it which instructed NLO to report data to Al Breslin (EML) on a weekly schedule. I said it would be no problem since NLO and EML results are discussed with Breslin at least once each week. Williams then asked that we also report the results to Oak Ridge, just as we have in the past. Agreed.

cc: D. A. Fuchs
A. F. Pennak

INSTRUCTIONS:

1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 1/13/78)

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF NL INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

OCT 1978

Mr. H. Doran Fletcher, Director
Uranium Enrichment Operations Division
Department of Energy
Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Fletcher:

NIAGARA FALLS RADON RESULTS, 9/7/78 - 9/28/78

Ref: Letter, S. F. Audia to H. D. Fletcher, "Niagara Falls Radon Results, 5/25/78 - 9/7/78," dated 9/18/78

The attached table contains the results of Niagara Falls radon monitoring during the period from September 7, 1978 to September 28, 1978. Previous data were reported in the reference letter along with a map that showed the monitoring locations.

Sincerely yours,

Original Signed By
S. F. AUDIA
Manager

S. F. Audia
Manager

MWB/vvs

attach.

cc: M. W. Beback
A. J. Breslin - ERL
H. D. Fletcher
✓R. C. Heatherton
C. A. Keller
A. F. Pennak

Central Files

Radon-222 Concentrations, Niagara Falls Site

Period	Monitoring Locations							
	1	2	3	4	5	6	7	8
9/7/78 - 9/14/78	0.80	(1)	<0.5	0.19	0.32	1.40	0.74	13.82
9/14/78- 9/21/78	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	14.85	2.81
9/21/78- 9/28/78	0.45	0.24	0.25	0.24	0.18	0.44	2.53	12.10

(1) TLD chip lost, broken, or fell out of position during the exposure period.

NATIONAL LEAD COMPANY OF OHIO

DOE CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
10/4/78	Doyle Williams	M. W. Boback

SUBJECT:

MEETING AT OAK RIDGE

SUMMARY OF DISCUSSION:

Doyle asked if I could attend an Oak Ridge meeting, October 12 or 13, to discuss methods to obtain improved radon flux measurements at Niagara Falls. Participants would be from OR, EML, NLO, and Ford, Bacon, Davis Utah, Inc. I told him October 12 was preferred but I could attend on either date.

cc: A. F. Pennak

INSTRUCTIONS:

1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 1/13/78)

NATIONAL LEAD COMPANY OF OHIO

DOE CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
10/3/78	Wayne Hibbitts	M. W. Goback

SUBJECT:

NIAGARA FALLS

SUMMARY OF DISCUSSION:

Wayne was at the Niagara Falls site last week and met with representatives of Ford, Bacon & Davis Utah, Inc., the consulting firm working for DOE-HQ on the problem of radon containment. The representatives told Wayne they will recommend to HQ that the indoor residues be leveled off and covered with water to reduce the rate of radon emanation. They also said they doubted the accuracy of the radon flux data obtained when Don Fuchs used the EML charcoal canisters in August. It was their opinion that the canisters became saturated during the two-day exposure period and the results were low. (EML came to this same conclusion and sent one of their men to repeat the measurements, with shorter exposure periods, about two weeks ago.)

I told Wayne that any plan to use a water covering on the indoor residues will require that the storage basin be checked thoroughly to insure there is no way for the water to drain out. There are indications that the water level in the Bldg. 411 basin fluctuates more rapidly than would be expected for a precipitation-evaporation cycle. Wayne agreed and was reminded that while in Bldg. 410, he heard, and others saw, water running into the Bldg. 410 storage pit. NLO will be formally asked (probably in the letter discussed below) to thoroughly study the movement of water at the storage buildings and recommend action to prevent any flow into or out of the storage pits.

NLO will be getting a letter from OR which may include a request to determine as accurately as possible the radon emanation rate from the DOE residues stored outdoors at Niagara Falls. Wayne thinks a covering effort cannot be justified until a radon "source term" is established. We may also be asked to make a change in the location of the radon monitors -- Wayne believes we need another one along the west side, near Bldg. 411, near the present station no. 8.

The [illegible] letter will also ask that NLO expedite collection of radon data at Weldon Spring and at the FNPC.

Any future work at Niagara Falls involving entry into one of the African Metals storage areas will have to have OR approval. Requests for approval may be made, by phone, to Doyle Williams.

cc: D. H. Fuchs
A. F. Hemax

INSTRUCTIONS:

1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 1/13/78)

NATIONAL LEAD COMPANY OF OHIO

DOE CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
9/18/78	R. W. Fibbitts	M. W. Boback MWB

SUBJECT:

RADIUM CONTENT OF WATER IN BLDG. 411, NIAGARA FALLS SITE

SUMMARY OF DISCUSSION:

Wayne called to discuss the problem of radon emanation from the water in Bldg. #11. C. A. Keller had raised a question about the water being a source of radon if the water is pumped to another building in order to prepare the residues for sealing.

Wayne's diffusion calculations led him to conclude the water is now and would continue to be a significant radon source, about equivalent to all of the residues combined. This conclusion seemed incorrect since the concentration of radium-226 in the water was only 1.9 dpm/mL. After a lengthy discussion, I agreed to consider the question and return the call. I also told Wayne I would ask Don Fuchs to call him with information about the size of the pool in Bldg. 411.

Late in the afternoon, after Don called, I called Wayne to tell him that it was still my opinion that the radium in the water would be insignificant as a radon source when compared with the residues. Using information he got from Roy Anderson, Wayne calculated a water volume of 670 m^3. If so, the total radium is 0.6 mCi, which is insignificant when compared with the quantity in the stored residues. If the water is pumped off and allowed to evaporate, the resulting solids will amount to 7 tons. The radium concentration in these solids will be 92 pCi/gram, which is about 100 x the concentration found in background soil. It is also about one percent of the concentration found in the various residues.

cc: A. F. Pennak

INSTRUCTIONS:

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NLO-GEN-2401 (REV. 1/13/78)

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF NL INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

SEP 18 1978

Mr. H. Doran Fletcher, Director
Uranium Enrichment Operations Division
Department of Energy
Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Fletcher:

NIAGARA FALLS RADON RESULTS, 5/25/78 - 9/7/78

The attached table contains the results of Niagara Falls radon monitoring for the period 5/25/78 to 9/7/78. This period covers the initial monitoring with the NLO-constructed passive radon monitors and includes all results obtained through September 7. We shall continue to report results to you, by letter, periodically.

Approximate sampling locations are shown on the attached diagram. With the exception of location 2, the passive radon monitors are mounted on the boundary fence. At location 2, the monitor is mounted on an inner fence about 50 feet from the K-65 silo.

Continued efforts are being made to improve the calibration of the NLO passive radon monitors and to determine the lower detection level. This limit will be below 0.5 pCi/ℓ and it is likely to be 0.2 pCi/ℓ or less. Until the concentration is determined, we shall report all positive results, as obtained, without a detection point cut-off; if readout of the TLD chips does not yield a positive value, the result will be reported as less than 0.5 pCi/ℓ.

Sincerely yours,
Original Signed By
S. F. AUDIA
Manager

MWB/vvs

S. F. Audia
Manager

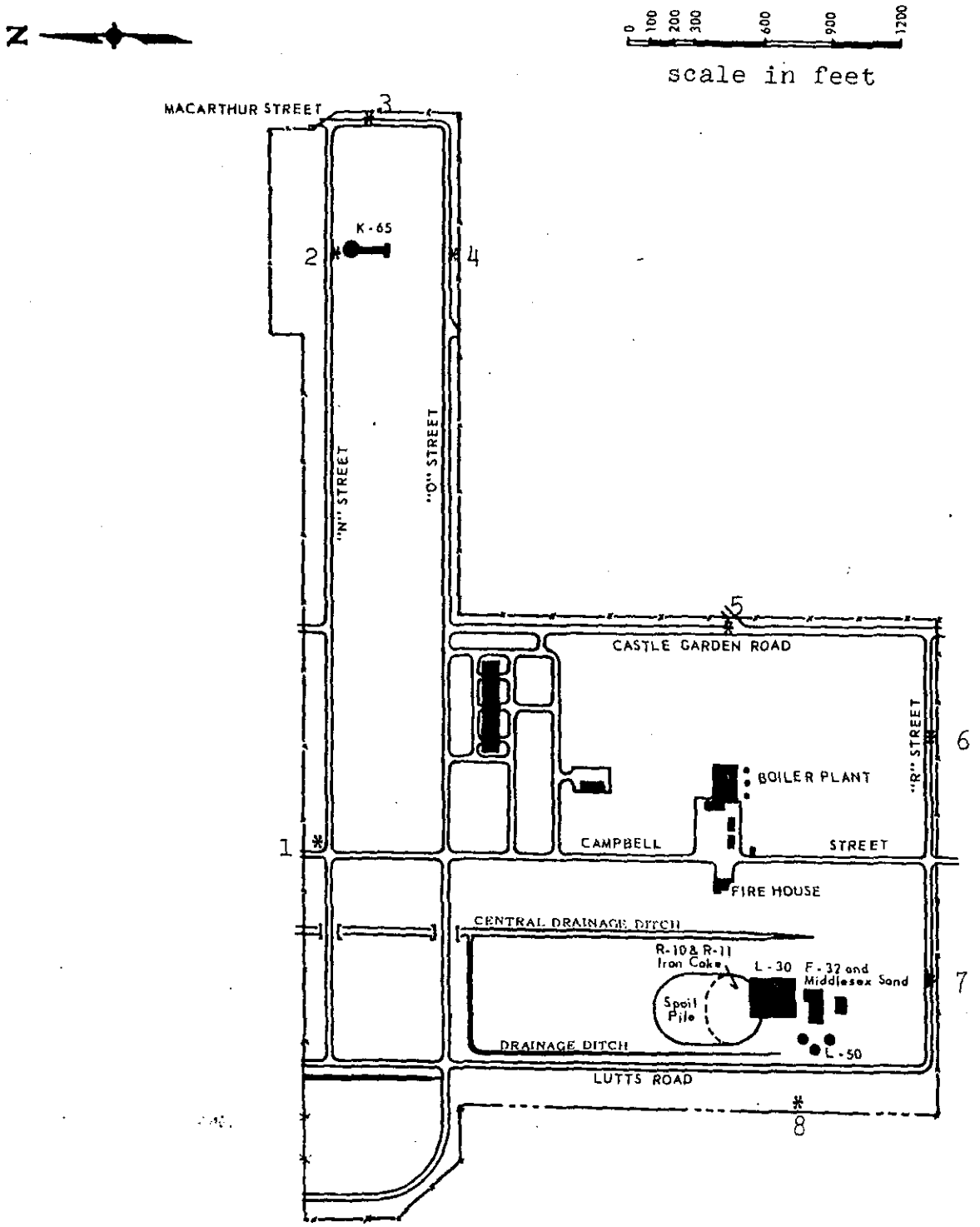
attach.

cc: [illegible] Schack
[illegible] Kreslin - ANL
H. D. Fletcher
R. C. Heatherton
C. [illegible] Keller
A. [illegible] Pennak
Central Files

Radon-222 Concentrations, Niagara Falls Site

Period	Monitoring Locations 1	2	3	4	5	6	7	8
5/25/78-6/1/78	0.67	<0.5	<0.5	0.31	<0.5	0.51	<0.5	0.19
6/1/78-6/15/78	(1)	0.11	0.42	0.15	0.20	0.32	0.76	2.92
6/15/78-6/29/78	(1)	0.07	0.36	<0.5	0.54	0.37	<0.5	<0.5
6/29/78-8/10/78	(1)	0.14	0.51	0.58	0.10	1.10	1.15	4.11
8/10/78-8/17/78	2.04	1.03	1.08	0.82	0.60	1.39	4.05	14.36
8/17/78-8/24/78	2.03	<0.5	1.05	<0.5	<0.5	1.60	4.66	14.23
8/24/78-8/31/78	1.43	0.06	0.04	0.01	0.17	<0.5	0.73	3.82
8/31/78-9/7/78	2.27	<0.5	<0.5	<0.5	(1)	1.04	(1)	(1)

(1) TLD chip lost, broken, or fell out of position during the exposure period.



Niagara Falls Site

*Location of NLO Passive Radon Monitors

Send copy to
RCH
LMD
MWD 9/12
MWD 9/13
AZA F1-3
LMD 9/12

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF NL INDUSTRIES, INC.

P. O. BOX 39158

September 11, 1978

Mr. R. Sorum, President
African Metals Corporation
123 William Street
New York, New York 10038

Dear Mr. Sorum:

In accordance with instructions from DOE-ORO I am returning to you the New York State Department of Environmental Conservation "Application For Permit to Construct or Certificate To Operate" and other materials which you sent with your letter of August 16, 1978.

We have not completed the form as you requested (again by instruction of DOE-ORO) but offer the following comments:

1. Mr. Cashman, NYS-DEC, in his letter to you stated that you must demonstrate that "radioactive emissions are 'as low as practicable'," and "submit details on control measures....." planned to reduce the discharge of radioactivity.

   We have just completed a brief study and literature search on work done to date by others on methods for reduction of radon exhalation from uranium mines and U tailings, and the possible application of the various proposed methods to the residues at Niagara Falls. A report on our study has been sent to H. Doran Fletcher at DOE-ORO, and is being evaluated by him. Possibly a portion of the information contained in the report could be made available to you by Mr. Fletcher.

   It should be noted that not very much data on field results of attempts to reduce radon exhalation is available. Most information obtainable are the

products of laboratory tests. Thus any decisions for field application of the various covers, sealants, etc. tested must be a matter of judgment based upon application of laboratory test results to the characteristics of the situation in question.

2. The second requirement mentioned by Mr. Cashman was the demonstration that "exposures in any uncontrolled areas are within permissible limits." He describes the necessity of mathematical modeling of environmental exposure pathways to confirm the projected levels through environmental monitoring.

   As you are aware, NLO (for DOE) has a program underway at the Niagara Falls site to monitor the radon concentrations at the site boundaries. Only a limited amount of data is available and certainly not enough to be determinative of yearly average ambient radon concentrations.

   Also, as you are aware, DOE through the efforts of the Environmental Measurements Laboratory and NLO has deployed radon samplers in various offsite locations selected in conjunction with local dignitaries. This program has just started and very little data is available. It should be noted that this effort will not comply with the NYSDEC requirement for mathematical modeling of environmental exposure pathways.

I am sorry we cannot be of more help to you in your relations with NYSDEC. I would suggest that contacts with our DOE-ORO administrator, H. D. Fletcher, might be more helpful.

Sincerely yours,
Original Signed By
A. F. PENNAK
Director of Engineering

A. F. Pennak
Director of Engineering

AFP:wfk

cc: S. F. Audia

SEP 11 15 15

Department of Energy
Environmental Measurements Laboratory
376 Hudson Street
New York, New York 10014

September 7, 1978

Mr. S. F. Audia
Manager
National Lead Company of Ohio
P.O. Box 39158
Cincinnati, Ohio 45239

Dear Mr. Audia:

The enclosed letter to Mr. Kirchue describes a radon monitoring plan for the DOE Niagara Falls site that EML is implementing at the request of Dr. Mott. The plan is intended to supplement the monitoring program already being conducted by National Lead of Ohio. We have been advised that Mr. Kirchue will be able to service our instruments, much as he is now servicing NLO instruments.

In a recent telephone conversation, Mr. Mike Boback suggested that I send you a copy of this plan for your information.

Sincerely,

A. J. Breslin, Director
Aerosol Studies Division

Enclosure:
As stated

Department of Energy
Environmental Measurements Laboratory
376 Hudson Street
New York, New York 10014

September 7, 1978

Mr. Joe Kirchue
National Lead Company of Ohio
Niagara Falls Plant
1397 Pletcher Road, Box 306
Lewiston, NY 14092

Dear Joe:

A radon monitoring plan is detailed on the enclosed map and table. It calls for the use of seven of the large EML PERMs that you have on hand and three small PERMs of the type that I showed to you in August. We should be able to send you the three additional instruments within a week or two. Incidentally, this plan is intended to supplement the present fence-line monitoring being conducted by NLO; it does not change the NLO plan in any respect.

There are 18 monitoring locations in all, consisting of ten indoor-only locations and eight indoor and outdoor locations. The latter group includes Kruger Chevrolet in Ransomville which does not appear on the map. The schedule provides for simultaneous measurements at six locations each week, necessitating a shift of instruments to new locations at the end of each week of exposure. The seventh large PERM is to be used for duplicate measurements, as shown in the next to the last column of the table. That is, it should be placed with the Niagara-Mohawk PERM during the first exposure period, with the NLO No. 1 PERM in the second exposure period, etc. In a similar fashion, one small PERM, which becomes free every third week, is to be used for duplicate measurements indoors, as shown in the last column of the table.

Most of the locations are fairly specific, by reason of their designations, but the locations on and nearby the site may require some explanation. For example, the Niagara-Mohawk and "O" Street locations are intended

to be, respectively, west and north of the 411 building-accelerator-spoil pile area and at about the same distance away as the Radar Station (0.2 to 0.3 mile). Also, Chemtrol "B", Chemtrol "A", and F. Monroe are intended to be, respectively, north, east, and south of the K-65 silo, also at a distance of 0.2 to 0.3 mile. The exact location in each case should be selected with due consideration for accessibility and other practical factors.

Additional portable monitoring shelters may be required, depending on the availability of porches, car-ports, and similar protected positions. Tom Cashman advises me that he can probably lend us more shelters, if needed.

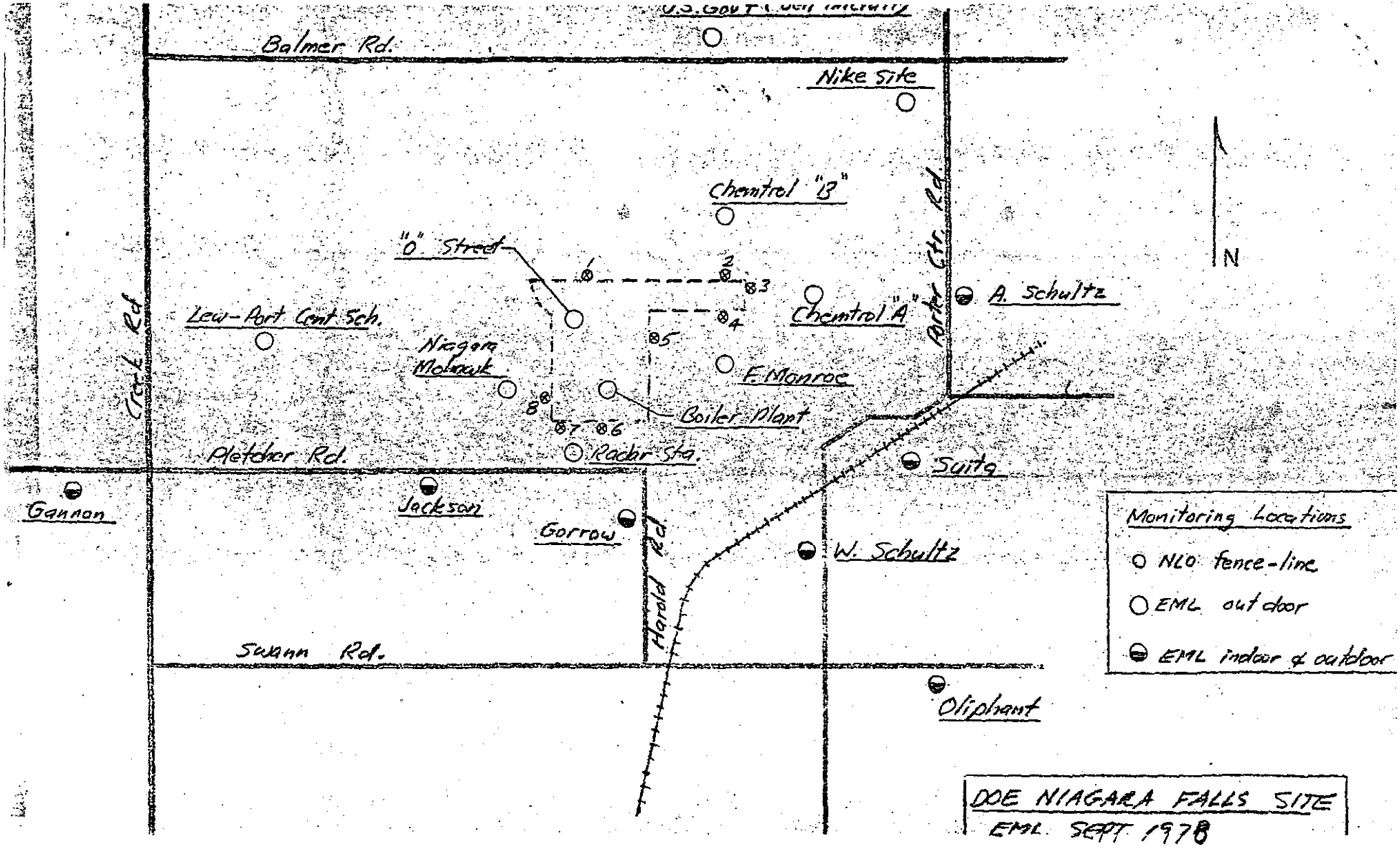
I'll be receptive to any suggestions that might improve this plan. If the plan looks feasible to you, it should be put into effect as soon as the additional PERMs arrive.

Sincerely,

A. J. Breslin, Director
Aerosol Studies Division

Enclosures: (2)

cc: S. F. Audia, w/encl.
T. Cashman, w/encl.
R. W. Ramsey, w/encl.
D. Williams, w/encl.


U.S. Govt Land Inventory
Balmer Rd.
Nike Site
Chemtrol "B"
"O" Street
Lew-Port Cent Sch.
Niagara Mohawk
Chemtrol "A"
A. Schultz
F. Monroe
Boiler Plant
Radar Sta.
Suitq
Fletcher Rd.
Gannon
Jackson
Gorrow
W. Schultz
Swann Rd.
Oliphant
Creek Rd.
Harold Rd.
Porter Ctr. Rd.
N
Monitoring Locations
NLO fence-line
EML outdoor
EML indoor & outdoor
DOE NIAGARA FALLS SITE
EML SEPT 1978

Radon Monitoring Plan for DOE Niagara Falls Site

Measurement Period	Outdoor Locations											Indoor and Outdoor Locations									Duplicates	
	Niagara-Mohawk	Radar Station	Boiler Plant	"O" Street	F. Monroe	Chemtrol "A"	Chemtrol "B"	Nike Site	Bell Aircraft	Lew-Port School	Gannon*	Jackson	Gorrow	Oliphant	W. Schultz	Suita	A. Schultz	Kruger + *	Chev.	L	S
1	L	L	L	L							L-S			L-S						Niag-Moh	Gannon
2					L	L	L					L-S			L-S		L-S			NLO 1	
3								L	L	L			L-S			L-S			L-S	Nike Site	
4	L	L	L	L							L-S			L-S						NLO 2	Oliphant
5					L	L	L					L-S			L-S		L-S			F. Monroe	
6								L	L	L			L-S			L-S			L-S	NLO 3	
7	L	L	L	L							L-S			L-S						Radar Sta	Gannon
8					L	L	L					L-S			L-S		L-S			NLO 4	
9								L	L	L			L-S			L-S			L-S	Bell Aircraft	
10	L	L	L	L							L-S			L-S						NLO 5	Oliphant
11					L	L	L					L-S			L-S		L-S			Lew-Port School	
12								L	L	L			L-S			L-S			L-S	NLO 6	
etc						etc								etc							etc

L = large PERM, for outdoor locations
S = small PERM, for indoor locations

*Background location
+ Not shown on map

NATIONAL LEAD COMPANY OF OHIO

OFFSITE DOE CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
9/6/78	Tom Cashman, State of New York	M. W. Boback MWB RCH/MWB

SUBJECT:

NIAGARA FALLS RADON RESULTS

SUMMARY OF DISCUSSION:

Mr. Cashman is Director of the Bureau of Radiation, Department of Environmental Safety, State of New York. He wanted our results of radon monitoring at the Niagara Falls site for his own use and for public release. I told him to call Doyle Williams, DOE-OR.

Doyle called me on 9/5/78 and 9/6/78 to ask for the latest radon results. He said he was working out an arrangement to have the data released on a scheduled basis. Therefore, I thought he would most likely be the person with whom Mr. Cashman should talk.

INSTRUCTIONS:

1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 1/13/78)

NATIONAL LEAD COMPANY OF OHIO

DOE CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
9/5/78	Al Breslin (EML)	M. W. Boback MWB RCH/MWB

SUBJECT:

EML REQUESTS FOR ASSISTANCE AT NIAGARA FALLS

SUMMARY OF DISCUSSION:

Ref: Letter, H. D. Fleischer to S. F. Audia, "Assistance To The EML Radon Monitoring Program - Niagara Falls Site," dated July 27, 1978

DOE HQ has asked EML to do radon monitoring at and around the Niagara Falls site (ref.) and Al said he is now working on a schedule for monitoring in private homes. He is planning to place monitors in selected homes for one week each month over the next year. He thought the location changing would take about one man-day per week. Instructions will be sent from EML to Joe Kirchue in a few days.

Because he is asking NLO employees for assistance, he thought that someone at Fernald should be kept informed and asked for an opinion. I suggested he provide S. F. Audia with a copy of any letter or instructions that he sends to Mr. Kirchue.

cc: L. M. Devir

INSTRUCTIONS:

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NLO-GEN-2401 (REV. 1/13/78)

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N.L. INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239
PHONE: AREA CODE: 513-738-1151

SEP 1 1978

Mr. H. D. Fletcher, Director
Uranium Enrichment Operations Division
Department of Energy
Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Fletcher:

REDUCTION OF RADON EMISSIONS AT NIAGARA FALLS SITE

In fulfillment of your request of August 1, 1978, NLO has completed its study designed to (1) identify the most effective method of reducing radon emissions at the Niagara Falls site, (2) determine areas of application of radon exhalation inhibitors for greatest effect on ambient air radon concentration, and (3) estimating the cost of site preparation and application of the radon exhalation inhibitors.

The study report is attached as Appendix A. We trust the data presented will be satisfactory for your use in discussions with African Metals Corporation on implementation of the study recommendations.

Sincerely yours,
Original Signed By
S. F. AUDIA
Manager
S. F. Audia
Manager

APP:wfk

Att.

cc: H. D. Fletcher
R. C. Heatherton - M. W. Boback
A. F. Pennak
C. E. Polson - J. H. Cavendish

APPENDIX A

REDUCTION OF RADON EMISSIONS AT NIAGARA FALLS SITE

Introduction:

Radon concentrations in the ambient air at certain locations on the boundaries of the Niagara Falls site have been identified as exceeding the ERDA-0524 concentration guide for radon in uncontrolled areas of 3 pCi/l. This study was performed to ascertain the feasibility and estimated cost of reducing the radon emissions from the residues stored at the site.

1.0 Analysis of alternative methods for reduction of radon emissions:

A literature search[1] was conducted of research and studies performed on methods for reducing radon exhalation and for removal of radon emissions. The search was divided into three fields of endeavor:

1. Scrubbing or absorption of radon;
2. Application of sealants whereby radon exhalation is inhibited;
3. Use of chemical stabilizers to reduce radon exhalation.

1.1 Scrubbing or absorption of radon:

Primarily work in this area has been restricted to laboratory experimentation. Some have employed absorption techniques[2] using activated carbon with and without silica gel. Others have used reaction of other agents with radon, such as bromine trifluoride[3] and other fluorine compounds and various organics.[4] Summed up, it is generally agreed that scrubbing of radon contaminated air is impractical and not a solution to the problem, although laboratory experiments have shown some success.

1.2 Application of Sealants:

Considerable test and development work has been done on testing of various sealants for inhibiting radon exhalation from mine tailings[5,6] and in uranium mines.[7,8]

Polymeric coatings were found to be efficient as radon barriers in mines[7] but less efficient in reducing radon exhalation from mine tailings.[5, 7] Asphalt emulsions were 95% effective in reducing radon flux in mine tailings applications.[5, 8, 9] Other organic materials were somewhat less effective in mine tailings tests.[5]

Again the work was mostly confined to laboratory experiments with very little field application; however, sufficient agreement on test results exists to merit the conclusion that surface sealants are most promising as radon exhalation inhibitors.

1.3 Use of chemical stabilizers:

Tests have been conducted with chemical stabilizers for both volumetric and surface applications on mine tailings. Among those tested were "Chemfix" and Dravo "Calilox." Effectiveness ranged from 40-90% in reducing radon flux;[5, 9] however, long term results are questioned, based upon the theory that total drying of the stabilized material will reduce its effectiveness through evaporation of contained water.

Since the effectiveness is still open to question and the application would be more difficult to remove, the chemical stabilizers are regarded as not suitable for situations such as at Niagara Falls where removal of the residues is contemplated in the near future.

1.4 Conclusions:

Based upon the state of knowledge outlined above, it is recommended that an asphalt emulsion (E-63) be employed as a surface sealant in those areas at the Niagara Falls site where reduction of radon exhalation is felt to be required.

2.0 Identification of Radon Sources:

2.1 Radon Emission Measurement

Work was performed at the Niagara Falls site August 14-17, 1978 to determine the radon emissions from the various residue storage areas and to determine radon concentrations in air at these locations.[14]

The following data on radon emissions from the residue surfaces were obtained by the use of charcoal canisters:

Niagara Falls Site
Radon Emission From Surfaces

	Location	^{222}RN Flux (pCi/m^2 Sec)
(a)	Inside Bldg. 411 on L-30 material	125
(b)	Inside Bldg. 411 on L-30 material (both samples on west side of building)	106
(c)	Inside Bldg. 411 on material on the east side of building	298
(d)	Inside Bldg. 413 (center) on L-50 material	246
(e)	Inside Bldg. 414 (center) on L-50 material	291
(f)	Outside, northwest of spoil pile on macadam material	217
(g)	Outside, northwest of spoil pile on topsoil covered macadam material	170
(h)	Outside, on R-10 storage pile	54.7
(i)	Outside, on spoil pile, north end	20.2
(j)	On sampling port (vent) on side of Bldg. 434 (K-65 silo) containing K-65 material	376
(k)	On concrete surface of Bldg. 434 (K-65 silo) 8' above ground	16.1
(l)	On concrete surface of Bldg. 434 (K-65 silo) 15' above ground	53.4

2.2 Conclusions:

1. Radon exhalation from the L-30 and L-50 residues in Bldgs. 411, 413, and 414 is substantial and inhibiting covering should be applied to the entire surface areas of these residues.

2. The high radon flux measurement at the sampling port of the K-65 silo (Bldg. 434) is indicative of the radon exhalation occurring at the surface of the K-65 residues within the silo and venting from the top of the silo. Although limited in surface area by the design of the silo, the radon emissions from the K-65 residues are regarded as of sufficient magnitude as to merit application of an inhibitor on the top surface within the silo.

   Radon exhalation from the K-65 residues through the concrete walls is of course inhibited by the concrete thickness. It is still distinctly measurable, particularly at any minute cracks and openings. However, ambient radon concentrations in the area have been shown to be substantially below the ERDAM-0524 limit of 3 pCi/l and therefore application of sealants to the exterior concrete surfaces of the silo is not recommended at this time.

3. Radon exhalation from the R-10 residues stored outside and north of Bldg. 411 is found to be substantially less than from the other residues; however, because of the very large surface area of the R-10 storage pile, the total radon emissions based upon the measurements could exceed the radon emissions from the L-30 residues. Taking into consideration the location of the R-10 storage relatively close to the west boundary of the site, it is recommended that radon exhalation inhibitors be applied to the surface of the pile.

4. The very small pile of macadam residues displays high radon flux measurements. Surface inhibitors should be applied here similar to those used on the R-10 storage pile.

3.0 Scope of Work Required:

3.1 General

All work shall be performed under proper supervision to protect the health and safety of the workmen. All personnel working within buildings or enclosures shall wear proper respiratory protection. Radiological protection, film badges and other monitoring equipment shall be provided.

3.2 African Metals Residues (K-65, L-30, L-50)

3.2.1 Any free water standing on the surfaces of the residues shall be collected or drained to a central point and pumped to Bldg. 412 for storage. This water is chiefly evident in Bldg. 411 and affects the L-30 residues.

3.2.2 The top surface of the residues within the silo or concrete buildings shall be hand graded to a reasonably level even surface, free of large lumps or protrusions.

3.2.3 The interior surfaces of the concrete walls shall be brush cleaned a minimum of 12 inches above the graded residues to provide clean surfaces free of dust and extraneous materials which could prevent satisfactory adherence of sealants.

3.2.4 The prepared interior surfaces of the residues and a minimum of six (6) inches high of the surrounding interior concrete surfaces above the residues shall be sprayed with Armak E-63 or approved equal asphalt emulsion, applied a minimum of 1/8" thick in not less than two coats.

3.3 R-10 and Macadam Residues

3.3.1 The surface of the storage piles including an area 10 feet on all sides shall be prepared by cutting all weeds to a minimum height above the surface. Thereafter, the entire area shall be rototilled to a depth of six inches and all root systems and stalks of weeds and other vegetation removed. The surface shall be hand raked to an even contour and rolled to compact the loosened soil and present a smooth even surface for application of the radon exhalation inhibitor.

3.3.2 The prepared surfaces of the storage piles including the surrounding 10' wide areas shall be sprayed with Armak E-63 or approved equal asphalt emulsion, applied a minimum of 1/8" thick in not less than two coats.

3.4 Subsequent Treatment

To compensate for aging and resultant hardening of the asphalt emulsion with possible cracks and porosity, a second application of Armak E-63 asphalt emulsion should be applied within two years of the original installation.

4.0 Cost Estimate:

4.1 African Metals Corporation Residues

4.1.1 K-65 Residues:

Preparation of surfaces:

6 man-days @ $200/day	$1,200

Application of Armak E-63:

1350 sq. ft. @ $.20/sq. ft.	260
Total	$1,460

4.1.2 L-50 Residues:

Preparation of surfaces:

8 man-days @ $200/day	$1,600

Application of Armak E-63:

6000 sq. ft. @ $.20/sq. ft.	1,200
Total	$2,800

4.1.3 L-30 Residues:

Pumping of water to Bldg. 412:

2 man-days @ $200/day	$ 400

Preparation of surfaces:

16 man-days @ $200/day	3,200

Application of Armak E-63:

24,000 sq. ft. @ $.20/sq. ft.	5,400
Total	$9,000

4.1.4 Cleanup and Decontamination of Equipment:

4 man-days @ $200/day	$ 800	
Total African Metals Corporation		$14,960

4.2 DOE Owned Residues:

4.2.1 R-10 and Macadam Residues:

Preparation of surfaces:		
60,000 sq. ft. @ $.20/sq. ft.	$12,000	
Application of Armak E-63:		
60,000 sq. ft. @ $.10/sq. ft.	6,000	
Cleanup and decontamination of equipment:		
2 man-days @ $200/day	400	
Total DOE Owned Residues.		$18,400

REFERENCES

[1] Literature Survey on the Methods of Controlling Radon and Radon Daughter Emanations. Letter, M. G. Mendel to J. H. Cavendish, August 18, 1978.

[2] On the Study of Radon Removal with Active Carbon, Nobuo Fusamura (Waseda Univ. Japan) Shigenobu Ono et al Nippon Kogyo Kaishi, 79; 590-7 (August, 1963) in Japanese.

On the Adsorption of Radon on Activated Carbon, Kapitanov Yu T. et al Geol. Razved. No. 7, 118-125 (in Russian).

[3] Chemical Methods for Removing Radon and Radon Daughters From Air, Stein L. (Argonne National Lab., Ill.) Science 175 No. 4029 1646-5 (31 March 1972).

Removal of Radon from Air by Oxidation with Bromine Trifluoride, Stein L. J. Inorg. and Nucl. Chem. 1973 35(1) 39-43.

[4] Proceedings of the Twelfth AEC Air Cleaning Conference, Oak Ridge, Tenn. 28-31 Aug., 1972 CONF-720823 Vol. I 346-397.

[5] Laboratory Research on Tailings Stabilization Methods and Their Effectiveness in Radiation Containment, Ford, Bacon & Davis Utah, Inc. April 1978.

[6] Use of Asphaltic Emulsion Sealants to Contain Radon and Radium in Uranium Tailings, BNWL-2190 JAN 1977.

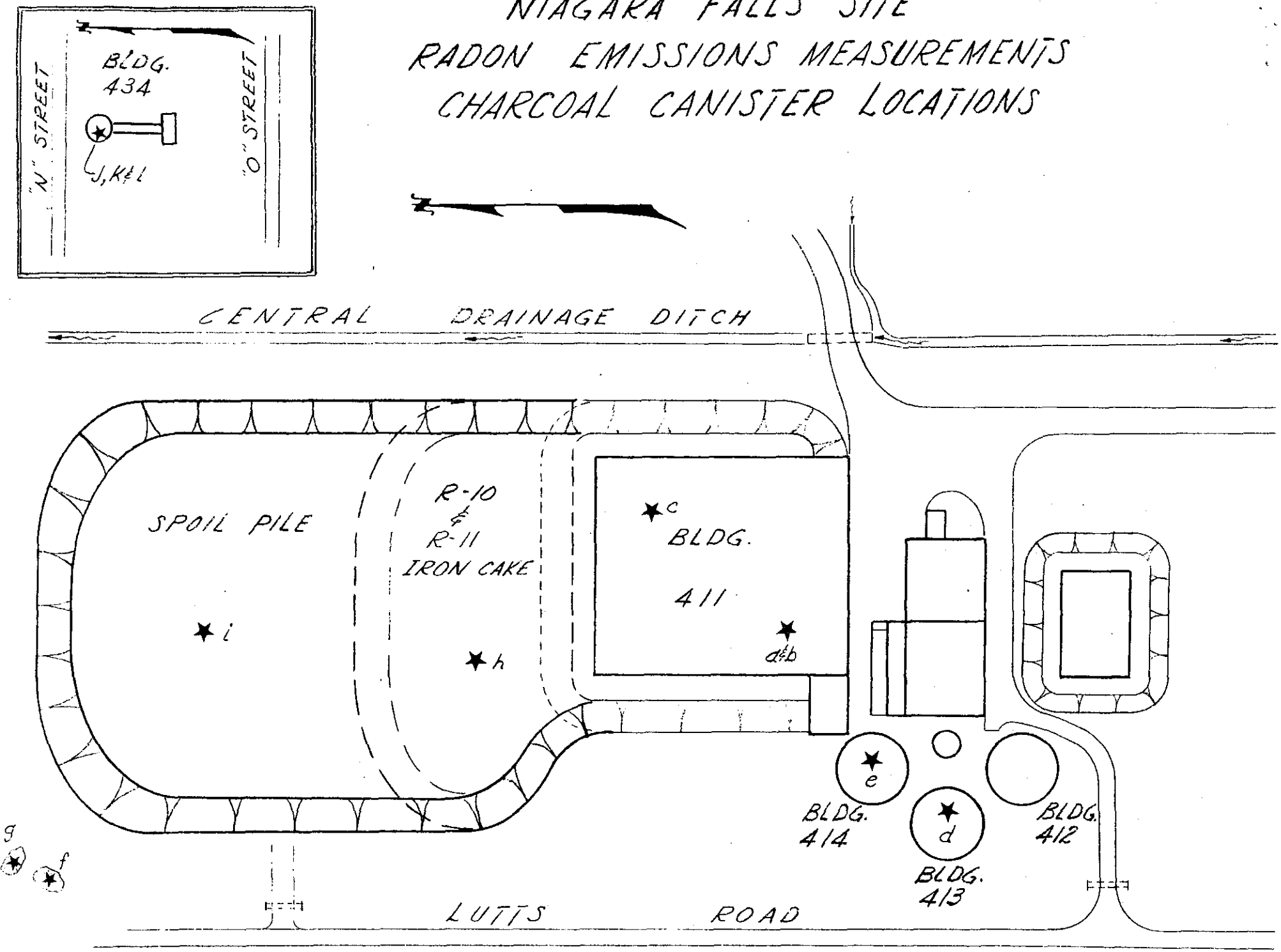
[7] Polymeric Sealants May Provide Effective Barriers to Radon Gas in Uranium Mines, J. C. Franklin, R. C. Bates and J. L. Habberstad, Engineering and Mining Journal 176, No. 9, P. 116, September, 1975.

[8] Development and Evaluation of Radon Sealants for Uranium Mines, H. G. Harmon et al UCRL-51818 May 21, 1975.

[9] Laboratory Research on Tailings Stabilization Methods and Their Effectiveness in Radiation Containment, P. J. Macbeth et al GJJ-21 April, 1978.

[10] Trip Report to NLO Niagara Falls Site, Lewiston, New York, August 14 to 17, 1978, D. A. Fuchs to R. C. Heatherton, September 1, 1978.

NIAGARA FALLS SITE
RADON EMISSIONS MEASUREMENTS
CHARCOAL CANISTER LOCATIONS



NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

AUG 2 4 1978

Mr. H. Doran Fletcher, Director
Uranium Enrichment Operations Division
Department of Energy
Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Fletcher:

RELIABILITY OF RADON RESULTS

Ref: Phone call, G. Love to M. W. Boback, 8/22/78

On 8/22/78, information on the reliability of radon results was reported by phone to G. Love, OR S&EC Division. In response to a request from Mr. Love, made in a return call (ref.), the following information is provided for the passive radon monitors being used at the Niagara Falls site.

Calibration data shows that the standard deviation for the determination of radon-222 with any individual monitor is in the range of ±11% to ±41%. The average standard deviation is ±23%.

As time and circumstances permit, additional calibrations will be made. When sufficient data are obtained, a limit of error will be reported with each individual result.

Sincerely yours,

Original Signed By
S. F. AUDIA
Manager

S. F. Audia
Manager

MWB/vvs

cc: M. W. Boback
A. Breslin - ERL
H. D. Fletcher
R. C. Heatherton
K. N. Ross

Central Files

NATIONAL LEAD COMPANY OF OHIO

DOE CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
8/22/78	M. W. Boback MWB	G. Love

SUBJECT:

"VALIDATION" OF NIAGARA FALLS RADON RESULTS

SUMMARY OF DISCUSSION:

Ref: Letter, S. F. Audia to H. D. Fletcher, "Radon Concentrations - Niagara Falls," dated July 25, 1978

After the reference letter was received at Oak Ridge, Wayne Hibbitts called and said HQ wanted the results "validated" before the data could be released. He didn't know what HQ meant by "validated" but thought that some expression of reliability was wanted.

I called Wayne today to give him the range of standard deviations for the passive radon monitors we are using at Niagara Falls. Wayne was not in and I discussed the data with Gary Love. Gary said he would pass the "validation" information on to Doyle Williams and HQ.

A short time later, Gary called and asked that the information I gave him be reported formally to Oak Ridge. A letter will be prepared for the Manager's signature.

cc: A. F. Pennak

INSTRUCTIONS:

1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 1/13/78)

8/23
8/23

AUG 22 14 45

NATIONAL LEAD COMPANY OF OHIO

A SUBSIDIARY OF NL INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

AUG 2 2 1978

Mr. H. Doran Fletcher, Director
Uranium Enrichment Operations Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Fletcher:

IDENTIFICATION OF A METHOD FOR REDUCING RADON EMISSIONS AT THE NIAGARA FALLS SITE

Enclosed is a copy of our literature survey of radon control methods which has been made in conjunction with your letter requests of August 1, 1978 (i.e. same subject). The report requested in your August 1, 1978 letter will be forwarded to you on or about September 5, 1978 as agreed upon by Messrs. D. B. Williams and M. W. Boback in their telephone conversation of August 21, 1978. The NLO sampling program and the identification of the radon sources have been delayed slightly due to the vacation schedule of key personnel at the Environmental Measurements Laboratory.

Sincerely yours,
Original Signed By
S. F. AUDIA
Manager

S. F. Audia
Manager

NRL:rs
Enc.
cc: H. D. Fletcher

bcc: R. C. Heatherton - M. W. Boback
A. F. Pennak

NATIONAL LEAD COMPANY OF OHIO

A SUBSIDIARY OF N.L. INDUSTRIES, INC.
CINCINNATI, OHIO 45239

August 21, 1978

SUBJECT LITERATURE SURVEY ON METHODS FOR CONTROLLING RADON AND RADON DAUGHTER EMISSIONS FROM RESIDUES

TO A. F. Pennak

FROM J. H. Cavendish

REFERENCE 1) H. D. Fletcher to S. F. Audia, Identification of a Method for Reducing Radon Emissions at the Niagara Falls Site, 8/1/78.

2) M. G. Mendel to J. H. Cavendish, Literature Survey on the Methods of Controlling Radon and Radon Daughter Emanations, August 18, 1978

As requested[1], we have conducted a survey of available literature on work designed to develop methods for controlling radon emissions from radioactive residue storage sites. Results are detailed in the attached report[2].

We feel the following conclusions may be drawn from this work:

1. Air cleaning by installation of scrubbing and/or adsorption equipment does not appear to be practical. The reported work in this area is all small scale, preliminary development type and demonstration of a practical engineered system is not near.

2. Development of sealants to prevent escape of the radon from the residues is much farther advanced and might be practical for the Niagara Falls site.

3. As pointed out in Mr. Fletcher's letter[1], identification of the specific source of the radon emissions is necessary and I presume this work is proceeding under the direction of Environmental Measurements Laboratory. When the sources have been identified, we will be able to evaluate the feasibility of testing the use of sealants. If the K-65 silo is a major source, devising a method for application of a sealant coating may be a major problem. If the L-30 and L-50 residues in Buildings 411, 413 and 414 are major sources, application of a sealant will again present difficult problems due to the water covering the residues.

4. We would recommend expediting the survey by Environmental Measurements Laboratory to identify radon sources followed by an Engineering evaluation of the feasibility of using sealants. If it is deemed feasible to use sealants, we would recommend testing the E-63 asphaltic emulsion.

Original Signed By
J. H. Cavendish

J. H. Cavendish

JHC/rhg

cc: S. F. Audia - R. M. Spenceley, M. G. Mendel, F. W. Neblett, J. B. Patton, C. E. Polson, D. B. Williams - ORO

NATIONAL LEAD COMPANY OF OHIO

A SUBSIDIARY OF NL INDUSTRIES, INC.
CINCINNATI, OHIO 45239

August 18, 1978

SUBJECT LITERATURE SURVEY ON THE METHODS OF CONTROLLING RADON AND RADON DAUGHTER EMANATIONS

TO J. H. Cavendish

FROM M. G. Mendel

REFERENCE

A literature survey of Nuclear Science Abstracts as well as Chemical Abstracts was made to determine the possible methods of controlling radon and radon daughter emanations. This information would be used to develop a possible scheme for the control of radon emanations from the stored African Metal Company's residues. Most of the literature is concerned with two approaches to the problem. The first technique is the removal of the radon from uranium mine air by a variety of methods. The second technique involves the use of sealants to control radon at its source namely uranium mines or milling tails.

Some of the pertinent articles with abstracts are presented:

"On the Study of Radon Removal with Active Carbon," Nobuo Fusamura (Waseda Univ. Japan) Shigenobu Ono et al Nippon Kogyo Kaishi, 79; 590-7 (August, 1963) in Japanese.

If a great deal of active carbon and silica gel are used, satisfactory radon removal from air is achieved. The abstract contains no engineering data as to quantities of materials required, air flows, and per cent removal of radon.

"On the Adsorption of Radon on Activated Carbon", Kapitanov Yu T. et al Geol. Razved. No. 7, 118-125 (in Russian).

The ability of activated carbon to adsorb radon is variable. Adsorption is dependent upon relative humidity and temperature. High humidity and temperature result in a decrease in adsorption. This work was performed on a small scale laboratory program.

"The Use of Vermiculite to Control Dust and Radon Daughters in Underground Uranium Mine Air", R. Washington et al CIM (Canadian Institute Mining and Met.) Bull. 1973, 66 (731) 152-160.

This article is concerned with the replacement of other filter types with vermiculite in the removal of radon daughter products from mine air. Vermiculite has advantages of price and stability in this application. A great deal of engineering data is presented. It should be emphasized that this material can remove radon daughter products but not radon gas.

"Chemical Methods for Removing Radon and Radon Daughters From Air", Stein L. (Argonne National Lab., Ill.) Science 175 No. 4029 1646-5 (31 March 1972).

Liquid bromine trifluoride and the solid complexes ClF_2SbF_2, BrF_2 SbF_6 react spontaneously with radon and radon daughters at 25°C converting radioelements to nonvolatile ions and compounds. This work is strictly a laboratory experiment.

"Removal of Radon from Air by Oxidation with Bromine Trifluoride", Stein L, J. Inorg. and Nucl. Chem. 1973 35(1) 39-43.

This is an update of the previous article by the author. It includes a few more solid fluoride complexes that can be used to react with radon and radon daughters. Again this is a laboratory study. It should be pointed out that many of these compounds are hazardous materials that are subject to degradation by moisture. Thier use on a large scale may be hazardous as well as not very efficient.

"Proceedings of the Twelfth AEC Air Cleaning Conference", Oak Ridge Tenn. 28-31 Aug., 1972 CONF-720823 Vol. I 346-397.

One of the sections of this conference was concerned with the cleaning of uranium mine air by a variety of techniques.

Papers were presented on the removal of radon gas by reaction with fluorine compounds, possible cryogenic separation of radon from mine air, and a possible separation of radon from air by centrifugation. Another paper concerns the scrubbing of radon contaminated mine air with organic compounds since radon is more soluble in certain organics as opposed to water. It is concluded that there is no practical way of removing radon gas from mine air even though laboratory tests have been performed with some success.

Several papers were presented concerning the removal of radon daughters by filtration and electrostatic precipitation.

Examination of the literature for articles concerning the use of sealants for control of radon emanation was pursued next. The publications and abstracts of these are presented below:

"Use of Asphaltic Emulsion Sealants to Contain Radon and Radium in Uranium Tailings", BNWL-2190 JAN 1977.

This article contains a great deal of information on the use of cationic asphalt emulsions to control radon emanations in tailings. Contains information on the preparation, techniques of applying, and studies of efficiency of these asphalt emulsions.

Radon permeation through a 1/8" thick asphalt emulsion tailing seal was not measurable. Two types of cationic asphalt emulsions (Armak E-63 and Armak 13MR) were used to form seals with Vitro Mine Tailings. No information as to the cost of these materials is presented.

"Polymeric Sealants May Provide Effective Barriers to Radon Gas in Uranium Mines", J. C. Franklin, R. C. Bates and J. L. Habberstad, Engineering and Mining Journal 176, No. 9, P. 116, September, 1975.

The application of polymeric coatings to uranium mine openings can prevent radon gas from entering the mine atmosphere according to laboratory tests conducted by the USBM Spokane Mining Research Center. Of the 46 coating materials tested on uranium ore samples, three were found to be 100% effecient as radon barriers and 22 materials were judged at least 50% effective. Toxicity, flammability, adhesion to wet and dry rock and cure rate in a minelike environment were evaluated to screen out unacceptable materials. Four of the best overall coatings (a latex, an unsaturated polyester, and two water based epoxies) were then tested in an underground uranium mine in the Ambrosia Lake District of New Mexico to evaluate their sprayability and their in place barrier efficiency. The coatings exhibited good sprayability, adhesion and curing in the mine. Radon gas emanation was reduced by 60% in one chamber and by 62% in the other. Costs of the process are estimated to be 40 cents per square foot.

"Development and Evaluation of Radon Sealants For Uranium Mines", H. G. Harmon et al UCRL-51818 May 21, 1975.

The purpose of this study was to evaluate selected coatings as radon barriers in uranium mines, first on their effectiveness in reducing radon permeation and second, on the basis of their potential toxicity during application or in a possible mine fire.

Films for the permeation study were selected from commerically available polymer systems of known composition. In agreement with the Bureau of Mines, seven coatings were selected for full evaluation. A list of these materials is presented along with comments as to their toxicity. No information is presented as to the cost of application of the materials to a uranium mine.

"Laboratory Research on Tailings Stabilization Methods and Their Effectiveness in Radiation Containment", P. J. Macbeth et al GJJ-21 April, 1978.

This report describes a study of various methods, techniques, and materials for stabilizing uranium mill tailings to reduce radon exhalation.

The effectiveness of several types of chemical stabilizers for both volumetric and surface application in reducing radon exhalation is reported. Some volumetric stabilizers reduced radon flux by 90% or more.

A list of polymer sealants used in the laboratory tests is presented along with their effectivenss in reducing radon exhalation.

One of the materials tests was E-63 asphaltic emulsion and it is claimed to reduce radon emanation by 95% when used as a 1/4" cover. This is the same material that was evaluated by BNWL with comparable results. In addition, four polymers were evaluated by an in situ test at a tailings site.

COMMENTS ON LITERATURE SURVEY

It would appear that none of the methods that involve removal of radon gas from air by scrubbing or adsorption offer a practical and economical solution to the control of radon emanation from stored African Metals Company residues. All of these methods are in a developmental state and not engineered for a large scale use. In addition, a concentrated radioactive sidestream would be developed which would present additional storage and handling problems.

The use of sealants to contain radon may offer a practical and economic solution to the stored African Metals Company residues. The use of sealants has not been used extensively on a large scale but tests on a smaller scale are encouraging. The use of alphaltic emulsion E-63 appears to be most attractive as indicated by tests of two investigators. The use of sealants to contain radon in residues should present a definite cost advantage over the other methods. One would think that the cost would be a fraction of the cost required to build and operate an air cleaning system.

M. G. Mendel
M. G. Mendel

MGM/rhg

cc: S. F. Audia - R. M. Spenceley
F. W. Neblett
J. B. Patton
A. F. Pennak
C. E. Polson
D. B. Williams - ORO

NATIONAL LEAD COMPANY OF OHIO

DOE CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
8/21/78	M. W. Rodaski MWR	Doyle Williams

SUBJECT: IDENTIFICATION OF A METHOD FOR REDUCING RADON EMISSIONS AT THE NIAGARA FALLS SITE

SUMMARY OF DISCUSSION:

Ref: Letter, L. D. Fletcher to S. F. Audia, same subject, dated August 1, 1978.

Following a discussion with Dick Leist on the due date for the subject report (ref.), I called Doyle Williams and asked if an extension of the August 28 due date would cause any problems. He said it would not and agreed with a revised due date of September 5, 1978.

Doyle said he would inform Mr. Fletcher's office of the change.

cc: N. R. Leist
A. F. Pennak

INSTRUCTIONS:

1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 1/13/78)

RKH 8/21

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N.L. INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

August 17, 1978

Mr. C. A. Keller, Assistant Manager
Department of Energy
Oak Ridge Operations Office
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Keller:

Enclosed are the view graph slides for Niagara Falls and Weldon Spring and the radon emission data for Niagara Falls which you requested.

Sincerely yours,
Original Signed By
A. F. PENNAK
Director of Engineering

A. F. Pennak
Director of Engineering

AFP:wfk

Encs.

cc: S. F. Audia - w/o encs.
H. D. Fletcher- w/o encs.
R. C. Heatherton - M. W. Boback - w/o encs.

MWB
8/18

Department of Energy
Oak Ridge Operations
P.O. Box E
Oak Ridge, Tennessee 37830

8/16

8/17

AUG 16 14 46

August 11, 1978

Mr. Paul A. Giardina, Chief
Regional Office of Radiation Programs
U. S. EPA Region 2
26 Federal Plaza
New York, N. Y. 10007

Dear Mr. Giardina:

LOOW RADON DATA

Reference is made to your July 20, 1978, memo requesting results of our September, 1977, radon sampling at the Lake Ontario Ordnance Works (LOOW).

As noted in my December 30, 1977, memo to you (and discussed by phone with your staff on January 11, 1978) these data are not considered to be representative and, in fact, are being supplemented by an ongoing sampling program. The one-week sample results for three perimeter locations are 0.7, 1.0, and 3.5 pCi/l. We have since obtained an additional five weeks of data in May and June which indicate that, in general, results are below limiting guidelines (3.0 pCi/l annual average). We have been instructed by our Headquarters to refrain from releasing the actual data pending its validation.

In addition, the Environmental Measurements Laboratory is planning an offsite monitoring program to verify that concentrations at publicly occupied locations are, as we believe, well within standards.

I am sorry we are unable to give you the more representative data we are now collecting, but it will be necessary to do additional equipment calibration and multiple samplings in known radon atmospheres in order to derive confidence level information and thus validate our data.

Sincerely,

J. F. Wing

J. F. Wing, Chief
Environmental Protection Branch

OSE:HWH

COPY

S. P. GIARDINA
NATIONAL LAND

NATIONAL LEAD COMPANY OF OHIO

DOE CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
8/8/78	M. L. Boback	A. George (EML) W. Hibbitts (OR)

SUBJECT:

IDENTIFICATION OF RADON SOURCES AT NIAGARA FALLS

SUMMARY OF DISCUSSION:

Ref: DOE Contact Report, Boback to Breslin (EML) and Hibbitts (OR), same subject, dated 8/4/78

The tentative plans given in the referenced contact report were discussed with Andy George. He said all of the instruments needed are available. Therefore, Don Fuchs will be at EML on 8/14/78 to pick up the instruments and then proceed to Niagara Falls for three days of sampling. Wayne Hibbitts was informed and he concurred.

Wayne was also questioned about the possibility of reporters seeking to interview Don Fuchs during the three-day sampling. Wayne's opinion was that Don could answer questions about the equipment and the reason for the special sampling. Wayne said he would check with Jim Alexander (Public Information Office) and let me know if Alexander suggests any different response.

cc: L. A. Devir
M. J. Grannen
A. F. Pennak

INSTRUCTIONS:

1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 1/13/78)

NATIONAL LEAD COMPANY OF OHIO

DOE CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
8/8/78	M. J. Boback MJB	A. Breslin (EML) H. W. Hibbitts (OR)

SUBJECT:

IDENTIFICATION OF RADON SOURCES AT NIAGARA FALLS

SUMMARY OF DISCUSSION:

Ref: Letter, H. D. Fletcher to S. F. Audia, "Identification of a Method for Reducing Radon Emissions at The Niagara Falls Site," dated August 1, 1978.

In the referenced letter, DOE-OR requests NLO to identify the principal sources of radon at the Niagara Falls site. A. Breslin, DOE-EML, and H. W. Hibbitts, DOE-OR, were named as contacts.

Instrumentation available for this task was first discussed with Al Breslin and a variety of techniques were considered. Contrary to the notion contained in the reference letter, EML has no specific device for such a task. We will have to use three types of instruments and there is a possibility that there will be no clear answer obtained in the short period of time imposed by the report deadline of August 8.

Al said he wanted Andy George, EML, to consider the plan for the use of three instrument types. Andy directs the actual use of this equipment and would have to be consulted about equipment condition and any prior commitments which might make the devices unavailable. However, Andy was on vacation and, except for a return on August 8 to meet a visitor, he would be on vacation until August 14. In addition, Al would be gone during the weeks of August 7 and August 14, returning to work on August 21.

We agreed on the following schedule:

(1) On August 8, I will call Andy George and discuss the tentative plan Al and I worked out. Andy would know if the equipment was available and could offer suggestions if changes were necessary. He could also leave instructions to prepare the equipment for step 2.

(2) On August 14, Don Fuchs would be at EML to meet with Andy and check out the instruments to be used. Don will then go to Niagara Falls, taking as many of the instruments as he can carry. Any leftovers will be sent by air freight to Niagara Falls.

(3) Sometime on August 15, Don will begin radon sampling around the storage areas. Scintillation flasks will be used. These flasks can be "read out" after a three-hour wait and then reused. Don will work overtime if doing so will make it possible to collect two series of samples on the 15th. He will continue the sampling and read-out on the 16th and 17th, working overtime if there is an advantage to do so.

(MORE)

INSTRUCTIONS:

1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 1/13/78)

8/4/78 M. W. Boback A. Breslin
H. W. Hibbitts

Identification of Radon Sources at Niagara Falls

(4) Two other sampling systems will be used. Charcoal canister samplers will be used once and then returned to EML for read-out. A continuous radon-daughter monitor will be set up offsite for background data which may be needed to interpret the onsite data.

(5) On August 21, all of the results will be discussed, by phone, with Al Breslin and Andy George.

After these tentative plans were agreed upon, I informed Wayne Hibbitts. He thought the plans were too elaborate and suggested a simpler strategy involving other portable equipment which we don't have and he couldn't offer. Since the reference letter declared Wayne as the methodology consultant, and since the necessary portable equipment would have to come from EML, it seemed necessary to relay this opinion to Al Breslin. When I called EML, however, I was told Al had left for the day. In the evening, I called him at home. Al thought Wayne's simplified approach had serious drawbacks and we decided to stick with our original plan. Wayne will be informed of this decision, or any final variation, after my August 8 call to Andy George.

There have been numerous "Niagara Falls" phone calls from andy to Oak Ridge and EML for which Contact Reports were not written. These started on July 13. Most of July 14 was spent on the phone, plus discussing the calls with R. C. Heatherton and K. N. Ross, preparing for the rush sampling requested (and then cancelled) by OR.

Al was at Niagara Falls on August 3 to determine locations for the EML sampling requested by W. E. Mott. He observed that the eight NLO radon samplers were in good locations. He said our use of a plastic bag to protect the devices was a good idea but he suggested longer bags to prevent rain from dripping into the silica gel compartment. Al said he made the suggestion to Joe Kirchue and Mr. Kirchue said he would replace the plastic bags.

cc: L. M. Devir
D. A. Fuchs
A. F. Pennak

NATIONAL LEAD COMPANY OF OHIO

ERDA CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
8/3/78	J. P. Kirchue	L. M. Devir

SUBJECT:

Niagara Falls Site

SUMMARY OF DISCUSSION:

Mr. Al Breslin, DOE-EML, New York City, accompanied by three representatives of the New York State Department of Environmental Control, D. McKenzie, R. Wozniak and H. Prins visited the site 8/3/78.

After a brief tour of the site discussions were held concerning the placement of eight DOE-EML Passive Radon Monitors. At this time Mr. Breslin contacted Frank Luscher, Town of Lewiston Environmental Commission and Town Board Member, Ms. Joan Gipp and requested they report to the site.

Mr. Luscher and Ms. Gipp visited the site and after a tour of the site and lengthy discussion Mr. Breslin stated three monitors were to be installed on site, two monitors were to be installed at the Lew-Port Central School, (1 inside and 1 outside). Installation of the remaining three monitors was to be decided by the Town of Lewiston.

Mr. Breslin requested that all the monitors be installed and serviced by NLO site personnel.

DOE-ORO Roy Anderson has been advised of the above.

cc:
R. C. Heatherton
A. F. Pennak

INSTRUCTIONS:

Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired. Forward two copies to Division Director, who in turn will send one copy to the Manager.

LO-GEN-2401 (REV. 2/7/75)

NATIONAL LEAD COMPANY OF OHIO

CONTACT REPORT

TE:	ORIGINATOR:	TALKED TO:
8/2/78	J. P. Kirchue	L. M. Devir

BJECT:

Niagara Falls Site

MMARY OF DISCUSSION:

Reference:

Letter, Fletcher to Audia, dated 7/27/78, subject: Assistance to the EML Radon Monitoring Program - Niagara Falls Site

Mr. Al Breslin, DOE Environmental Measurements Laboratory, New York City, telephoned Kirchue and advised him he will visit the Niagara Falls Site August 3 and 4, 1978.

cc:
R. C. Heatherton
A. F. Pennak

TRUCTIONS:

Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
Forward two copies to Division Director, who in turn will send one copy to the Manager.

GEN-2401 (REV. 2/7/75)

RW 7/31

AUG 1 11 30

Department of Energy
Oak Ridge Operations
P.O. Box E
Oak Ridge, Tennessee 37830

July 27, 1978

National Lead Company of Ohio
ATTN: Mr. S. F. Audia
Manager
P. O. Box 39158
Cincinnati, Ohio 45239

Gentlemen:

ASSISTANCE TO THE EML RADON MONITORING PROGRAM - NIAGARA FALLS SITE

By TWX dated July 26, 1978, copy enclosed, W. E. Mott, Director, Division of Environmental Control Technology, Headquarters, asked the Environmental Measurements Laboratory to establish a radon monitoring program for the Niagara Falls Site. We understand that this survey program is to include the DOE site proper as well as other offsite locations.

Please instruct your site personnel to provide assistance to EML in their monitoring efforts. This would include servicing of the radon monitoring equipment if EML finds that such an arrangement would be to their advantage.

The monitoring program being undertaken by EML is in no way intended to supplant our current monitoring efforts. They are to proceed as originally planned.

Sincerely,

H. Doran Fletcher, Director
Uranium Enrichment Operations Division

OUO:DBW

Enclosure:
As stated

cc: W. E. Mott, ECT-GTN, MS E-201
C. A. Keller, AMO

NNNN

RECEIVED
ORO DOE
COMM CENTER
JUL 26 10 41 AM '78
BY

EAK
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J Deletin

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ZNR UUUUU

P 261430Z JUL 78

FM USDOE WILLIAM E MOTT GERMANTOWN MD

TO ZEN/J H HARLEY DIR ENVIRONMENTAL MEASUREMENTS LAB 376

HUDSON ST NEW YORK NEW YORK

Copy to Henchard
Sent 7-26

INFO RHEGORO/C A KELLER ASST MGR FOR OPER OAK RIDGE TN

RHEGORO/F F HAYWOOD OAK RIDGE NATIONAL LAB OAK RIDGE TN

AE

BT

UNCLAS SUBJECT: RADON MONITORING AT FORMERLY UTILIZED SITES

CONFIRMING THE TELEPHONE CONVERSATION OF JULY 18TH BETWEEN RAMSEY AND BRESLIN, WE REQUEST THAT EML PROCEED TO SECURE SIXTY TO ONE-HUNDRED ADDITIONAL INSTRUMENTS TO ALLOW SIGNIFICANT EXPANSION OF THE RADON MONITORING EFFORT AT FORMERLY UTILIZED SITES. SPECIFICALLY, WE REQUEST EML GIVE HIGH PRIORITY TO THE ESTABLISHMENT OF A RADON MONITORING SURVEY OF THE FORMER LAKE ONTARIO ORDINANCE WORKS (LOOW) AT LEWISTON, NEW YORK, INCLUDING OFFSITE PROPERTIES. THIS MONITORING PROGRAM SHOULD DEPLOY ANY AVAILABLE INSTRUMENTS AND, IF NECESSARY, SHOULD EMPLOY INSTRUMENTS

PULLED FROM OTHER SITES PROVIDED IT DOES NOT INTERFERE WITH IMPORTANT LONG-TERM RADON MONITORING ACTIVITIES AT THOSE SITES. BY COPY OF THIS TELETYPE WE ARE REQUESTING OAK RIDGE TO MAKE APPROPRIATE ARRANGEMENTS WITH THE SURVEILLANCE AND MAINTENANCE CONTRACTOR, NATIONAL LEAD, AT THE LOOW TO SERVICE THE RADON MONITORING INSTRUMENTS AND RENDER SUCH ASSISTANCE AS CAN BE PROVIDED BY THE SURVEILLANCE STAFF TO YOUR MONITORING EFFORTS.

Fletcher please handle

PARA. IN ARRANGING FOR OFFSITE RADON MONITORING, WE HAVE MADE PRELIMINARY CONTACT WITH DR. MARVIN RESNICOFF WHO HAS INDICATED A WILLINGNESS TO ASSIST IN THE DEPLOYMENT OF RADON MONITORS. PLEASE NOTIFY US WHEN YOU ARE READY TO DEPLOY MONITORS OFFSITE SO THAT WE MAY MAKE THE NECESSARY ARRANGEMENTS WITH DR. RESNICOFF. IN CONNECTION WITH THE CONONSBURG PENNSYLVANIA REMEDIAL ACTION PROGRAM, WE WOULD LIKE FOR EML TO CONSIDER THE ESTABLISHMENT OF A PROGRAM TO DETERMINE THE EFFECTIVENESS OF ENHANCED VENTILATION IN BUILDINGS AT THE CANONSBURG INDUSTRIAL PARK AS A MEANS OF CONTROLLING RADON EXPOSURE. SPECIFICALLY, WE WANT TO EXPLORE THE EFFECTIVENESS OF ENHANCED VENTILATION EQUIPMENT INSTALLED IN THE BUILDINGS AT CANONSBURG AS PROPOSED BY FORD, BACON AND DAVIS UTAH INC (FBDU) AND WOULD LIKE TO HAVE EML ESTABLISH A PROGRAM OF RESEARCH TO MONITOR

THE EFFECTS OF THE ENHANCED VENTILATION, THIS SHOULD INCLUDE EXPERIMENTS TO DETERMINE APPROPRIATE OPERATING CYCLES FOR THE EQUIPMENT SO AS TO CONTROL THE RADIOLOGICAL EXPOSURE OF PERSONNEL, BUT MINIMIZING THE ENERGY REQUIREMENTS OF VENTILATION FANS AND SUPPLEMENTAL HEATING AND/OR COOLING EQUIPMENT REQUIRED FOR SUCH ENHANCED VENTILATION. WE HAVE FORWARDED INFORMATION ON THE FBDU OBSERVATIONS CONCERNING THE UTILITY OF ENHANCED VENTILATION TO MR. BRESLIN TO ASSIST IN ESTABLISHING THIS PROGRAM.PARA. WE WOULD LIKE TO MEET WITH YOU AT YOUR EARLIEST CONVENIENCE TO ARRANGE A COORDINATED PROGRAM INVOLVING EML, FBDU AND ORNL. ANTICIPATING THAT ADDITIONAL TRAVEL TO CANONSBURG AND LEWISTON WILL BE REQUIRED OF EML, ADDITIONAL DOE PERSONNEL TRAVEL FUNDS CAN BE MADE AVAILABLE FROM ECT DIVISION IF YOU WILL MAKE A SPECIFIC REQUEST FOR EACH TRAVEL AUTHORIZATION. SHOULD YOU HAVE ANY QUESTIONS OR REQUIRE ADDITIONAL CLARIFICATIONS, PLEASE CONTACT DR. MOTT, DIRECTOR, ECT, OR MR. RAMSEY.

BT

#5491

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

July 25, 1978

Mr. H. D. Fletcher, Director
Uranium Enrichment Operations Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Fletcher:

RADON CONCENTRATIONS - NIAGARA FALLS

Data on the analyses of radon concentrations in ambient air samples at Niagara Falls for the periods shown follow:

Sampler Location	Sampler Number	Average pCi/liter 5/25/78 to 6/1/78	6/1/78 to 6/15/78	6/15/78 to 6/29/78
Campbell St. North end	1	0.67		
N St. North of K-65	2		0.11	0.07
McArthur St. East of K-65	3		0.42	0.38
O St. South of K-65	4	0.31	0.15	
Vine St. & Castle Garden Rd	5		0.20	0.54
R St. South of Boiler Plant	6	0.51	0.32	0.37
R St. South of L-30	7		0.76	
Lutte Rd. West of L-30	8	0.19	2.92	

Notes:

1. Blank spaces indicate initial reading was lower than blank reading or the gamma crystal was higher than the radon sample crystal.

2. These samples were read using an old procedure and only one calibration. The amount of Radon indicated is very low.

It must be recognized that (1) the very low levels of Radon in the samples are very difficult to determine accurately, (2) the analyzer is new and therefore NLO experience with it and background data is very limited and (3) the number of samples run are very few. Therefore, we feel the confidence level in the data accuracy is relatively low and the data should be used accordingly.

Sincerely yours,
Original Signed By
R. M. SPENCELEY
Assistant Manager
for S. F. Audia
Manager

AFP/rb

cc: H. D. Fletcher
R. C. Heatherton - K. Ross
A. F. Pennak

JUL 31 9 42

NATIONAL LEAD COMPANY OF OHIO

ERDA CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
July 17, 1978	Doyle Williams, ORO	A. F. Pennak

SUBJECT: NIAGARA FALLS RESIDUES

SUMMARY OF DISCUSSION:

1. Williams requested that a literature search be made of the feasibility of scrubbing radon gas from air. The thought is to collect the radon emanating from the L30, L50 and K65 residues by using plastic sheet envelopes over the stored residues with very low negative pressures, and scrubbing out the radon. Several problems were discussed namely:

   a. Residues belong to African Metals Company. DOE's right to interfere or work in buildings leased to African Metals was questionable and would have to be negotiated, as well as who would bear costs.

   b. Scrubbing, if feasible would result in a radioactive scrub liquor which would require disposal, with accompanying problems.

   c. A mechanical scrubbing process would probably require different type of personnel at Niagara Falls for operation and maintenance than those presently employed at the site.

   If the literature search indicates feasibility NLO is requested to estimate costs and determine best method of radon collection, scrubbing and disposal.

2. Dr. Mott (DOE-HQ) will probably want a progress report in August on work done to date on the Niagara Falls alternatives project.

A. F. Pennak

AFP:wfk

MWB 7/31

cc: ~~R. C. Heatherton~~ - ~~M. W. Boback~~
C. E. Polson - J. H. Cavendish
G. C. Smith - L. M. Devir

INSTRUCTIONS:
1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 2/7/75)

NATIONAL LEAD COMPANY OF OHIO

DOE XERDAX CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
7/11/78	H. W. Hibbitts	M. W. Boback MNB

SUBJECT:

RADON SAMPLING AT NIAGARA FALLS SITE

SUMMARY OF DISCUSSION:

Wayne had a number of questions about the method used for radon monitoring at Niagara Falls. He asked about the equipment, its calibration, theory of operation and the interpretation of results. He asked that our plans for calibration and TLD readout be summarized in three or four paragraphs, typed, and sent to him. He also wants copies of any reports which might aid in understanding the theory and operation.

We can send him a copy of an EML report which briefly describes the radon monitors and a copy of an IH&R procedure written by Don Fuchs for the Niagara Falls crew. I'll write the several paragraphs he requested.

cc: D. A. Fuchs

INSTRUCTIONS:

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2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 2/7/75)

NATIONAL LEAD COMPANY OF OHIO

DOE ERDA CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
3/28/78	Wayne Hibbitts	M. W. Boback MWB

SUBJECT:

RADON SAMPLING AT NIAGARA FALLS

SUMMARY OF DISCUSSION:

Wayne wanted to know when we would be able to start the radon sampling at Niagara Falls. I told him the radon monitors are now being calibrated by the Environmental Monitoring Laboratory, New York City, and we may have the first unit in operation in about one month.

Oak Ridge has received a letter from the Sierra Club, asking for information about radon monitoring. Wayne is preparing the reply and wanted to include something about the use of the radon monitors.

INSTRUCTIONS:

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2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 2/7/75)

Department of Energy
Oak Ridge Operations
P.O. Box E
Oak Ridge, Tennessee 37830

10/21 10/24 10/24 A.J.P.

OCT 21 14 57

OCT 17 1977

National Lead Company of Ohio
ATTN: Mr. S. F. Audia
Manager
Post Office Box 39158
Cincinnati, Ohio 45239

Gentlemen:

Subject: RADON SAMPLING AT THE NIAGARA FALLS SITE

Reference your October 6, 1977 letter, same subject as above, transmitting recently evaluated radon data.

Due to the level of radon measured near the R-10 area, it appears advisable to better define the long-term ambient levels of radon for comparison with concentration guides. It is our understanding that the Environmental Measurements Laboratory (EML) will probably prefer that NLO build its own sampler using EML plans, rather than continuing to borrow EML samplers.

Please plan to gather these additional radon samples at the Niagara Falls site. Should the expense or effort required prove more extensive than now thought, please let us know so we can modify our request.

Sincerely,

H. Doran Fletcher

H. Doran Fletcher, Director
Uranium Enrichment Operations Division

OSE:HWH

CC: D. E. Large
W. H. Travis

NATIONAL LEAD COMPANY OF OHIO

ERDA CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
10/14/77	H. W. Hibbitts	M. W. Boback

SUBJECT:

ADDITIONAL RADON SAMPLING AT LOOW

SUMMARY OF DISCUSSION:

Reference: Letter Audia to Fletcher, Radon Sampling At The Niagara Falls Site, dated October 6, 1977.

Wayne requested additional radon sampling at the LOOW site because of the high concentrations reported in the reference letter. He did not specify a schedule but thought sampling might have to be done intermittently over a one-year period to obtain adequate information.

A formal request for the sampling will be made in a letter from H. D. Fletcher to S. F. Audia. IH&R will proceed to make arrangements with the New York Environmental Measurements Laboratory for the radon sampling.

cc: D. A. Fuchs

INSTRUCTIONS:

1. Complete this form in sufficient detail to make Division Director and Manager generally aware of what transpired.
2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 2/7/75)

NATIONAL LEAD COMPANY OF OHIO
A SUBSIDIARY OF N L INDUSTRIES, INC.

P. O. BOX 39158 CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

OCT 6 1977

Mr. H. Doran Fletcher, Director
Uranium Enrichment Operations Division
Department of Energy
Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Fletcher:

RADON SAMPLING AT THE NIAGARA FALLS SITE

During the period from August 30, 1977 through September 6, 1977, passive monitors were used to measure the concentration of radon-222 at the Niagara Falls site. The highest concentration in three samples collected was 3.5×10^{-9} µCi/ml, south of the R-10 storage area. This concentration is 117% of the Manual Chapter 0524 limit for Rn-222 in uncontrolled areas.

After a request from H. W. Hibbitts, OR, for radon sampling, arrangements were made with A. J. Breslin, Department of Energy, Environmental Measurements Laboratory, for sampling equipment and analytical services. Three passive radon monitors were taken to the Niagara Falls site and set up by a NLO representative on 8/30/77. The monitors were cared for and taken down on 9/6/77 by Niagara Falls site personnel, and were sent back to NLO where they were checked and forwarded to the Environmental Measurements Laboratory for analysis. The results, shown below, are average concentrations for the seven-day monitoring period.

Location	Radon Concentration ($\times 10^{-9}$ µCi/ml)
South of K-65 Tower	0.7
East of R-10 Area	1.0
South of R-10 Area	3.5

The sampling locations, given in Figure 1, were all at the site boundary fence. According to a record kept by site personnel, the winds were generally calm or from the west.

Please advise if additional sampling is desired.

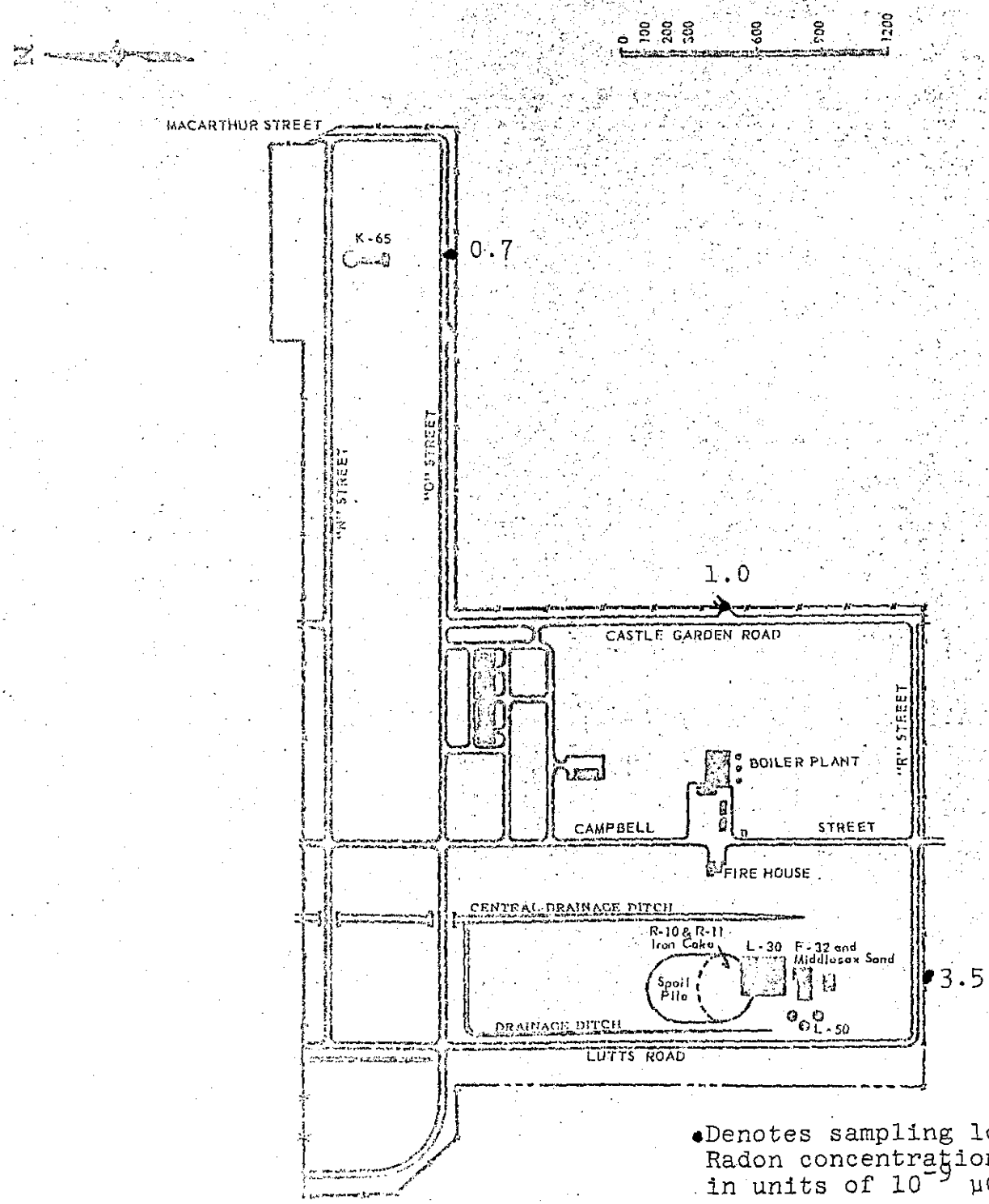
Sincerely yours,
Original Signed By
S. F. AUDIA
Manager

S. F. Audia
Manager

DAF/vvs

cc: M. W. Doback
A. J. Breslin
H. D. Fletcher - 2x
R. C. Heatherton
A. F. Fennak

Central Files



•Denotes sampling location.
Radon concentrations are given in units of 10^{-9} µCi/mℓ.

FIGURE 1. Air Sampling Locations at Niagara Falls Site

NATIONAL LEAD COMPANY OF OHIO

ERDA CONTACT REPORT

DATE:	ORIGINATOR:	TALKED TO:
2-7-77	M. W. Poback	W. Hibbitts

SUBJECT:

RADON SAMPLING AT LEWISTON, N.Y. SITE

SUMMARY OF DISCUSSION:

After reporting an NPDES violation to Wayne, I told him that radon monitors had been set up at the Lewiston site and results would be reported to him as soon as we received the results from HASL. He was pleased to hear that the sampling had been done and said he would now not bother to write the formal letter requesting the sampling. He verbally requested the air sampling when results of the Weldon Spring air sampling were reported to him in July and, at that time, said a formal request would follow. Apparently, there will be no letter from Wayne and this contact report will have to serve as documentation of the request for air sampling.

INSTRUCTIONS:

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2. Forward two copies to Division Director, who in turn will send one copy to the Manager.

NLO-GEN-2401 (REV. 2/7/75)

ERF-21

Oak Ridge Associated Universities

MEMORANDUM

AU 0004760

Crs

TO Dr. Lushbaugh FROM Craig Steger

DATE February 17, 1981 COPIES TO D. M. Robie, Betsy Dupree, ERF/File

SUBJECT LINDE DATA MAINTAINED AT ORAU-CER TYRONE ROAD

In response to the growing interest of the role that the Linde Air Products Tonawanda, New York facility, played in the production of uranium in the period from 1942 through approximately 1948, I am enclosing a descriptive inventory of all the Linde data we have in our possession beginning with historical accounts and ending with actual personnel information. Some of the following entries were shown to the Union Carbide group (Drs. Tom Lincoln and Seaton Garrett) you brought in on February 5 while others were documented in my audit this week. In addition to the flowchart I prepared based on the New York Operations Office (NYOO) Medical Division report entitled "Health Hazards in NYOO Facilities Producing and Processing Uranium (A Status Report - April 1, 1949)" and the sections on Linde which were abstracted and sent to DOE, we have in our files:

1. "A Background Report for the Formerly Utilized Manhattan Engineer District/Atomic Energy Commission Sites Program" DOE/EV-0097 (September 1980). A copy of the section on New York State disbanded sites including the Buffalo, New York area Union Carbide subsidiaries, Linde and Electrometallurgical Companies, and the Carbide dumpsites, Lake Ontario Ordnance Works, the Haist property, and the Seaway Industrial Park (all of the preceding also located in the Buffalo area) was given to Dr. Lincoln.

2. Dr. Lincoln also made note of DOE Report EV-0005/5 entitled "Formerly Utilized MED/AEC Sites Remedial Action Program (Radiological Survey of the Former Linde Uranium Refinery, Tonawanda, New York) May 1978 - Final Report." Both #1 and #2 are public documents available from the National Technical Information Service (NTIS) in Springfield, Virginia.

3. A chronological sequence of MED site visits of the Linde plant has been compiled ranging from April 1944 through January 1945. This series of work reports was organized by the MED in an attempt to document and correct industrial health hazards both for uranium and other agents in the workplace. The sections of these reports dealing with Linde are quite specific in their criticisms of plant conditions and dovetail nicely with other hygiene accounts.

4. For our historical file, I am in the process of acquiring ten Linde construction, process, and operation reports declassified in 1957. These will be added to our file of declassified historical, and process articles which have been arranged by the various facilities in our study.

ILK

5. Incidental to the growing interest in the Linde plant, I am building a file of newspaper articles about Linde and the various waste disposal sites appearing currently in the two Buffalo newspapers.

6. The Tyrone Road document inventory includes Linde records of personnel located at its Ceramics plant (a facility involved in U_3O_8 and nickel production from 1942-1945 and UO_2 production for one year). Running from April 1944 through September 1946, these original plant documents include monthly hires and terminations, name, Social Security number (SSN), age, sex, race, and an encrypted occupational hazard for which we have located the code. The hazard category, based on what is called the "Beilstein Code Numbers," is comprised of approximately ninety uranium and chemical compounds judged to be potential hazards in the MED facilities. All the original MED health records in our possession seem to have this code included in the individual worker's history.

7. We also have the originals of the Linde Ceramics Plant lab exams, (name, SSN, physical data, blood, urinalysis, and in some cases, Wassermann and x-ray results) covering the complete alphabet and what seems to be a period from 1942 through 1946.

8. Apparently in response to the risk encountered by Linde workers, the MED generated a statistical study of a selected group of employees sometime in the 1940's. We have in our records inventory the tabulation of the hemograms and urinalyses and some of the notes and correspondence relating to the production of the study. As is the case with any of the personnel data in our possession, the accuracy and/or completeness of these records is yet to be determined.

9. Resulting from the early efforts of the MED to computerize the health records of wartime workers, we have a two-volume computer printout of the MED employees which we have called the "Rochester Files" Listings 1-6. Included in this study are undetermined fractions of MED's Metal Hydrides, Ames Labs, Linde and Electrometallurgical Companies, University of California Radiation Lab (at Berkeley), Harshaw,

Westinghouse, Mallinckrodt, Kellex, Metallurigcal Labs, Columbia Princeton, Vitro Allis Chalmers, the DuPont plants in New Jersey, and the Middlesex facilities. I have put the MED correspondence about its statistical study together with the multitude of changes in keypunch formats and layouts with the intention of clarifying the Rochester Files in general and the Linde section in particular (comprising approximately 16,000 lines). As noted in #8, the validity of the records is under question not only because of their organization as an early occupational study in the rush of the war years, but also due to the fact that computer science was in an early stage of development in the 1940's. An early Mancuso document discounts the use of data collected by the MED, finding its reliability "seriously questionable" when cross-referenced to the Union Carbide medical and payroll files. However, Betsy Dupree and I have made informal checks of the Linde and Mallinckrodt entries using the proper format information and have found it consistent with the data on the original lab exams. Despite the frequent alterations in keypunch formats, it is unlikely that the entirety of the MED statistical study is invalid.

If you have any questions about these documents, I will be happy to retrieve them for you. I will also update you on any additions to this or any of the other files that I am building.

CS:jm

KTL

CD

AU 0004761

LINDE AIR PRODUCTS

Linde Air Products and another Buffalo based division of Union Carbide, the Electro Metallurgical Company, formed an integral part of the uranium production cycle through the 1940's. Through contracts with the Manhattan Engineer District (MED) and later with the AEC from 1942 through 1948, Linde was engaged in: converting domestic and Belgian Congo pitchblendes to U_3O_8; U_3O_8 to UO_2; UO_2 to UF_4; and some experimental work with converting enriched UF_6 to UO_3.

After its U_3O_8 plant was placed in standby in the Spring of 1944, the majority of the work done at Linde was in the green salt process (UF_4), an area in which only Linde, the Mallinckrodt Chemical Works (St. Louis, Missouri), and later the Harshaw Chemical Company, (Cleveland, Ohio) concentrated.

The process at Linde's UF_4 "Ceramics Plant" began with UO_2 shipments from Mallinckrodt. After manual loading in magnesium trays, the trays were placed in the reaction furnaces for hydrofluorination. The trays were then removed and the contents emptied into a hopper. After being pulverized, the UF_4 was discharged into drums for shipment to Electro Metallurgical for conversion into uranium billets.

MED work reports for 1944 conducted by medical personnel visiting the early sites, found persistent hygiene and housekeeping problems at Linde. An April 1949 New York Operations study indentified the problem among the sixty-five men in the process area as originating in the "manual operations involving the powdered uranium compounds." While Linde's "moderately severe uranium dust exposure" was concentrated in the

fifteen operations receiving thirty-three times the preferred level of seventy alpha $d/m/m^3$, plans for placing the facility on standby obviated all but minor changes in the production areas. Operations at Linde terminated late in 1949.

N/PF
RY 0004762

April, 1981

SUMMARY OF RECORDS KNOWN TO BE AVAILABLE FOR "NIAGARA FRONTIER" SITES
WHICH COULD BE USEFUL IN PHASE 1-3 OF DATA COLLECTION

SITE	YEAR 43	44	45	46	47	48	49	50	51	52	53	54	55	58
Bethlehem Steel									DS	DS				
Electro Metallurgical Company	LE	LE	LE	LE		FB	FB DS U OE				S			
Harshaw Chemical Company	DS LE R PE	FB,R DS,PE LE U	FB,R DS,PE U LE	FB,PE R LE	FB,R DS,PE U,SS LE	FB,LE DS,R OE,U PE	FB,R DS,PE LE U	FB,R DS,PE SR,OE LE	FB,U DS,DE OE R	FB OE U R	FB,DE OE U	FB	FB	
LOOW/ LOSA						FB	RS R FB	U OE FB DS	BR,FB R OE U	DS,SS PE U FB	BR R FB	FB	SR	U
Linde Air Products	X PE LE R	R,U PE LE X	LE,U R PE X	R LE PE X	SR,R LE X,PE X	FB,R U,PE X OE,LE	FB U,X OE,LE R,PE	DS U PE LE	R U	R U	U	DS SS		
Simonds Saw and Steel Company						OE LE PE	OE U FB R	OE R U	OE	OE R U	OE R	OE		

KEY:

- BR Breath Radon
- DE Decontam. Survey
- DS Dust Studies
- FB Film Badge
- LE Lab Exams
- OE Occupational Exposure Studies
- PE Physical Exams
- R Roster
- GROUP { RS Radon Samples; SR Radiation Survey; SS Surface Smears }
- U Urinalyses - U/F
- X Chest X-rays

IAGARA FRONTIER" SITES: LOCATION, PERIOD OF OPERATION, AND "POPULATION SIZE"

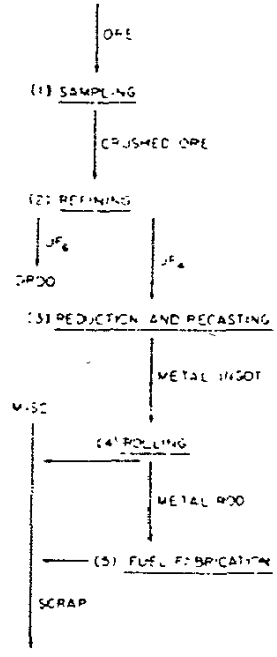
SITE	LOCATION	PERIOD OF OPERATION STARTED	PERIOD OF OPERATION ENDED	"POPULATION SIZE"
ethlehem Steel	Lackawanna, NY	1949	1951	?
lectro Metallurgical Company	Niagara Falls, NY	Nov., 1942	June, 1953*	175
arshaw Chemical Company	Cleveland, OH	Sept., 1942	1960	780
ake Ontario Ordnance Works	Lewiston, NY	Jan., 1944	1958+	?
inde Air Products	Tonawanda, NY	Nov., 1942	June, 1953*	1650-3750
imonds Saw and Steel Company	Lockport, NY	May, 1948	Dec., 1956	200

Plant was dismantled by this date

Placed on standby in 1958. DOE currently has a storage lease agreement here which expires July 1, 1983.

THE URANIUM PRODUCTION INDUSTRY

SOURCE: Breslin, A.J. Occupational Exposures to Uranium Air Contamination in Feed Materials Production Facilities, 1948-1956. In: Symposium on Occupational Health Experience and Practices in the Uranium Industry Held in New York City, Oct. 15-17, 1958. HASL-58.



(2) Linde Air Products, Tonawanda, NY
Harshaw Chemical Co., Cleveland, OH

(3) Electro Metallurgical Co., Niagara Falls, NY

(4) Simonds Saw and Steel Co., Lockport, NY
Bethlehem Steel, Lackawanna, NY

(6) SCRAP RECOVERY + WASTE STORAGE (6) Lake Ontario Ordnance Works Lewiston, NY

Figure 1 Uranium production sequence

Table 1

Number of Production Workers by Year and by Process

Process	1948	1949	1950	1951	1952	1953	1954	1955	1956
Ore crushing and sampling	25*	25*	26	25*	23	23	20*	24*	28*
Refining	204	214*	267*	267*	235	212	167	230*	238*
Reduction and recasting	96	102*	122	135*	170*	232	310*	105*	135
Rolling	32	49	40	38	109	101	150*	223	—
Fuel fabrication	—	—	—	—	19	87*	100	123*	271
Scrap recovery	—	27	92*	37	50	50	34	43	—
Total	354	417	557	502	606	705	781	748	672

*Adjusted to compensate for missing segments of data in these years

LINDE AI' ' RODUCTS' CERAMICS PLANT: URANIUM PROCESSING OPE' ' .NS

UO_2 → Transfer to weighing drums* → Manually load into magnesium trays* → Transfer to movable racks* → Load trays into reaction furnace* → Hydrofluorination → UF_4

Received in fiber containers by carload lots from Mallinckrodt Chemical Works — 32 P.L.† — 2.5 P.L. — 0.6 - 0.9 P.L.

Remove trays from furnace → Replace trays in movable racks → Transport to another location → Dump into portable hopper → Elevate mechanically to top of micro-pulverizer → Feed material into blender

32 P.L. — 32 P.L.

Tumble → Discharge into small steel drum → UF_4 sent to ElectroMet

32 P.L.

* These operations cause dispersal of dust.

† Multiples of preferred levels for uranium dust (70 d/m/m^3). Dust study done October 28 to November 2, 1948.

April, 1981 PRESENTATION

MANHATTAN ENGINEERING DISTRICT: GLOSSARY OF TERMS

BLACK OXIDE	U_3O_8
ORANGE OXIDE	UO_3
BROWN OXIDE	UO_2
GREEN SALT	UF_4
DERBY	IMPURE URANIUM METAL
INGOT, BILLET	PURIFIED URANIUM METAL

UX1 - Thorium-234
UX2 - Pa-234

Oak Ridge Associated Universities

MEMORANDUM

AU 0004763

	Those listed below	FROM	Wm. L. Beck
DATE	April 2, 1981	COPIES TO	File/ERF
SUBJECT	DICK DUFFEY: A FORMER LINDE WORKER		

Dick Duffey, Chemical Engineering Professor, University of Maryland, called me to inquire about ORAU summer programs for University faculty and to ask "how are things in Oak Ridge, etc.". During the conversation, I mentioned my envolvement in the Epidemiology Program and this led to Dick telling me that he had worked at Linde from 1940-42, at Metal Hydrides 1942-43, and was "in and out" of Middlesex. He said he would be happy to tell us what he knows about the early history of these sites and to give us names of some of the key personnel who worked there. He mentioned that he still has contact with some of these people such as the "manager" of Linde.

Dick is also working as a consultant to Aerospace. He works primarily with Andy Wallo at Germantown, Maryland. Aerospace has a contract with DOE to investigate the old MED, AEC, ERDA sites as part of the Formerly Utilized Sites Remedial Action Plan (FUSRAP) Program. They wrote the document "A Background Report for the Formerly Utilized Manhattan Engineering District/Atomic Energy Commission Sites Program" (DOE/EV-0097, September 1980) which we have found to be very useful.

I told Dick that Don Robie would probably want to call him back and get some more specific information from him, and if he comes to Oak Ridge this summer we would certainly want to have him visit the Epidemiology Group and relate the history of his work experience in the New York MED sites to our group. Dick said he would be pleased to help us in any way that he could. Dick's address and phone number is:

Dick Duffey
University of Maryland
Department of Chemical Engineering
College Park, Maryland 29742
Phone: 301-454-2431

WLB:jm

To: Dr. Lushbaugh
Don Robie
Craig Steger
Betsy Dupree

Tell Dick Don to go ahead

Bechtel

NIPF

Oak Ridge Associated Universities

AQ 0004764

MEMORANDUM

TO Linde File

FROM E. A. Dupree

DATE April 10, 1981

COPIES TO Dr. C. C. Lushbaugh, CER Senior Staff
EBF/File

SUBJECT INTERVIEW WITH ROY ANDERSON, A FORMER LINDE EMPLOYEE

On April 8, 1981, Roy Anderson visited CER in order to assist us in our study of the "Niagara Frontier" sites. Anderson is very helpful and knowledgeable about Linde. He was also able to give me some information concerning Electrometallurgical Company, Simonds Saw and Steel Company, Lake Ontario Ordnance Works/Lake Ontario Storage Area and the Haist Property. He said that Berwyn Robinson, who currently lives in Oak Ridge, would also be able to help us. Robinson started working at Linde after and stayed longer than Anderson did.

Taking each site in turn, I will relate what Anderson told me. First a comment about Linde and Electromet. Both of these sites were owned by Carbon and Carbonium Company (CCC). The plant managers at both sites reported to James A. Holiday of CCC. Both plants were shut down and dismantled concurrently.

LINDE

The mission of this site was to produce UF_4 from the uranium ore it received. The process is outlined in Figure 1. The entire process was carried out in the Ceramics Plant. The types of feed material which were processed are outlined in Table 1. A time line describing the history of the operations is given in Table 2.

The Condition of the Work Environment at the Ceramics Plant

The management of Linde was concerned about the conditions of the working environment at the Ceramics Plant. They worked with the University of Rochester and later the A.E.C., giving priority to implementing the improvements that these two organizations suggested.

The biggest problem existed in the Step I Process Area where the ore which was received for processing was dumped into the system. The hazard was due to the radium which was present in the ore. For each ton of pure uranium recovered from this plant, 260-280 mg of radium were removed in the process. The ore was dry and coarsely ground so that it dusted easily. Initially, the African pitchblende which came from the Perry Warehouse was shipped in burlap bags which created a big dust problem. To cut down on this dust problem, it was decided that each burlap bag would be sealed inside a paper bag at Perry Warehouse prior to being shipped to Linde. However, the paper bags had to be saved and returned to Perry Warehouse for reuse. Therefore, they had to be deflated and bundled up. During deflation the ore dust inside the bags was pushed out and suspended in the air.

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During the period of operations, dust collectors and vacuum cleaners were also initiated into the system to control the dust problem. By the end of its operation, Linde had pretty good control on its dirt and dust problem in this area.

The workers in this area were required to wear dust masks from the time operations started up. They did not know they were working with uranium, but they were told that the material was a health hazard, and they should avoid breathing the dust. The earliest film badges issued by the University of Rochester to monitor MED workers were for the workers in the ore dumping area at the Ceramics Plant.

In Process Area Steps II, III, and IV, the hazard to the workers was not from dusting of radium-bearing ores but from the toxicity of the uranium itself. The material being fed into Step II was 96-98% U_3O_8 compared to the ore fed into Step I which was never more than 18% U_3O_8. The process was pretty clean with the need for cleanliness enhanced by the fact that Linde was held accountable for any uranium lost during processing.

ELECTROMETALLURGICAL COMPANY

Electromet was in operation from 1943-1949. The plant was shut down and dismantled by the end of June, 1953. Electromet coverted UF_4 to uranium metal. Most of the UF_4 came from Linde with the remainder coming from Mallinckrodt Chemical Works, Harshaw Chemical Company, and DuPont Dye Plant at Deepwater, New Jersey

Linde File INTERVIEW WITH ROY ANDERSON April 10, 1981
A FORMER LINDE EMPLOYEE

SIMONDS SAW AND STEEL COMPANY

Simonds was under contract with the New York Operations Office to roll uranium and thorium metal billets into rods of 1 1/8" diameter which were then shipped to Hanford or National Lead of Ohio (NLO) to be cut into slugs which were used in operations at Hanford and Savannah River. These operations began in 1948 or 1949 and continued routinely until at least the end of 1952 when the rolling mill at NLO began operating. Simonds may have continued to do rolling on a special order basis until 1953 or 1954.

Simonds rolled the billets on a campaign basis. The billets to be rolled were shipped to and stored at Lake Ontario Storage Area (LOSA) until a large enough quantity was available to roll. Frank Epp and Jerry Hughs ran LOSA. Simonds would shut down its routine operations and roll all the billets which LOSA sent. When rolling was complete, the finished rods were sent back to LOSA. Simonds cleaned up and decontaminated the equipment used to roll the billets and resumed normal operations until LOSA had collected a shipment of billets large enough to be rolled. Simonds rolled billets a couple of days a month.

LAKE ONTARIO ORDNANCE WORKS (LOOW)

LOOW was a shut-down Army TNT Plant covering 1500 acres. MED took over the Baker-Smith area of the reserve in December, 1943 or January, 1944. This area contained large sheet metal warehouses.

Tailings from L-30 processing at Linde were placed in a total of 8300 drums. Ninety-three to 95% of these drums were wooden distillery barrels held together with steel bands and the remainder were steel drums. All of these drums were stacked 2-3 high to completely fill the warehouses on the Baker-Smith area of LOOW. These tailings contained 99% of the radium and less than 1% of the uranium content of the ore. The cobalt and nickel content of the ore was not present in these tailings. The material was wet when placed in the drums. This moisture eventually rusted out the steel rings so that the drums literally fell apart. When this occurred, the tailings were moved to the large tank on the Water Storage Area of the site (same tank mentioned in the next paragraph).

In the meantime, drums could not be made fast enough to keep up with the production of the L-30 tailings. Permission was obtained to dump this residue into a large tank (190' x 200' x 24' deep) on the Water Storage Area of LOOW. All of the L-30 tailings filled half of this tank. This material is still here.

Linde File INTERVIEW WITH ROY ANDERSON April 10, 1981
A FORMER LINDE EMPLOYEE

The small amount of tailings from the processing of L-50 was stored in 2-3 round accelerator tanks on the Water Storage Area.

There was a good bit of residue from the R-10 processing. This was taken by the truck-load and dumped on the ground in a field north-east of the Water Storage Area. This area was covered with 1½ -2 feet of dirt, then straw, and finally grass seeded to prevent erosion. This material is still there.

HAIST PROPERTY

This was a 15-18 acre tract of land where MED and AEC dumped residue from the processing of Colorado concentrates. There were no personnel permanently assigned to work here.

EAD:jm

LINDE: DESCRIPTION OF PR SS AT THE CERAMICS PLANT

1 Low Grade Uranium Ore Assay $\leq$ 18% U_3O_8 → 2 Impure U_3O_8 Assay 96-98% U_3O_8 → Ether Extraction → 3 Uranyl Nitrate Hexahydrate → Denitration Heat → 4 UO_3 → Reduced with Cracked Ammonia → 5 UO_2

→ Anhydrous HF → 6 UF_4 → Ground Mg Thermite Reaction → 7 U Metal Derbies → Vacuum Recast Furnace → 8 U Metal Ingots

AREA	PROCESS STEP	STARTS AT	ENDS AT
	I	1	2
	II	2	5
	III	5	6
	IV	6	8

Notes:

1. The U metal ingots were shipped to Electrometallurgical Co.
2. The residue from the processing which contained over 99% of the radium in the ore was shipped to LOOW.
3. Routinely .25 - .75% of the uranium in the ore was lost in the residue. Losses were never more than 1%.
4. The processing at Mallinckrodt Chemical Works and Linde were very similar. Exposures to the workers were very similar unless MCW was working with Q-11 African pitchblende which had a much higher uranium content than any feed material processed at Linde.
5. There was competition between MCW and Linde concerning which plant could process the most material, produce a product with the highest assay, and have the smallest loss of uranium during processing.

TABLE 1

LINDE: TYPES OF FEED MATERIAL USED IN THE OPERATION OF THE CERAMICS PLANT

TYPE OF MATERIAL	CODE	TIME PERIOD PROCESSED		ASSAY OF U_3O_8*	QUANTITY PROCESSED (TONS)
Colorado concentrates	L-19	06/--/43	11/--/43	12 - 14 %	+
African pitchblende	L-30	11/--/43	09/--/44	8.2 %	
African pitchblende	L-50	10/--/44	11/--/44	4 - 6 %	Several thousand
Colorado concentrates	L-19	11/--/44	01/--/46	16 - 18 %	+
African pitchblende	R-10	02/--/46	06/--/46	2 - 3 %	
Torbernite	Q-20			~8.2 %	1500
Torbernite	Q-20	06/10/46	06/13/46	14.4 tons	84.42
Residues and scrap		06/--/43	06/--/46	- - - - -	

Maximum quantity of ore processed in any week was 1.5 million pounds of R-10

*Assay of uranium = Assay of U_3O_8 x .842

+Colorado concentrates were processed during about 50% of the time of operation of the Ceramics Plant

TABLE 2

LINDE: TIME LINE OF OPERATIONS AT THE CERAMICS PLANT

DATE	EVENT
1942	Ceramics Plant was designed
04/27/43	Step II began operations
06/05/43	Step III, ore digestion, began operations with Colorado concentrate
11/23/43	First box car of L-30 arrived from Perry Warehouse
11/26/43	First of the L-30 was processed
07/04/44	Washing of burlap bags in which the ore was received began
09/30/44	Last truck-load of residue from the processing of L-30 was dumped at LOOW
10/03/44	First truck-load of residue from the processing of L-50 was dumped at LOOW
10/10/44	Burning of burlap bags in which the ore was received began
11/04/44	Last truck-load of residue from the processing of L-50 was dumped at LOOW
11/22/44	Residue from processing of L-19 was again dumped at the Haist property
~11/--/44	Started processing Colorado concentrate again
01/21/46	Last of the L-19 went into the digest tanks
02/--/46	First of the R-10 went into the digest tanks
06/20/46	Last of the residue from processing of R-10 was dumped at LOOW
06/20/46	Burning of burlap bags in which ore was received ended
12/--/46	Step III shut down
11/01/47	Contract No. AT30-1 General 165 went into effect
11/05-10/47	Step III started up again
12/--/48	Step III shut down again
06/--/49	Step I dismantled
12/14/50	Final decontamination survey issued
01/01/53	Contract No. 7405-N14 was closed out
06/30/53	Dismantling of Ceramics Plant was complete
10/15/53	Contract No. AT30-1 General 165 which covered the remaining operations at Linde was closed out

3745

Robie, 1981*, Conversation with [Name Redacted2] (NLO) Concerning Linde Air Products, Tonawanda, New York*
Correspondence with attachments; D. M. Robie; April 10, 1981, pp. 2-28.

DC-PF

AU 0004765

Oak Ridge Associated Universities

MEMORANDUM

TO Betsy Dupree FROM D. M. Robie DMR

DATE April 10, 1981 COPIES TO Dr. Lushbaugh, ERF/File

SUBJECT CONVERSATION WITH MR. RICHARD HEATHERTON (NLO) CONCERNING LINDE AIR PRODUCTS, TONAWANDA, NEW YORK

At your request, I called Mr Richard Heatherton at NLO since I was aware of the fact that he was at Linde in the 40's. I asked him the following questions per our discussion: 1) What was his capacity and what was the period of time that he worked at Linde? Mr. Heatherton said that he was a Chemist in the Control Room at Linde in 1943. He transferred to the Production Department where he became a technical assistant or advisor. After that, he dropped out of the Manhattan District Project for about one and one-half years and then returned to Linde in 1947 as a Health Physicist. He left the Linde contract and went to Lake Ontario Ordnance Works from 1949-1950. From there he went to the New York Operations for approximately one year and then National Lead of Ohio in 1951 when the contract was started there. 2) Does he know if L-19 is "Colorado concentrate?" Dick said that he did not know anything about L-19. 3) Could he provide some information on roster sizes, maximum and minimum sizes at any given time, or approximate total size of the worker population at Linde and other sites? Dick said that the number of workers on the Linde payroll at any one time was approximately three to four hundred employees, and it was a rather consistent number of employees from late 1943 to the close-out of Linde Operations. He left in March of 1946. The Electromet Corporation roster was quite a bit smaller than Linde. He would estimate approximately 100 employees. Simonds Saw and Steel was a very small operation. Only 25 to 30 employees were involved in the Manhattan District operation, and this was only for a couple days per month. These employees then returned to their normal activities. Bethlehem Steel did work for the Manhatten District and AEC and continued working until NLO opened near Cincinnati in late 1951. This was an off and on again process rolling operation, and they worked on the Manhattan Project approximately one time a month for one or two days each time. A similar operation existed at Allegany Ludlum Company near Albany, New York. Lake Ontario Ordnance Works was originally a TNT Plant for the United States Army. Some of the waste residuals from the Linde Operation went to Lake Ontario in 1945-46. He was not sure of the organizational set-up there, but he was reasonably certain that at no time was an Army organization involved with the Manhattan District. It was an Army organization when it was a TNT Plant prior to the Manhattan District days. He said that some equipment discarded by Linde in 1947 was taken to Lake Ontario Ordnance Works. Dick said that he was not familiar with the Harshaw Chemical Company operations; however, he was aware of the fact that this plant was operated for MED and AEC and it was under New York Operations Office for a period of time. This company was involved with the production of UF_4 from uranium oxide. He could not make even a rough estimate of roster sizes for Bethlehem Steel, Lake Ontario Ordnance

Works, or Harshaw. 4) What was the greatest potential radiation exposure problem at the Linde Plant? Dick said that alpha air-borne material was the greatest problem. Gamma was a problem due to the fact that there was some pitchblende at the operation. The uranium refinery process at Linde was similar to Mallinckrodt. 5) What percentage of people were monitored at Linde and what types of people were generally monitored? A very small percentage of personnel were monitored in the early days of the project. However, the likelihood for higher exposures occurred during this time. There were no air samples or any bioassasys taken at Linde in the early years, at least not that he was aware of. In 1947, they started air surveys; and Dick was involved with this. Approximately 50 to 60 percent of the employees were monitored with film badges since the process was involved with the conversion of uranium oxide to UF_4. This was the so-called Step 3 process at Linde. The greatest risk was to production workers. (Approximately 40% of the employee population). 5) Is he aware of any other rosters that might be available? Dick was surprised that all of the medical records and rosters were not readily available because it was so well documented as to where they were sent and what happened to them. 6) What are his comments concerning the Linde insurance carrier? He was aware that the insurance carrier was located in the Buffalo area, and felt that they would have an accurate roster since all personnel were insured as required by state law in New York. Only a small percentage of employees elected to have state coverage so this roster should be rather complete and would be available from the insurance company if it has not been destroyed.

During the period 1940-43, there was sparse data. Not much was done in the way of sampling, although there were a lot more exposures during that period of time. This was about all of the information that he was able to provide during our telephone conversation.

He said that Mr. Frank Epp would be most helpful and that he could get his address if needed. Mr. Epp is currently retired and living in Florida. Dick could get his address through his son who lives near NLO.

I told him you may be contacting him sometime soon, and he said he would be more than willing to help anytime.

DMR:jm

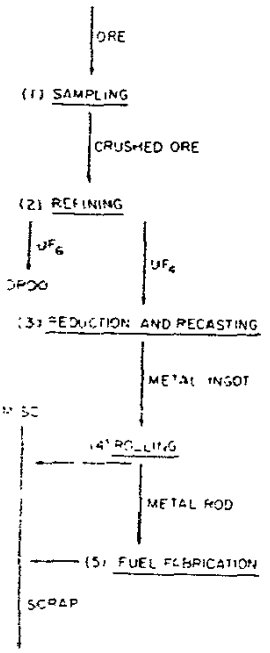
April, 1981

MANHATTAN ENGINEERING DISTRICT: GLOSSARY OF TERMS

BLACK OXIDE	U_3O_8
ORANGE OXIDE	UO_3
BROWN OXIDE	UO_2
GREEN SALT	UF_4
DERBY	IMPURE URANIUM METAL
INGOT BILLET	PURIFIED URANIUM METAL

THE URANIUM PRODUCTION INDUSTRY

SOURCE: Breslin, A.J. Occupational Exposures to Uranium Air Contamination in Feed Materials Production Facilities, 1948-1956. In: Symposium on Occupational Health Experience and Practices in the Uranium Industry Held in New York City, Oct. 15-17, 1958. HASL-58.



(2) Linde Air Products, Tonawanda, NY
Harshaw Chemical Co., Cleveland, OH

(3) Electro Metallurgical Co., Niagara Falls, NY

(4) Simonds Saw and Steel Co., Lockport, NY
Bethlehem Steel, Lackawanna, NY

(6) SCRAP RECOVERY + WASTE STORAGE (6) Lake Ontario Ordnance Works Lewiston, NY

Figure 1 Uranium production sequence

Table 1

Number of Production Workers by Year and by Process

Process	1948	1949	1950	1951	1952	1953	1954	1955	1956
Ore crushing and sampling	25*	25*	26	27*	23	23	20*	24*	28*
Refining	201	211*	267*	267*	235	212	167	230*	238*
Reduction and recasting	96	102*	122	135*	170*	232	310*	195*	135
Rolling	32	59	80	98	109	101	150*	223	--
Fuel fabrication	--			--	19	87*	100	123*	271
Scrap recovery	-	27	32*	37	50	50	34	43	-
Total	354	417	607	502	606	705	781	748	672

*Adjusted to compensate for missing segments of data in these years

"NIAGARA FRONTIER" SITES: LOCATION, PERIOD OF OPERATION, AND "POPULATION SIZE"

SITE	LOCATION	PERIOD OF OPERATION STARTED	PERIOD OF OPERATION ENDED	"POPULATION SIZE"
Bethlehem Steel	Lackawanna, NY	1949	1951	?
Electro Metallurgical Company	Niagara Falls, NY	Nov., 1942	June, 1953*	175
Harshaw Chemical Company	Cleveland, OH	Sept., 1942	1960	780
Lake Ontario Ordnance Works	Lewiston, NY	Jan., 1944	1958+	?
Linde Air Products	Tonawanda, NY	Nov., 1942	June, 1953*	1650-3750
Simonds Saw and Steel Company	Lockport, NY	May, 1948	Dec., 1956	200

---

* Plant was dismantled by this date

+ Placed on standby in 1958. DOE currently has a storage lease agreement here which expires July 1, 1983.

LINDE AI RODUCTS' CERAMICS PLANT: URANIUM PROCESSING OPE ONS

UO_2 → Transfer to weighing drums* → Manually load into magnesium trays* → Transfer to movable racks* → Load trays into reaction furnace* → Hydrofluorination → UF_4

Received in fiber containers by carload lots from Mallinckrodt Chemical Works — 32 P.L.† — 2.5 P.L. — 0.6 - 0.9 P.L.

Remove trays from furnace → Replace trays in movable racks → Transport to another location → Dump into portable hopper → Elevate mechanically to top of micro-pulverizer → Feed material into blender

32 P.L. — 32 P.L.

Tumble → Discharge into small steel drum → UF_4 sent to ElectroMet

32 P.L.

* These operations cause dispersal of dust.

† Multiples of preferred levels for uranium dust (70 d/m/m^3). Dust study done October 28 to November 2, 1948.

ELECTRO METALLURGICAL COMPANY: URANIUM PROCESSING OPERATIONS

UF_4 → Place in blender with Mg powder → Tumble → Place in refractory lined container ("bomb") → Seal bomb → Place bomb in gas-fired furnace → DIRTY U DERBY

Received in steel drums by truck from Linde — 557 P.L.* — 5 P.L. — 5.5 P.L.

Pneumatically chip off slag
18 P.L.

→ Slag salvage → SLAG
→ Slag salvage → RECOVERED U

→ CLEAN U DERBY → Place in induction-heated high vacuum furnace → Heat → Remove mold from furnace → DIRTY U BILLET → Clean surface

— 11 P.L. —

Remove sample with power hacksaw → CLEAN U BILLET shipped to rolling mills

4 P.L.

Multiple of preferred level of uranium dust (70 d/m/ms). Dust study done November 3-5, 1978.

SUMMARY OF RECORDS KNOWN TO BE AVAILABLE FOR "NIAGARA FRONTIER" SITES
WHICH COULD BE USEFUL IN PHASE 1-3 OF DATA COLLECTION

	YEAR													
SITE	43	44	45	46	47	48	49	50	51	52	53	54	55	58
Bethlehem Steel									DS	DS				
Electro Metallurgical Company	LE	LE	LE	LE		FB	FB DS U OE				S			
Harshaw Chemical Company	DS LE R PE	FB,R DS,PE LE U	FB,R DS,PE U LE	FB,PE R LE	FB,R DS,PE U,SS LE	FB,LE DS,R OE,U PE	FB,R DS,PE LE U	FB,R DS,PE SR,OE LE	FB,U DS,DE OE R	FB OE U R	FB,DE OE U	FB	FB	
LOOW/ LOSA						FB	RS R FB	U OE FB DS	BR,FB R OE U	DS,SS PE U FB	BR R FB	FB	SR	U
Linde Air Products	X PE LE R	R,U PE LE X	LE,U R PE X	R LE PE X	SR,R LE X,PE X	FB,R U,PE X OE,LE	FB U,X OE,LE R,PE	DS U PE LE	R U	R U	U	DS SS		
Simonds Saw and Steel Company						OE LE PE	OE U FB R	OE R U	OE	OE R U	OE R	OE		

KEY:

BR	Breath Radon	LE	Lab Exams	RS	Radon Samples
DE	Decontam. Survey	OE	Occupational Exposure Studies	SR	Radiation Survey
DS	Dust Studies	PE	Physical Exams	SS	Surface Smears
FB	Film Badge	R	Roster	U	Urinalyses - U/F
				X	Chest X-rays

"NIAGARA FRONTIER" SITES: TABULATION OF DATA AVAILABLE ON COMPUTER

1. ROCHESTER TAPES — NUMBER OF INDIVIDUALS WITH INFORMATION FOR THIS ATTRIBUTE

SITE	TOTAL NUMBER	SSN	NAME LAST	NAME FIRST	NAME MIDDLE	SEX	RACE	AGE	HAZARD CODE	FILM BADGE	PERIOD COVERED FROM	PERIOD COVERED TO
Electro Metallurgical	188	188	175	175	64	188	188	186	188		092843	043046 (Exam)
Harshaw Chemical Company	767	448	767	721	428	132	132	122	132	188	030143 082344	032447 (Exam) 032448 (FB)
Linde Air Products	1650	1650	1650	1648	565							

2. SOCIAL SECURITY SUBMISSION

	SITE: HARSHAW	SITE: LINDE
DATE SENT	Aug., 1980	Nov., 1979
NUMBER SENT	457	1625
STATUS: ALIVE	233	742
DEAD	109	594
UNKNOWN	75	168
NONMATCH	36	111
IMPOSSIBLE	4	10

Oak Ridge Associated Universities

MEMORANDUM

TO Linde File

FROM E. A. Dupree

DATE April 10, 1981

COPIES TO Dr. C. C. Lushbaugh, CER Senior Staff
EBF/File

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In Process Area Steps II, III, and IV, the hazard to the workers was not from dusting of radium-bearing ores but from the toxicity of the uranium itself. The material being fed into Step II was 96-98% U_3O_8 compared to the ore fed into Step I which was never more than 18% U_3O_8. The process was pretty clean with the need for cleanliness enhanced by the fact that Linde was held accountable for any uranium lost during processing.

ELECTROMETALLURGICAL COMPANY

Electromet was in operation from 1943-1949. The plant was shut down and dismantled by the end of June, 1953. Electromet coverted UF_4 to uranium metal. Most of the UF_4 came from Linde with the remainder coming from Mallinckrodt Chemical Works, Harshaw Chemical Company, and DuPont Dye Plant at Deepwater, New Jersey

Linde File INTERVIEW WITH ROY ANDERSON April 10, 1981
A FORMER LINDE EMPLOYEE

SIMONDS SAW AND STEEL COMPANY

Simonds was under contract with the New York Operations Office to roll uranium and thorium metal billets into rods of 1 1/8" diameter which were then shipped to Hanford or National Lead of Ohio (NLO) to be cut into slugs which were used in operations at Hanford and Savannah River. These operations began in 1948 or 1949 and continued routinely until at least the end of 1952 when the rolling mill at NLO began operating. Simonds may have continued to do rolling on a special order basis until 1953 or 1954.

Simonds rolled the billets on a campaign basis. The billets to be rolled were shipped to and stored at Lake Ontario Storage Area (LOSA) until a large enough quantity was available to roll. Frank Epp and Jerry Hughs ran LOSA. Simonds would shut down its routine operations and roll all the billets which LOSA sent. When rolling was complete, the finished rods were sent back to LOSA. Simonds cleaned up and decontaminated the equipment used to roll the billets and resumed normal operations until LOSA had collected a shipment of billets large enough to be rolled. Simonds rolled billets a couple of days a month.

LAKE ONTARIO ORDNANCE WORKS (LOOW)

LOOW was a shut-down Army TNT Plant covering 1500 acres. MED took over the Baker-Smith area of the reserve in December, 1943 or January, 1944. This area contained large sheet metal warehouses.

Tailings from L-30 processing at Linde were placed in a total of 8300 drums. Ninety-three to 95% of these drums were wooden distillery barrels held together with steel bands and the remainder were steel drums. All of these drums were stacked 2-3 high to completely fill the warehouses on the Baker-Smith area of LOOW. These tailings contained 99% of the radium and less than 1% of the uranium content of the ore. The cobalt and nickel content of the ore was not present in these tailings. The material was wet when placed in the drums. This moisture eventually rusted out the steel rings so that the drums literally fell apart. When this occurred, the tailings were moved to the large tank on the Water Storage Area of the site (same tank mentioned in the next paragraph).

In the meantime, drums could not be made fast enough to keep up with the production of the L-30 tailings. Permission was obtained to dump this residue into a large tank (190' x 200' x 24' deep) on the Water Storage Area of LOOW. All of the L-30 tailings filled half of this tank. This material is still here.

Linde File INTERVIEW WITH ROY ANDERSON April 10, 1981
A FORMER LINDE EMPLOYEE

The small amount of tailings from the processing of L-50 was stored in 2-3 round accelerator tanks on the Water Storage Area.

There was a good bit of residue from the R-10 processing. This was taken by the truck-load and dumped on the ground in a field north-east of the Water Storage Area. This area was covered with 1½ -2 feet of dirt, then straw, and finally grass seeded to prevent erosion. This material is still there.

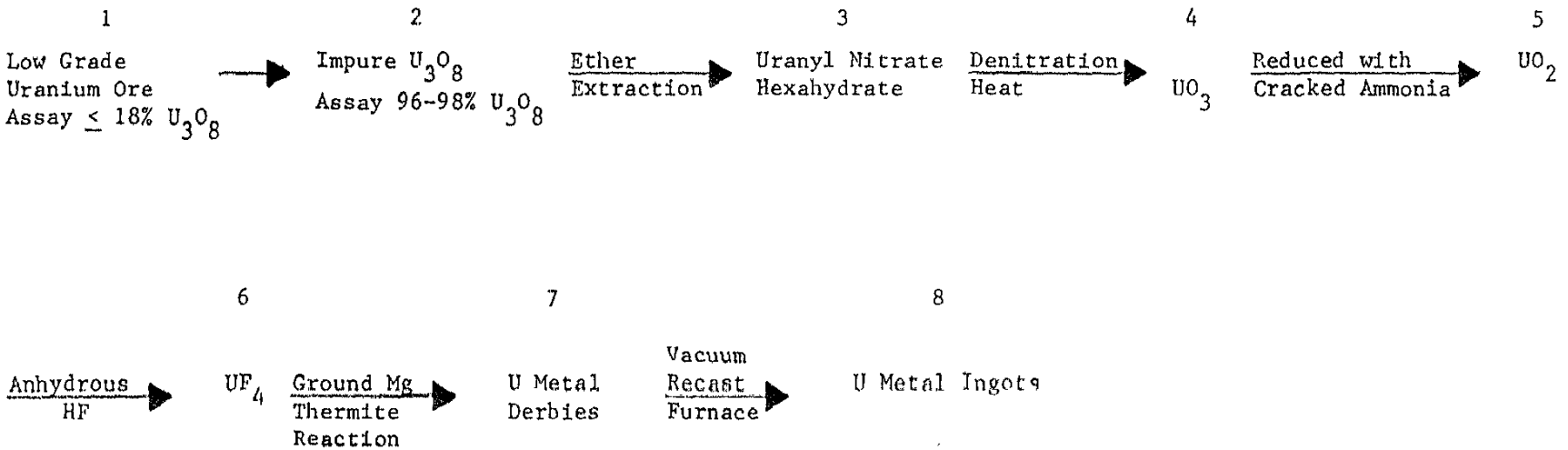
HAIST PROPERTY

This was a 15-18 acre tract of land where MED and AEC dumped residue from the processing of Colorado concentrates. There were no personnel permanently assigned to work here.

EAD:jm

FIGURE 1

LINDE: DESCRIPTION OF PROCESS AT THE CERAMICS PLANT



AREA	PROCESS STEP	STARTS AT	ENDS AT
	I	1	2
	II	2	5
	III	5	6
	IV	6	8

Notes:

1. The U metal ingots were shipped to Electrometallurgical Co.
2. The residue from the processing which contained over 99% of the radium in the ore was shipped to LOOW.
3. Routinely .25 - .75% of the uranium in the ore was lost in the residue. Losses were never more than 1%.
4. The processing at Mallinckrodt Chemical Works and Linde were very similar. Exposures to the workers were very similar unless MCW was working with Q-11 African pitchblende which had a much higher uranium content than any feed material processed at Linde.
5. There was competition between MCW and Linde concerning which plant could process the most material, produce a product with the highest assay, and have the smallest loss of uranium during processing.

TABLE 1

LINDE: TYPES OF FEED MATERIAL USED IN THE OPERATION OF THE CERAMICS PLANT

TYPE OF MATERIAL	CODE	TIME PERIOD PROCESSED		ASSAY OF U_3O_8*	QUANTITY PROCESSED (TONS)
Colorado concentrates	L-19	06/--/43	11/--/43	12 - 14 %	+
African pitchblende	L-30	11/--/43	09/--/44	8.2 %	
African pitchblende	L-50	10/--/44	11/--/44	4 - 6 %	Several thousand
Colorado concentrates	L-19	11/--/44	01/--/46	16 - 18 %	+
African pitchblende	R-10	02/--/46	06/--/46	2 - 3 %	
Torbernite	Q-20			~8.2 %	1500
Torbernite	Q-20	06/10/46	06/13/46	14.4 tons	84.42
Residues and scrap		06/--/43	06/--/46	- - - - -	

Maximum quantity of ore processed in any week was 1.5 million pounds of R-10

*Assay of uranium = Assay of U_3O_8 x .842

+Colorado concentrates were processed during about 50% of the time of operation of the Ceramics Plant

TABLE 2

LINDE: TIME LINE OF OPERATIONS AT THE CERAMICS PLANT

DATE	EVENT
1942	Ceramics Plant was designed
04/27/43	Step II began operations
06/05/43	Step III, ore digestion, began operations with Colorado concentrate
11/23/43	First box car of L-30 arrived from Perry Warehouse
11/26/43	First of the L-30 was processed
03/--/44	Step II processing of uranium was shut down
07/04/44	Washing of burlap bags in which the ore was received began
09/30/44	Last truck-load of residue from the processing of L-30 was dumped at LOOW
10/03/44	First truck-load of residue from the processing of L-50 was dumped at LOOW
10/10/44	Burning of burlap bags in which the ore was received began
11/04/44	Last truck-load of residue from the processing of L-50 was dumped at LOOW
11/22/44	Residue from processing of L-19 was again dumped at the Haist property
~11/--/44	Started processing Colorado concentrate again
01/21/46	Last of the L-19 went into the digest tanks
02/--/46	First of the R-10 went into the digest tanks
06/20/46	Last of the residue from processing of R-10 was dumped at LOOW
06/20/46	Burning of burlap bags in which ore was received ended
12/--/46	Step III shut down
11/01/47	Contract No. AT30-1 General 165 went into effect
11/05-10/47	Step III started up again
12/--/48	Step III shut down again
06/--/49	Step I dismantled
12/14/50	Final decontamination survey issued
01/01/53	Contract No. 7405-N14 was closed out
06/30/53	Dismantling of Ceramics Plant was complete
10/15/53	Contract No. AT30-1 General 165 which covered the remaining operations at Linde was closed out

Oak Ridge Associated Universities

MEMORANDUM

TO Dr. Lushbaugh, CER Senior Staff FROM Craig Steger

DATE May 5, 1981 COPIES TO

SUBJECT DATA ON URANIUM PROCESSING AT LINDE BASED ON "CONSTRUCTION, OPERATION AND PROCESS REPORTS"

STEP I: Dates of operation 6/14/43 → 7/18/46

Produced U_3O_8 from low grade pitchblende, carnotite ores

African metals (from pitchblende deposits with no previous chemical processing)

1. L-30 (10.54% U_3O_8)
2. L-50 (6.70% U_3O_8)
3. R-10 (3.53% U_3O_8)

3 principal foreign ores

4. Q-20 from torbernite ores--Additional: used for a short time
5. L-19 (14-16% U_3O_8)
6. G.U.T. or iron box sludge (18% U_3O_8) Dried liquor from carnotite ore processing-passed through reduction bed of iron filings prior to shipment to Linde
7. Also processed slurries resulting from the processing of U_3O_8 to UO_2 at Linde and other plants (50-70% U_3O_8)

STEP II: Dates of operation 4/27/43 → 3/8/44

$U_3O_8 \rightarrow UO_2$

F-29 (U_3O_8 as feed material 97.05% min.)

P-65 (UO_2 as product 97.0% min.)

STEP III: Dates of operation 7/25/43 → 6/26/46

$UO_2 \rightarrow UF_4$

SOURCES OF UO_2 (97.0% min.)	CODES
Mallinckrodt	C-306, C-316
Dupont	C-103
Linde (Step II)	P-65

CS:jj

Oak Ridge Associated Universities

MEMORANDUM

TO Those listed below FROM Wm. L. Beck

DATE April 2, 1981 COPIES TO File/ERF

SUBJECT DICK DUFFEY: A FORMER LINDE WORKER

Dick Duffey, Chemical Engineering Professor, University of Maryland, called me to inquire about ORAU summer programs for University faculty and to ask "how are things in Oak Ridge, etc.". During the conversation, I mentioned my envolvement in the Epidemiology Program and this led to Dick telling me that he had worked at Linde from 1940-42, at Metal Hydrides 1942-43, and was "in and out" of Middlesex. He said he would be happy to tell us what he knows about the early history of these sites and to give us names of some of the key personnel who worked there. He mentioned that he still has contact with some of these people such as the "manager" of Linde.

Dick is also working as a consultant to Aerospace. He works primarily with Andy Wallo at Germantown, Maryland. Aerospace has a contract with DOE to investigate the old MED, AEC, ERDA sites as part of the Formerly Utilized Sites Remedial Action Plan (FUSRAP) Program. They wrote the document "A Background Report for the Formerly Utilized Manhattan Engineering District/Atomic Energy Commission Sites Program" (DOE/EV-0097, September 1980) which we have found to be very useful.

I told Dick that Don Robie would probably want to call him back and get some more specific information from him, and if he comes to Oak Ridge this summer we would certainly want to have him visit the Epidemiology Group and relate the history of his work experience in the New York MED sites to our group. Dick said he would be pleased to help us in any way that he could. Dick's address and phone number is:

Dick Duffey
University of Maryland
Department of Chemical Engineering
College Park, Maryland 29742
Phone: 301-454-2431

WLB:jm

To: Dr. Lushbaugh
Don Robie
Craig Steger
Betsy Dupree

LINDE AIR PRODUCTS

Linde Air Products and another Buffalo based division of Union Carbide, the Electro Metallurgical Company, formed an integral part of the uranium production cycle through the 1940's. Through contracts with the Manhattan Engineer District (MED) and later with the AEC from 1942 through 1948, Linde was engaged in: converting domestic and Belgian Congo pitchblendes to U_3O_8; U_3O_8 to UO_2; UO_2 to UF_4; and some experimental work with converting enriched UF_6 to UO_3.

After its U_3O_8 plant was placed in standby in the Spring of 1944, the majority of the work done at Linde was in the green salt process (UF_4), an area in which only Linde, the Mallinckrodt Chemical Works (St. Louis, Missouri), and later the Harshaw Chemical Company, (Cleveland, Ohio) concentrated.

The process at Linde's UF_4 "Ceramics Plant" began with UO_2 shipments from Mallinckrodt. After manual loading in magnesium trays, the trays were placed in the reaction furnaces for hydrofluorination. The trays were then removed and the contents emptied into a hopper. After being pulverized, the UF_4 was discharged into drums for shipment to Electro Metallurgical for conversion into uranium billets.

MED work reports for 1944 conducted by medical personnel visiting the early sites, found persistent hygiene and housekeeping problems at Linde. An April 1949 New York Operations study indentified the problem among the sixty-five men in the process area as originating in the "manual operations involving the powdered uranium compounds." While Linde's "moderately severe uranium dust exposure" was concentrated in the

fifteen operations receiving thirty-three times the preferred level of seventy alpha $d/m/m^3$, plans for placing the facility on standby obviated all but minor changes in the production areas. Operations at Linde terminated late in 1949.

4413

Harris, 1956, *Open Field Burning of Low Level Radioactive Contaminated Combustible Wastes*; Willaim B. Harris and Martin S. Weinstein; 1956

C.W. Shewalter, Production Division
Oak Ridge Operations Office

November 19, 1956

W.B. Harris, Chief, Industrial
Hygiene Branch, HASL

SYMBOL: HSH:WBH

We are enclosing three copies of our report which describes an investigation we did at the Lake Ontario Storage Area. This consisted of two studies during which time we burned first 5 crates and later 20 crates of the contaminated waste materials. We believe that the entire building could similarly be burned without any measurable hazard to life or property, while at the same time relieving us of a significant fire hazard.

We would be happy to come to a meeting at Oak Ridge or any other location of your selection to discuss the advisability of the disposal of this building in this manner.

Enclosure:
Open field burning (3)

F-1005

[illegible], HEALTH & SAFETY 3-4

293

G.W. Stevenson, Production Division
Oak Ridge Operations Office

November 19, 1956

W.B. Harris, Chief, Industrial
Hygiene Branch, HASL

SUBJECT: HSH:WBH

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Enclosure:
Open field burning (3)

1956 NOV 23 AM 9:06
OAK RIDGE OPERATIONS
U.S. A.E.C.
1956 NOV 23 AM 9:06
OAK RIDGE OPERATIONS
U.S. A.E.C.
INDUSTRIAL HEALTH & SAFETY
NOV 27 1956

OPEN FIELD BURNING OF LOW LEVEL RADIOACTIVE CONTAMINATED COMBUSTIBLE WASTES

W. B. Harris and M. S. Weinstein
Industrial Hygiene Branch
Health and Safety Laboratory,
U.S.A.E.C.
New York, New York

ABSTRACT

Three investigations at three different levels of volume up to approximately 10 tons have been conducted. These involved burning of contaminated laboratory wastes containing millicurie amounts of activity in an uncontrolled open field. Extensive sampling of the area out to a distance of 2,000 feet revealed negligible contamination of the air and neglible fallout under the conditions of test.

& SAFETY 3-4
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OPEN FIELD BURNING OF LOW LEVEL RADIOACTIVE CONTAMINATED COMBUSTIBLE WASTES

William B. Harris
Martin S. Weinstein

BASIC CONSIDERATIONS

The operation of a radiochemical laboratory almost of necessity results in the generation of relatively large quantities of contaminated burnible waste materials. These materials are the familiar Kleenex, Diaper paper, and other absorbant materials, rubber gloves, wooden table tops, and so forth. With the expanding scope of the Atomic Energy Program, the quantities of such materials in many cases become overwhelming. It is increasingly evident that a practical, economical means must be devised for disposition of these wastes, which at the same time is consistent with the danger which might arise from them.

In the past, such materials have either been baled and stored above ground; incinerated in large very costly incinerators; buried under the ground and covered; or weighted with concrete and immersed in the ocean.

Each of these methods is costly and laborious, and when one looks at the nature of the waste materials, they all appear unnecessarily precautionary.

When the Health and Safety Laboratory was faced with the possibility of having the AEC pay the cost for the disposition of very large quantities of such material, serious consideration was given to alternative methods. The most obvious, of course, was that of handling the material as non-contaminated paper, and burning it in the open with no further control.

In order to investigate the permissibility of such a procedure a series of three experiments were set up, each one depending successively on the success of the previous one. The first involved the burning of 500 pounds of material, the second was made up of about 4,000 pounds, while the third consisted of crates containing 13,500 pounds.

METHOD OF STUDY

In each case a superficial examination was made of the meteorologic conditions existing at the time in the area. An estimate was made of the height of the smoke plume in order to permit application of the diffusion equations. It was considered desirable to compare the data which were obtained with those which might be predicted from theory.

Sampling patterns were laid out and samples were obtained on gum paper for fallout evaluation and by means of filters to determine the airborne concentration. All samples were obtained continuously throughout the experimental period. The fallout samples were collected on pressure sensitive cellophane film one square foot in area, and the air samples on 1-1/8" diameter Whatman #41 filter paper at a flow rate of 15 liters per minute. All fallout samples were dry ashed and counted for beta activity on an automatic geiger tube instrument. The air samples were counted for both β and α activity, and the final ash assayed for total β and α.

RESULTS

In Table I is shown the results of the three experimental runs.

TABLE I

EXPERIMENTAL RESULTS

Item		Case I	Case II	Case III
Weight (lbs)	Original	500	4,000	13,500
	Ash	170	290	1,320
	Reduction (%)	66	93	90
Volume (ft^3)	Original	-	200	770
	Ash	-	22	75
	Reduction (%)	-	90	90
Activity (μc)	Original	780	2,000	10,000
	Ash	~780	~2,000	~10,000
	Estimated Recovered Fallout	0.26	20	~100
Fallout ($d/m/ft^2$)	Maximum	17	6,000	40,000
	Minimum	negl.	12	46
	Distance to Background (ft)	400	400	~800
Air Contamination uc/ml($\times 10^{-12}$)				
	α	1.4	-	3.2
	β	1.4	4.0	3.2

DISCUSSION

In order to evaluate the results of the test, some sort of criteria must be derived against which the results can be measured. In general, the materials which were picked up were found to be largely mixed fission products, although small but measurable amounts of plutonium were found in some of the analyses. Presuming, however, as a limiting case that the beta activity was all strontium 90 and the alpha activity all plutonium, the following criteria would be applicable:

TABLE II

LEVELS OF PERMISSIBLE CONCENTRATION OF RADIOACTIVE CONTAMINANTS

(From NBS Handbook 52)

Medium in which contained	Material	
	Pu^{239}	$Sr^{90} + Y^{90}$
Air	2×10^{-12} µc/ml	2×10^{-10} µc/ml
Soil*	5.65×10^{4} d/m/ft^2	3.75×10^{5} d/m/ft^2

* The value for soil assumes the same permissible concentration as in water and that the activity is all in the top 3".

In case #1 the wastes were in the form of loose boxed material so that a volume designation would be meaningless. In the other two cases the wastes had been previously tightly packed by a baling machine and had to be broken open to permit sufficient aëration for adequate incineration. Volume reductions were by a factor of 10.

There is a certain inherent variation in the weight reductions, depending upon the amount of non-burnable materials such as laboratory glassware and bits of metal which were included in the wastes. It would be presumed that if weight reduction were a primary factor, some procedure of segregation would be employed which would reduce the non-combustibles to a minimum. In the first experiment the weight reduction was by a

factor of three, whereas in both of the other cases the ash was less than 10% of the original weight.

In the first case the loss in activity was almost nil, with only 0.26 microcuries of activity computed for the fallout from an initial activity level of almost 1 millicurie. On both the second and third burning, loss of activity was negligible with a computed level of 20 microcuries in the fallout from an initial 2 millicuries quantity in the second case. The final burning of seven tons of baled material presented more anomolous results because of the conditions which obtained during the experiment. A rough estimate based on ash measurements and other similar baled material, however, indicates approximately 10 millicuries of initial activity resulting in a fallout of approximately 100 microcuries.

The airborne activity in no case exceeded 4×10^{-12} microcuries per milliliter of either alpha or beta activity even at a distance of 25 ft.

In Figure 1 is shown the average surface activity level plotted against radius from the pyre for the second experiment. It can be seen here that there is reasonably good agreement with the diffusion equation and that the fallout in this case probably was reduced to zero at approximately 400 feet. The maximum soil contamination even at 25 feet from the burning is far below the permissible level for either strontium or plutonium. The air activity levels are of the order of the maximum permissible level for continuous occupational exposure to plutonium. These also occurred at about 25 feet from the pyre. Beyond this radius no measurable quantity was found.

Figure 2 presents the same information for the final experiment.

Here the results are somewhat difficult of interpretation because of two extraneous factors which strongly affected the results. In the first place the experiment was carried out during a period of intermittent drizzle coupled with a highly variable wind pattern. At one time or another the wind blew from each point of the compass. In the second place the data indicate that, superimposed on the fallout from the burning, was a generalized fallout in the area. An examination of fallout records throughout the country verifies that on the day in question, levels of approximately 400 to 600 disintegrations per minute per square foot were measured from weapons test fallout activity. As can be seen from Figure 2 a general background of approximately 550 disintegrations per minute per square foot appears to have been present in the vicinity of the testing site.

These factors make any interpretation of the data only tentative. However, maximum values can be presented. The greatest fallout level, which occurred at 10 feet, was 40,000 $d/m/ft^2$. This is still well below a conservative permissible level for strontium or plutonium. The air activity was somewhat lower than in the previous case. This can be explained somewhat by the presence of rain. It appears from extra-

polation of the data presented in Figure 2 that the maximum extent of measurable fallout was approximately 800 feet.

CONCLUSION

The results of three experiments involving the burning of combustible materials under widely varying conditions and using greatly different quantities of waste indicates no biologically significant contamination either of the soil or of the air, created by the incineration. The quantity of material that was burned in the largest of the experimental runs is higher than would be expected to accumulate at a laboratory site in a reasonable period. If incineration of this type is carried on with a frequency dictated by the scope of operations it should be possible to consume all of the combustible waste materials in this manner, and thereby very significantly reduce the volume and weight of materials to be disposed of.

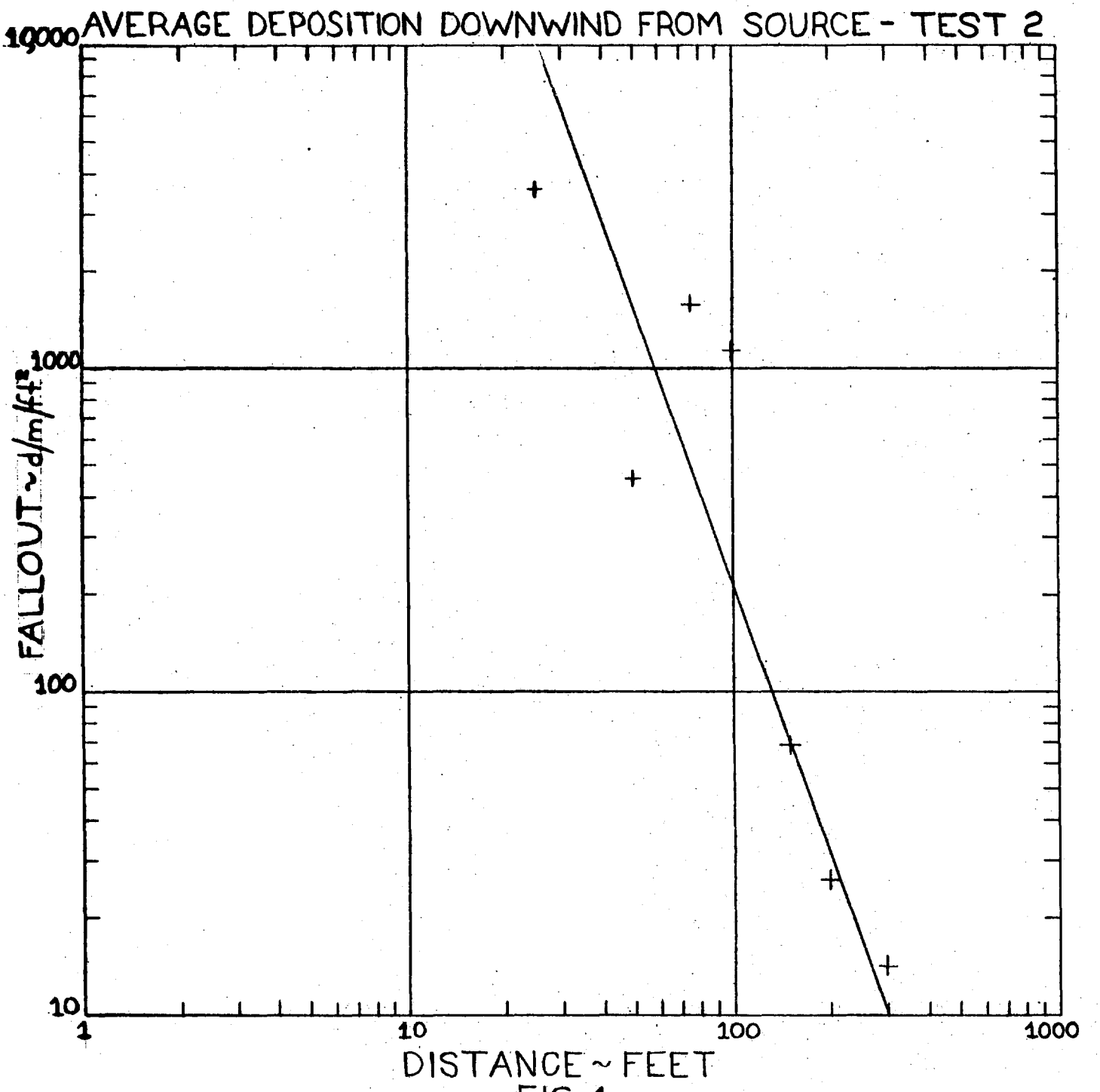
AVERAGE DEPOSITION DOWNWIND FROM SOURCE - TEST 2
10,000
1000
100
10
FALLOUT ~ d/m/ft²
1
10
100
1000
DISTANCE ~ FEET

FIG. 1

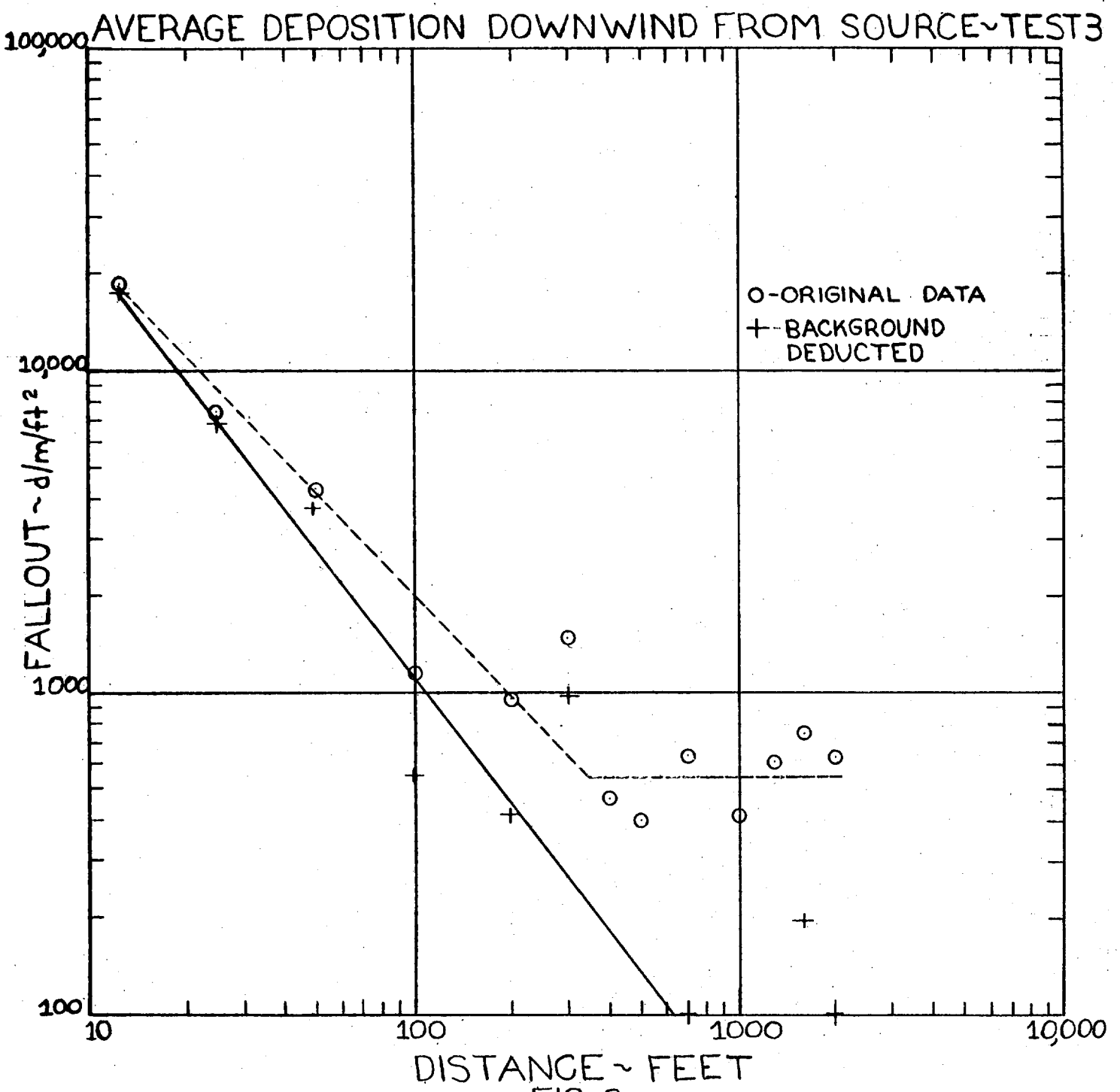
AVERAGE DEPOSITION DOWNWIND FROM SOURCE~TEST3
100,000
10,000
1000
100
FALLOUT ~ d/m/ft²
10
100
1000
10,000
DISTANCE ~ FEET
O-ORIGINAL DATA
+-BACKGROUND DEDUCTED

FIG. 2

F. W. Malone, Chief, Niagara Falls Branch 28 NOV 1956

F. R. Dowling, Director, Feed Materials Division,
ORO

WAREHOUSE FOR CONTAMINATED MATERIAL STORAGE AT NFS

SYMBOL: OF:CWS

We note in the submission of the midyear financial plan by Hooker Electrochemical Company that, on Page 4, they comment that extensive repairs are needed on the building housing the contaminated material at the Niagara Falls Site. We are aware that this building is in deplorable condition but, for reasons given below, question the economy of repairing this structure.

We understand that the contents of the building represent a number of years' accumulation of combustible rubbish generated at Knolls Atomic Laboratory. These materials were sent to Niagara Falls, baled, boxed, etc., because Knolls had no method of disposal for this material. The structure picked for storage of these materials is a construction warehouse erected by the original construction contractor for the Lake Ontario Ordnance Works. This building was not assumed to be a permanent structure in the first instance; it is at least 15 years old and has received very little maintenance since its erection.

We believe, before any decision should be reached as to repairing the building at this time, a rather full investigation should be made of the alternates which may be available to us in devising other ways of dealing with this problem. The following ways of dealing with the problem come to mind:

Scheme A. To continue "as is" storing the material in the existing building, repairing the building as indicated, and over a number of years' time probably having to completely replace the building, with the subsequent move of the stored material to the new facility. This method, with minimum immediate expense, has the potential of infinite continuous small expense, amounting over the years to a very real financial drain which could well overcome a more expensive immediate method which would provide a permanent solution.

Scheme B. Off-site disposition of the material in a permanent manner. One of these methods is sea disposal, which necessitates the proper packaging for sinking, transportation costs, and arrangements with the

MEDICINE, HEALTH & SAFETY Niagara Falls 3-4

4-7415 Rath

Navy. Costs and procedures associated with such a disposal method can be obtained by contacting the New York Office.

Another scheme of permanent off-site disposal has come to our attention and is as follows:

Mr. John M. Stevens of the Woodbury Clay Company, Hollidaysburg, Pennsylvania, visited Oak Ridge recently for discussions on the subject of utilizing his company-owned abandoned clay pits for disposal of contaminated residues. Mr. Stevens' discussion indicated many favorable factors in the interest of the Commission's disposal problem. He is now in the process of obtaining CAP licenses for possession of controlled materials. Direct communication with Mr. Stevens is in order.

Scheme C. On-site elimination of the continued storage problem.

Again, two methods suggest themselves:

1. The digging of a large pit into which the materials can be dumped and covered with appropriate earth. We presume this is geologically feasible because of the past record of burial of other contaminated materials at the Niagara Falls site.

2. A proposal which has been suggested a number of times in the past, i.e., that we set fire to the building and reduce the contents to a reasonable volume before attempting further disposition means. There may well be some real merit to such a plan, although the destruction of government property, i.e., the building, and the health and safety aspects of this scheme will need further resolution.

We believe the choice of specific methods of dealing with this problem should be based on financial considerations and that any of the procedures which require administrative, health and safety, and asset destruction approvals should be undertaken after we find the benefits which will accrue to us by the resolution of these various problems. Therefore, we suggest that you ask Hooker to prepare some comparative cost estimates based on the above methods of disposition or any other schemes which may occur to them. We believe that the cost estimates should contain the following components:

Scheme A.

1. Yearly cost to maintain building.

2. Estimated building replacement on a time schedule established by HEC.

3. Cost of movement of materials from building to building if the replacements occur.

4. Items 2 and 3 amortized on a yearly basis to show the actual yearly government cost under our present scheme of operation.

Scheme B.

1. Costs of preparation for disposal, i.e., weighting, boxes, bales, etc., for sea submersion or recrating, etc., as may be required to permit common carrier haulage of wastes to other dumping grounds.

2. Costs of shipping, including sea burial costs if this method is feasible.

3. Costs of storage at dump. We understand that Mr. Stevens is willing to accept a one time fixed fee per ton for storage at his location.

Scheme C.

1. Pit burial.

   a. Cost of pit.

   b. Cost of removal to pit.

   c. Cost of filling pit.

2. Controlled burning.

   a. Cost of the fire, i.e., special precautions to prevent spread of fire, etc.

   b. Cost of cleanup of residual from fire.

      (1) Removal of non-burnables to contaminated metal storage areas.

      (2) Deep plowing of land over which ashes of fire are distributed.

   c. Salvage value of building destroyed in fire. An estimate of this value can probably be obtained from one of the building wreckers used in the past at NFS.

Based on the above types of analysis, we would appreciate receiving the Hooker recommendation as to the best way to handle this problem and their and your comments on the feasibility and problems associated with the various solutions.

ORIGINAL SIGNED BY J. W. RUCH

F. R. Dowling

CC: N. H. Woodruff
H. M. Roth — Feed Materials Div. Res. &Devel. Supply Div. Safety Dr.
F. P. Trent — Shoemaker:gbm
N. H. Marsden

DISPATCHED
U. S. A. E. C.
OAK RIDGE OPERATIONS

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Vessels, 1958, *Bioassay Results, Hooker Electrochemical Company, AEC Contract No. AT (30-1)-1524*, memorandum; R. D. Vessels; July 29, 1958, p. 3.

STANDARD FORM NO. 64

Office Memorandum • UNITED STATES GOVERNMENT

TO : Herman W. Roth, Director, Research and Development Division, Oak Ridge Operations

DATE: JUL 29 1958

FROM : R. D. Vessels, Acting Director, Reactor Engineering and Technical Services Division, SNROO

SUBJECT: BIOASSAY RESULTS, HOOKER ELECTROCHEMICAL COMPANY, AEC CONTRACT NO. AT(30-1)-1524

SYMBOL: RETS:BMB

As requested in your memorandum of May 5, 1958, the twelve contractor personnel involved with the handling and burning of low-level combustible KAPL wastes at the Lake Ontario Ordnance Site have submitted urine specimens and the following results for mixed fission products obtained:

Name	Bottle #	Volume ML	Results in d/m/24 hrs.
A. Blazejewski	12	1200	0.0 ± 9.4
C. Bowman	11	1000	4.1 ± 10.4
A. Brown	10	1200	0.5 ± 10.4
C. Chesterfield	1	1200	14.3 ± 9.7
W. Collins	7	1200	3.6 ± 10.4
J. Hanner	9	1100	0.0 ± 9.4
H. Kania	6	1200	5.6 ± 9.2
S. Pisarski	8	1000	5.7 ± 10.4
J. Ringvelski	5	1200	14.3 ± 9.7
W. St. Onge	4	1000	12.0 ± 9.7
P. Seager	3	1000	16.4 ± 9.7
A. Winslow	2	1200	13.3 ± 9.7

All results are below a physically significant level of 50 d/m/24 hrs. established and defined by KAPL as the lower limit of reliable analytical and counting detectability. The personnel involved therefore received only negligible fission product exposures, estimated to be less than 0.015 rem/wk.

If this office can be of any further assistance in this matter, kindly let us know.

AUG

7571

MEDICINE, HEALTH & SAFETY 3-4 (Contaminated Items)

U. S. A E C
OAK RIDGE OPERATIONS

1958 AUG 1 PM 1 : 26

4458

Roth, 1958, *Request for Analysis of Urine Samples*, correspondence; Herman M. Roth; May 5, 1958, p. 5

V. V. Hendrix, Director, Reactor Engineering
and Technical Services Division, Schenectady
Naval Reactors Operations Office
Herman M. Roth, Director, Research and Development
Division, Oak Ridge Operations

May 5, 1958

REQUEST FOR ANALYSIS OF URINE SAMPLES

SYMBOL: ORB:AS

Reference is made to my memorandum to you dated December 26, 1957, symbol ORB:AS, subject: "KAPL Wastes Stored at LOOS", in which we informed you that we had arranged with our contractor at the Niagara Falls Site to burn the low level combustible KAPL wastes that have been stored at Niagara Falls prior to shipping the remainder of these solid wastes to Oak Ridge for burial.

The burning operation has been completed and we would like to have KAPL analyze urine specimens submitted by Hooker Electrochemical Company personnel who were involved in this work in order to complete our evaluation of any potential internal exposure they may have received. While there are alternative locations where such specimens might be analyzed, KAPL's urinalysis program includes a routine analytical procedure for the same spectrum of mixed fission products of interest here. The results obtained from the urinalysis we request would therefore be directly comparable with KAPL's own results and would permit a more meaningful evaluation than we could obtain elsewhere.

If you and the contractor agree to assist us in this regard we would appreciate your arranging for KAPL to send 12 urine specimen containers and appropriate instructions for submitting the specimens to Mr. Frank W. Malone, Chief, Niagara Falls Branch, USAEC, Lewiston, N. Y. This request is for the analysis of a single group of samples with the possible exception that the results may indicate a need for re-sampling certain individuals.

The contract with the Hooker Electrochemical Company will be closed out on June 30, 1958. It is, therefore, necessary that we obtain all the specimens we require, and preferably the urinalysis results as well, by that time.

Your cooperation and assistance in making these arrangements will be greatly appreciated.

ORIGINAL SIGNED BY
HERMAN M. ROTH

S 2993

MEDICINE, HEALTH & SAFETY - 3-4 (Contains)

Herman M. Roth

OFFICE ▶	CC: F. W. Malone, Niagara Falls		Bio. Br.	Res. & Dev.	Feed Materials	
	J. W. Ruch, ORO					
SURNAME ▶			Schoen:ef			
DATE ▶			5/2/58	5/5	5/2/58	

Form AEC-318 (Rev. 9-53)

U. S. GOVERNMENT PRINTING OFFICE 16—62761-3

ORB:AS

Oak Ridge, Tennessee
May 5, 1958

Union Carbide Nuclear Company
Post Office Box P
Oak Ridge, Tennessee

Attention: Dr. J. A. Swartout, Deputy Director
Oak Ridge National Laboratory

Subject: REQUEST FOR BURIAL OF KAPL WASTES STORED AT NIAGARA FALLS

Gentlemen:

Reference is made to our letter dated December 20, 1957, subject: Waste Burial - Niagara Falls Drums.

We have been in the process of disposing of all KAPL wastes stored at Niagara Falls preparatory to closing out our contract there and transferring the responsibility for the property to the New York Operations Office. Wastes had been stored above ground at this location on an interim basis pending more suitable and permanent disposition. It is no longer possible to continue this method of storage and we have no alternative but to ask that the Laboratory accept these wastes for burial. We have arranged for the burning of the combustible wastes containing low level contamination and have in this manner substantially reduced the total volume of wastes involved. There are, however, approximately seven car loads of waste in 4' x 4' x 4' wooden boxes which must be discarded. We have discussed this matter with your Mr. A. J. Witkowski informally, and he is aware of the details of this problem. Mr. Frank W. Malone, Chief, Niagara Falls Branch, USAEC, will contact Mr. Witkowski concerning the details of these waste shipments.

Costs incurred by ORNL are to be accumulated and transferred through the current account to ORO with the identification, "For ORO Activity 2170".

We regret the necessity for asking that you do this, but again no suitable alternative exists. Your cooperation and assistance in this matter is appreciated.

Very truly yours,

S 3011

MEDICINE, HEALTH & SAFETY -3-4 (Contaminated Sites)

Herman M. Roth
Director
Research and Development Division

OFFICE ▶		Bio. Br.	Res.&Dev.	Feed Materials		
SURNAME ▶	CC: C. E. Center, UCNC R. C. Armstrong, ORO F. W. Malone, Niagara Falls J. W. Ruch, ORO	Schoen:ef	Roth	Carbory		
DATE ▶			5/6/58	5-5-58		

Form AEC-318 (Rev. 9-53)

U. S. GOVERNMENT PRINTING OFFICE 16—62761-3

UNITED STATES
ATOMIC ENERGY COMMISSION

IN REPLY REFER TO:
OF:TPC

Oak Ridge, Tennessee
April 18, 1958

Hooker Electrochemical Company
P. O. Box 344
Niagara Falls, New York

Attention: Mr. Walter S. Beanblossom
Administrative Assistant to Management

Gentlemen:

This letter refers to your telephone conversation of April 7, 1958, with Mr. B. M. Robinson in which burning of KAPL wastes was discussed.

We propose, and understand that you are agreeable, to make burning and shipment of the KAPL wastes within the scope of maintaining and operating the storage area adjacent to the Boron Metals Plant (Reference: Article I, Paragraph 3 (g), Modification No. 2, Contract No. AT-(30-1)-1524). Under the provision for modification of the Commission's letter of July 7, 1953, as set forth in the above contract reference, you are hereby authorized to burn, ship or make other disposition of the KAPL wastes as the Commission may direct. With the letter of July 7, 1953, so modified, costs for disposal of KAPL wastes are allowable under the contract. Funds to cover such work have been provided in our FY 1958 budget. Your written concurrence in the proposed revision to the July 3, 1953, letter will be appreciated.

It is our hope that the KAPL wastes may be totally disposed of prior to June 30, 1958, when administrative responsibility for the Boron Metals Plant and the adjacent storage area will be transferred to the AEC New York Operations Office. To this extent we would appreciate continuance of burning "low dose rate" (6 mr/hr or less) waste and shipment of material in excess of such tolerance as early as possible.

MEDICINE, HEALTH & SAFETY 3-4 (Contaminated Items)

APR 29 1958

H-4111

Herman M. Roth

Procedures to be followed, including precautionary measures, in burning and handling of KAPL wastes are outlined in two reports by Mr. J. L. Hanner of your company, dated March 4, 1958, and April 7, 1958. These reports cover conferences in which health physics personnel of the AEC New York and Oak Ridge Operations Offices participated. The reports fully set forth instructions given by AEC representatives. The report of April 7, 1958, brings up to date work to be done in the period to June 30, 1958.

We believe that the procedures and measures described in these reports are consistent with the requirements of Article VI, Paragraph 6, Modification No. 11, of the contract with respect to the taking of reasonable precautions to protect health and minimize danger from hazards to life and property in the burning area.

Any costs or expenses, including possible liability to third parties incurred in performing this work will be considered as allowable costs as provided in contract Article II, Paragraphs 2 (r) and 2 (t).

We appreciate the cooperation you are giving in effecting a timely and orderly shutdown of the Boron Metals Plant and its related activities.

Very truly yours,

S. R. Sapirie
Manager
Oak Ridge Operations Office

DISPATCHED
U. S. A. E. C.
OAK RIDGE OPERATIONS

1958 APR 29 AM 9:49

AIRMAIL

V. V. Hendrix, Director, Reactor Engineering and Technical Services Division, (Schenectady Naval Operations
Herman M. Roth, Director, Research and Development Division, Oak Ridge Operations

December 26, 1957

KAPL WASTES STORED AT LOOS

SYMBOL: ORH:AS

It has become necessary to dispose of the contaminated wastes from KAPL which are presently stored at the Lake Ontario Ordnance Storage Site at Niagara Falls, N.Y. These wastes are of two major types and it is planned that each will be handled in a somewhat different manner.

First, there are several hundred 4' x 4' x 4' wooden boxes containing combustible and non-combustible solids. Arrangements have been made with our contractor at Niagara Falls, the Hooker Chemical Company, to burn the combustibles and thereby reduce the total volume of these wastes prior to the shipments to Oak Ridge for burial. The Health and Safety Laboratory, NYOO determined experimentally sometime ago that this could be accomplished without significant environmental contamination. HASL will provide the necessary health physics monitoring services during these burning operations. It occurred to us that KAPL might be interested in viewing and perhaps taking some environmental monitoring measurements during these burning operations in connection with the evaluation of their own waste handling problems. If there is any such interest, arrangements can be made through F. W. Malone, Chief, Niagara Falls Branch, Lewiston, N.Y.

There are also some 1000 drums of evaporator slurry which were generated in KAPL's waste treatment plant. Arrangements have been made for Hooker Chemical Company personnel to load and ship all of these drums to Oak Ridge commencing on or about January 6, 1958. Since Hooker Chemical Company does not normally handle or ship radioactive material they will require some competent guidance in the preparation of these shipments. KAPL routinely makes similar shipments to Oak Ridge and has therefore had considerable experience with such aspects as loading to achieve maximum shielding of the more highly radioactive drums, the extent to which stacking of the drums is possible, the pertinent ICC regulations, the method of applying for special permits from the Bureau of Explosives, etc. Hooker personnel will require technical assistance from some source in preparing these shipments and since KAPL's experience is so specifically pertinent, assistance from someone like Mr. D. A. Manieri would be more helpful than that available from

I 8550
By tx 8

other sources not experienced with this type of shipment. Proper guidance will greatly expedite the shipment of these KAPL wastes and thereby reduce the costs involved. It would therefore be greatly appreciated if you could arrange for KAPL to provide this assistance.

Any additional information regarding these shipments may be obtained from Arthur Schoen, Research and Development Division, ORO, or Frank Malone in Niagara Falls.

ORIGINAL SIGNED BY
HERMAN M. ROTH
Herman M. Roth

CC: F. W. Malone, Niagara Falls
OK J. W. Mich, ORO

OFFICE ▶	Bio. Br.	Res. &Dev.				
SURNAME ▶	Schoen:ef	Roth			3-4	Cortan items
DATE ▶	12/26/57	12/30/57				

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ORB:JAL

Oak Ridge, Tennessee
12-20-57

Union Carbide Nuclear Company
Post Office Box P
Oak Ridge, Tennessee

Attention: Dr. J. A. Swartout, Deputy Director
Oak Ridge National Laboratory

Subject: WASTE BURIAL - NIAGARA FALLS DRUMS

Gentlemen:

Confirming an informal telephone conversation with Mr. A. F. Rupp of your organization, tentative plans are being made to send one thousand drums of waste from the Niagara Falls Site to ORNL for burial.

This waste is composed of concentrated residues from chemical processes at KAPL and should be in a highly viscous or solid state. All of the waste was chemically neutralized prior to its being sealed in 55 gallon drums. The level of radiation at the surface of the drums ranges from 500 mr/hr to 1500 mr/hr.

About 200 of the drums are mild steel and have been exposed to the elements for several years. As a result these drums are in an extremely poor condition and it is considered imperative that they be disposed of immediately. It is planned to place each of these drums inside of a 65 gallon steel drum capable of containing the waste.

The Niagara Falls Branch of the AEC has been advised to make preliminary arrangements for this burial with Mr. E. J. Witkowski of ORNL.

Costs incurred by ORNL in disposaing of the drums are to be accumulated and transferred through the current account to ORO with the identification, "For ORO Activity 2170".

MEDICINE, HEALTH & SAFETY 3-4 (Contaminated Items)

T 8330 Rpt 58

It will be appreciated if you can accommodate this waste shipment.

Very truly yours,

ORIGINAL SIGNED BY
HERMAN M. ROTH

Herman M. Roth
Director
Research and Development Division

CC: C. E. Center, UCNC (2)
R. C. Armstrong, ORO
J. W. Ruch, ORO
L. D. MacKay, ORO
N. A. Shearon, ORO
F. W. Malone, Niagara Falls

BC: J. A. LEIBERMAN, WASH.

OFFICE ▶	Bio. Br.	Res.&Dev.				
SURNAME ▶	Lenhard:ef					
DATE ▶	12/17/57	12/19/57		12/20		

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NLC, 1980*, Review of Radon Monitoring at the DOE-Niagara Falls Storage Site,* NLCO-0004EV; National Lead Company (NLC) of Ohio; March 31, 1980

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REVIEW OF RADON MONITORING AT THE DOE-NIAGARA FALLS STORAGE SITE

FEED MATERIALS PRODUCTION CENTER
NATIONAL LEAD COMPANY OF OHIO

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NLCO-0004EV
Special

REVIEW OF RADON MONITORING

AT

THE DOE-NIAGARA FALLS STORAGE SITE

Harold W. Humphrey
Technical Division

Prepared for

UNITED STATES DEPARTMENT OF ENERGY

Date: March 31, 1980

APPROVED:

C. E. Polson
Director, Technical Division

AUTHORIZED BY:

J. H. Cavendish
Director, D & D Division

NATIONAL LEAD COMPANY OF OHIO
P. O. Box 39158 Cincinnati, Ohio 45239

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EML Generator for Radon and Radon Daughters

APPENDIX A-2

NLO Generator for Radon and Radon Daughters

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APPENDIX B-1

EML Weekly Off-site Radon Monitoring Results (Outdoors)

APPENDIX B-2

Weekly DOE-NF Radon Monitoring Results

ABSTRACT

Radon-222 monitoring results for the U. S. Department of Energy-Niagara Falls Storage Site over the period May, 1978 to February, 1980 are reviewed and summarized in this report.

Radon-222 levels in inhabited areas surrounding the storage site were all found to be no greater than 0.5 pCi/l compared to an average ambient air background for the region of 0.23 $\pm$0.01 pCi/l. Ambient air radon levels rapidly approach background within 0.5 to 1.0 mile from the storage site. Weekly surveillance information, averaged over a year, indicates that six of the eight fenceline ambient air monitoring stations showed concentrations well within the concentration guide limit of 3.0 pCi/l for uncontrolled areas. The remaining two adjacent stations (along the western boundary fence) showed elevated average radon levels of 4.28 and 5.68 pCi/l, respectively. The higher levels at the western boundary fence are attributed to the Spoil Pile area, which is within a hundred feet of the present boundary fence.

Maxima were observed in both soil air and ambient air monthly radon levels, which correlate closely with meteorological parameters. A spoil pile radon flux survey is described which identifies radon source isopleths and quantifies yearly average pile emissions. Average off-site radon flux from soil was found to be 0.14 $\pm$0.07 pCi/m^2-s. Weighted

average (yearly) radon flux from the spoil pile was found to be 407 pCi/m^2-s.

The effects of applying asphaltic emulsion, or water, to reduce radon emissions are discussed. Application of asphaltic emulsion to residues in storage buildings resulted in an average reduction in radon emissions of 94%.

Variables affecting radon emanation and measurement are discussed, including: instrumentation; meteorological conditions; and source distribution and magnitude.

Recommendations are suggested to improve the existing radon monitoring program and future useful innovations are discussed.

INTRODUCTION

The National Lead Company of Ohio (NLO), a subsidiary of NL Industries, Inc., assumed custodial responsibility for management of the U.S. Department of Energy-Niagara Falls Storage Site (DOE-NF) in January, 1972. Since that time NLO has instituted a program of testing soil, air and water to assess the influence of the DOE-NF site on the surrounding environment.

This report endeavors to summarize one aspect of this program: radon measurements.

Since a thorough characterization of the physical description and history of the DOE-NF site has been reported elsewhere,[1] no further effort will be made in this report to elaborate on these aspects of the site.

Due to the potential health hazard of radon, both the U.S. DOE and the State of New York have adopted relatively stringent guideline limits on concentrations of radon in air, for uncontrolled environments. The value presently accepted by both organizations is an annual average of three picocuries radon per liter of air (MPC_A = 3 pCi/l).

Radon-222 (hereafter called radon) is formed from the radioactive decay of ^{226}Ra (Table I), a by-product of uranium processing. If allowed to accumulate, the ^{222}Rn activity will attain its equilibrium activity (99.6%) in about 30 days (Figure 1). In practice, since radon is a gas, some fraction of the radon is evolved from the parent resulting in disequilibrium of the decay chain. Figure 2 illustrates the activity buildup in an initially pure source of radon (e.g., airborne radon). It will be noted from the figure that ^{218}Po reaches its equilibrium value (99.6%) in about 30 minutes. The other alpha particle emitting daughter (^{214}Po) does not achieve equilibrium (97.11%), until about 4 hours, however. Beyond 4 hours a mixture of ^{222}Rn and its daughters will decay with the 3.823 day half life of the ^{222}Rn parent. Several radon assay techniques utilize a measurement of ^{218}Po and ^{214}Po content to determine initial radon concentration (after an appropriate decay correction). Other assay techniques employ the fact that alpha activity (from ^{222}Rn, ^{218}Po and ^{214}Po) reaches its maximum value (2.9148 times the initial ^{222}Rn activity) in about 215 minutes.

CHRONOLOGICAL HISTORY

The first cursory radon measurements were made at the DOE-NF site in August, 1977 at the request of the Oak Ridge Operations Office of the DOE. Prior to this time it was not felt that airborne radioactive materials were being generated at the site, since wastes stored in the open had been covered with 15,000 yd^3 of slightly contaminated, contiguous soil in 1972[2,3] (shortly after NLO assumed responsibility for the site).

Three radon measurements were made at the site covering the week of August 30 - September 6, 1977 using passive environmental radon monitors (PERM's) borrowed from the Environmental Measurements Laboratory (EML). The PERM's were located at points 4, 5 and 8 (shown on Figure 3). Average radon concentrations for the period are given in Table II. Although only one assay exceeded the concentration guide (CG) by about 14%, it was felt that a long-term radon monitoring program at the DOE-NF site was needed.[4]

In late October, 1977 one EML-PERM was obtained for use as a model for the construction of eight units for field use. The completed units were sent to EML for calibration and subsequently returned to NLO in mid-May, 1978. Routine radon measurements were initiated at the DOE-NF site on May 25, 1978 and have continued up to the present time, interrupted only by periods of recalibration and/or maintenance. A radon calibration chamber was fabricated at NLO to permit future calibrations of the

PERM's to be performed in-house. The NLO calibration chamber is a modified version of a unit developed at EML by J. W. Thomas (Appendix A).

In addition to routine on-site measurements by NLO, EML has also established several off-site monitoring points within several miles of the DOE-NF site. These points serve as a basis for determining the effect, if any, of radon emanations from the site on populated areas in the nearby environs. Collection of off-site radon data began in August, 1978 and has continued up to the present time.

RESULTS

During the 21 months since the beginning of routine radon monitoring at the DOE-NF site a great deal of data has been compiled in an effort to quantify off-site levels and to identify on-site source terms. Definitive measurements are greatly complicated by the large number of variables affecting both radon exhalation (from buildings, residues and soil) and radon measurements.

The eight PERM's located at the fixed locations indicated on Figure 3 are integrating instruments that are normally deployed for one week intervals. Readings from these units are then translated into an average ambient air radon concentration for the period. Although there are nine locations indicated on the fence line, only eight PERM units are actually employed. During the week of November 30 to December 7, 1978 unit #5 was permanently relocated at position #9 to provide additional coverage for this portion of the site. Measurements at position #5 had been at, or near, background levels. Each of the PERM units is affixed on a boundary fence with the exception of unit #2 which is located on an interior fence, approximately 50 ft. north of the K-65 storage area. In addition, EML also regularly monitored two on-site locations: "O" Street and the Boiler Plant.

At the present time EML is monitoring 20 representative, off-site outdoor locations, as well as 10 buildings (indoors) in the immediate area. Table III summarizes the current off-site radon measurement

data.[5] The approximate location of each outdoor off-site monitoring point is indicated on Figure 4.

The variability of radon measurements taken at any given location (indicated by the range values in Table III) once again points up the temporal, seasonal and meteorological influences on these data. Similar variations were also seen in data obtained by NLO. When these variables are propagated with normal statistical variations in radiation measurements, it can lead to misinterpretations and erroneous conclusions if too few data points are being considered. For this reason the best estimate of ambient radon levels at a given location should be an annual average, which in effect smooths out localized short-term perturbations.

In order to determine the influence of the DOE-NF site on the radon level in the surrounding areas it is necessary to establish a background level at a location far enough removed geographically so as not to be influenced by the site. Data from three locations monitored by EML for over a year was statistically evaluated (Table IV) and two of the locations were compared to a third, control site, almost 4 miles away (Ransomville). The radon background values obtained at one and two miles are statistically indistinguishable from the level at the four mile control point, therefore the best background estimate was the average of all three locations (i.e., 0.23 $\pm$0.01 pCi/l). This value should be subtracted from all radon measurements to obtain an "absolute"

value. The average background radon level obtained at the DOE-NF site compares exactly with that obtained at Chester, NJ (an EML regional monitoring station).[6]

If background is subtracted from all off-site values (Table III) it will be apparent that all measurements are at the 0.5 pCi/l level, or less. This is well within the 3.0 pCi/l concentration guide. Radon levels within a half mile of the site are approximately 2 to 3 times background indicating that the site is contributing to environmental radon, but it is not causing significant increases at residences surrounding the site.[6] In addition, ambient radon levels rapidly approach background within 1/2 to 1 mile from the storage site (reasonably close to the pre-1972 size of the DOE-NF site).

Sufficient data has been gathered at the boundary fence radon monitoring stations to note definite seasonal trends and to compute average emanation rates from the site. It should be noted, however, that data on average monthly emanation rates are based on a maximum of two values, and in some instances only one value was available. Weekly data for the 21 month period is contained in Appendix B. For purposes of seasonal evaluation, weekly data for each month were averaged and the results are given in Table V.

A review of the concentration levels for each station (Figures 5-13) indicates: (1) stations #1 through #6 are below the concentration

guide level all during the year, (2) the average radon level at station #7 is well within 3.0 pCi/l, it does exceed 3.0 pCi/l in August and September, however, and (3) station #8 and #9 both exceed the concentration guide when averaged over the year.

Inordinately high values during September, 1979 caused maxima in radon levels for stations #7, #8 and #9 for this month. During this period remedial action was being performed at the site on Buildings #413 and #414 to lower radon exhalation from stored residues. The entrapped radon contained in these buildings was pumped out during this period to lower it to a safe working level. September, 1979 average concentration values may therefore be artificially high.

Maxima inthe data for July, at stations #1, #3, #6, and #9, are probably actual and their presence has been supported by additional information to be discussed later. Small maxima during the March—April period are also reasonable, and expected, based on meteorological considerations. The composite radon emanation concentration for the whole site is 1.69 pCi/l when considered over a calendar year. Figure 14 illustrates the site composite of all monitoring stations over a calendar year.

Prior to July, 1979 several attempts were made to identify areas on and near the DOE-NF site exhibiting levels of radioactivity in excess of background. According to an EG&G aerial radiological survey (October, 1978) six areas were identified as being between 2-20 times more radioactive than background. These areas are: the R-10 residue storage area,

near West Patrol Road (^{137}Cs contamination), K-65 tower area, north burial area, railroad bed (eastern boundary), and the central drainage ditch. The principal contaminant in each case was identified as ^{226}Ra (^{222}Rn precursor), except for the area with ^{137}Cs contamination indicated above.

Ford, Bacon & Davis Utah (Report FBDU-265, October 31, 1978) performed brief radon transport calculations for the site and offered remedial action alternatives. The materials stored in Buildings 411, 413 and 414 were found to be the major contributors to excess radon levels at the fence line. Some question was raised as to the validity of the radon flux terms upon which the calculations and subsequent conclusions were based. Approximately 22% of the fence line activity at stations #7 and #8 was attributed to the residue spoil pile. Flooding of the residues in Buildings 413 and 414 was proposed as the most cost effective means of reducing radon exhalation from these sources. Covering the residues with an asphaltic emulsion was also proposed as an alternative. The latter proposal was implemented in September, 1979.

In an effort to define the strength and location of radon emission sites in and around the spoil pile, a comprehensive evaluation began in November, 1978. One hundred and twenty soil/air flux measurements were made on, and near, the spoil pile (Figure 15) using charcoal canisters. The sample points were 14 feet apart for a total length of 420 feet and each line was separated by a distance of 70 feet. The north-south and east-west traverses were conducted on different days, therefore readings

at grid points Y 11 — B 10 should be comparable; the same holds true for Y 16 — A 10, Z 11 — B 5, and Z 16 — A 5. In addition, fourteen grab air samples were taken near the west boundary fence with a 2 mph wind blowing from the east. Figure 16 shows the location of the grab air sample points (several duplicate samples were taken). Two upwind measurements were also made (indicated on Figure 16 as points A and B) for reference; average values obtained at each of the sampling points are shown on the figure. Pole #12 roughly corresponds to PERM station #8, at which a value of 6.0 pCi/l was obtained for a comparable time period. Upwind measurements were one and two times backgound, respectively; however, the fence line measurements exhibited a definite radon profile (Figure 16). Maxima appeared at pole positions #14 and #16 (approximately 75 ft. and 275 ft. north of the northwest corner of Building #411 and 200 ft. west) indicating the major source of airborne radon at the western fence line to be the Spoil Pile area. The close proximity of the spoil pile to the fence line (<100 ft.) and easterly winds combine to produce elevated radon levels at the fence.

Efforts to develop a source term for radon emanation from the spoil pile have been hindered by the extremely heterogeneous nature of the residues stored there. This fact is confirmed by the radon soil/air concentration isopleths (Figure 15). Actual measurements (in pCi/m^2-s) are indicated at their respective sampling locations.

Ten off-site locations were chosen for soil/air background measurements.[7] Triplicate assays were performed at each location. The average background soil/air radon emanation rate was calculated to be 0.14 $\pm$0.07 pCi/m^2-s. The lowest spoil pile measurements (approximately 4 times background) were observed near the center of the pile which was partially covered (in 1972) with soil containing low levels of contamination.

In order to calculate an average radon source term for the spoil pile the approximate dimensions shown on Figure 15 were assumed. Based on this assumption the extent of the spoil pile is 3.43 acres (149,193 ft^2). In light of the fact that all areas included are at least four times background, this is probably a valid assumption. The inclusive area of each isopleth was empirically determined (by weight) using the scale 1" = 60'. All of the data points included in a given isopleth were used to compute an average flux value for that region. A weighted average flux value was then computed for the entire pile, based on the area of each isopleth. The weighted average radon spoil pile flux was thus calculated to be 317 pCi/m^2-s and the geometric centroid of the pile is approximately 206 ft. due north of the northwest corner of Building #411.

The effect of seasonal variations on the spoil pile radon exhalation rate was studied by leaving two charcoal canister supports permanently emplaced for over a year. A third unit was located in an open field to serve as a "background" reference. The location of each unit and the

average results for a calendar year 1979 are given in Table VI. A plot of the data (Figure 17) reveals a similar peak in March and July to that seen in fence line ambient air measurements. The November average spoil pile assay (positions 1 and 2) for eight independent measurements was 306.0 pCi/m^2-s, which compares well with the weighted average values (317 pCi/m^2-s) obtained during the November, 1978 spoil pile traverses. The yearly average spoil pile measurement for positions #1 and #2 was 393.2 pCi/m^2-s. Correcting for monthly variations in flux, the weighted average radon exhalation rate becomes:

$$\text{YEARLY AVERAGE SPOIL PILE RADON EXHALATION RATE} = (317)\frac{(393.2)}{(306.0)} = 407 \text{ pCi/m}^2\text{-s}$$

In July, 1979, a comprehensive radiological survey was initiated at the DOE-NF site by Battelle Columbus Laboratories (BCL) under a subcontract with NLO.[8] This survey was the most systematic approach to the identification and quantification of radon sources at the DOE-NF site to date. Not all questions relating to radon exhalation at the DOE-NF site could be answered in the relatively short duration of this study (about three months) but a great deal of information has been acquired.

BCL confirmed earlier conclusions by NLO that the Spoil Pile area is a primary contributor to elevated off-site radon levels and that Buildings #411, #413, #414, and #434 also provide significant contributions.

Characterizing radon emission levels from these sources has been difficult due to: the diversity of instrumentation utilized, areas surveyed,

sampling conditions and measurement units, as well as measurement uncertainty. Radon measurements at the DOE-NF site have been conducted by: NLO, EML, BCL, PNWL, and FBDU. Each organization has adopted what it considers to be optimal instrumentaion and procedures and few agencies have actually endeavored to cross-check or compare measurements (with the possible exception of NLO and EML, to a limited degree). A great deal of information is unusable since exact sampling locations and conditions are unavailable. Measurement errors have not been reported in many cases, making it difficult to interpret assay differences as being actual, or merely statistical abberations.

For these reasons, the BCL data is probably the most useful gathered on radon emission from various sources at the DOE-NF site. The data base covers roughly a three-month period, during which repetitive measurements were conducted under identical conditions, at various fixed locations. There are some anomalies in the BCL data, however, and one should be wary of making absolute judgments based upon them.

Three different techniques were utilized by BCL for radon collection and analysis. There appears to be no cross comparison between techniques, however, an analysis of soil air data by two different techniques (Table VII) at a given location, indicates that there is no statistically significant difference between the two methods. The average absolute difference between techniques was a rather high 41%, however. The average value for the two methods is therefore the best estimate of the soil air radon level for that grid coordinate.

There was an excellent correlation between EML flask values for the western boundary fence (Figure 16) and values obtained by BCL for soil air radon (Figure 18). Maxima appear at roughly similar locations in each case.

Comparison of the two techniques utilized for ambient air measurements (Table VIII) indicates a relatively good correspondence between them.

Only one area (S 19 W 16) of relatively high radon concentration in air was identified: this area corresponds closely to the previously identified area of high soil air radon content (Table VII). Flux measurements, per se, were not made during the BCL radiological survey; the air radon immediately adjacent to the soil was analyzed instead.

This type of data should be helpful in drawing relative conclusions, such as the identification of radon sources, but the data will be difficult to correlate with emission rates from the soil (flux). In addition, soil air measurements would probably be more influenced by meteorological conditions during sampling than a flux assay.

Ambient air measurements at the spoil pile were somewhat meager as seen in Table IX. There appears to be generally good agreement with the maximum in the fence line radon soil air measurements at S 19; unfortunately, measurements were not made at S 27 to verify the larger soil air maximum at that location.

Measurements of soil air and ambient air were made at each of three locations near the spoil pile (Table X). A comparison of these values will yield information relative to the relationship between the two measurement locations.

Since flux data were unavailable from BCL for the spoil pile, the previously determined average flux value (407 pCi/m^2-s) could not be compared directly to the composite average ambient air value (Table X). Clearly the ambient air value would be greatly influenced by wind velocity and since about 4-10 hours would be required for the heavier radon to completely diffuse into the higher strata of air, a concentration gradient would be expected, and was observed in the BCL data.

Radon measurements were made in all the residue storage buildings at the DOE-NF site; again BCL data is the most complete (Table XI), although measurements have been made by other organizations periodically.

These assays, although very useful for radiological health and remedial action indicators, are difficult to interpret as far as developing source term information. Grab samples of the air surrounding these buildings would have been more useful for source evaluation, as would a determination of building exhalation rates. For example, radon content under the concrete top disc atop the K-65 tower (Bldg. 434) was extremely high (about 50,000 pCi/l), fence line readings for locations surrounding the tower (viz. Stations #2, #3, and #4), however,

indicated that off-site radon levels from this area reached only a maximum of 0.41 pCi/l (Station #3).

The BCL data (Table XI) also indicates the effectiveness of the asphaltic emulsions applied to Buildings #413 and #414. Radon emission from the residues was reduced by 96.4% and 92.2% for Buildings #413 and #414, respectively. The addition of the Petromat® substrate prior to the asphaltic emulsion (Bldg. 413) further reduced the radon level to one-half that of Building #414.

DISCUSSION AND CONCLUSIONS

A great number of factors affect radon measurements; among these are: instruments utilized, meteorological conditions and source distribution and composition.

INSTRUMENTATION

Instruments utilized for the determination of radon fall into two major categories: those indicating instantaneous (grab sample) concentrations and those yielding time integrated concentrations. Leggett, et al.[9] have shown that radon concentration varies quite significantly during diurnal periods; another study[10] has shown up to an order of magnitude variation in radon concentration, at a given location, over a period of a year. For these reasons, estimates of radon concentration should be averaged over as long a period as possible to eliminate short-term perturbations and should include as many measurements as are reasonably feasible. Yearly averages tend to smooth out variations due to statistical measurement uncertainty, as well as cyclic diurnal and seasonal variations.

The most commonly used grab sample technique is the Lucas chamber (developed by H. F. Lucas, Jr.). This device (Figure 19) consists of a cell which has been coated with a ZnS(Ag) scintillator which gives off visible light when struck by alpha particles from radon and its daughters. It is normally evacuated prior to use and an air sample

is filtered into the active volume of the cell (normally taking less than one minute). Daughter atoms are allowed to grow to their maximum alpha activity (Figure 2) and the cell's activity is measured. The Lucas cell can be used either in the grab, or continuous mode and it is quite often used to standardize other detection systems. BCL has used cryogenic preconcentration of air to enhance the sensitivity of the Lucas cell technique.

The four most common long-term radon measuring instruments are: activated charcoal, alpha track etch film, Wrenn chambers, and PERM's. Of the four techniques, the activated charcoal is the most sensitive (0.01 pCi/l) and the alpha track etch film is the least sensitive (100 pCi/l).[11]

Activated charcoal is normally utilized in a canister (such as the Army M-11 gas mask canister) which is affixed to a surface for subsequent radon flux measurement (Figure 20). An integrated radon sample is normally collected over a period of from 16 to 24 hours. The absorbed radon is then either counted directly with a NaI(Tl) scintillation detector or deemanated and counted in a Lucas cell. The charcoal can be regenerated for reuse by passage of dry air through the canister.

The alpha track etch film (such as that marketed by Terradex Corp. (Figure 21) is relatively insensitive to all but airborne alpha emitting gases. When radon comes in contact with the coated film it leaves tracks, the number of which is proportional to the radon activity causing them. Alpha track etch films are normally left in place to

incubate about 30 days and then the radon concentration is calculated from the number of tracks/cm^2.

The Wrenn chamber allows filtered air to diffuse into a sensitive volume where the daughter activity is collected on a ZnS(Ag) scintillation detector. The Oak Ridge National Laboratory has developed an automatic continuously monitoring, unattended version of this chamber (Figure 22) for environmental monitoring. When operated in the manual mode, samples are normally collected over a seven-day period.

The PERM (Figure 23), developed by A. C. George, operates in a manner similar to the Wrenn chamber. Dry air is allowed to passively diffuse into the sensitive detector volume where daughter activity is collected on a thermoluminescent detector (TLD). The TLD chip (normally LiF) is then removed and related to original radon activity using a TLD reader.

Each of the foregoing instruments have their drawbacks and advantages. Humidity, for instance, appears to affect most of them (to varying degrees) and could cause erroneous results (in either direction, depending on the instrument and the manner in which it is employed). Parzyck, et al.[11] has an excellent comparison table of many of the more commonly used radon detectors; most of his comparison information is reproduced in Table XII. Radon detectors can be further divided into: (1) those using field collection and analysis, and (2) those using field collection and laboratory analysis.

Instruments falling into the first category are the portable, self-contained units utilized for continuous, or long-term operations. Instruments in the latter category are those requiring additional processing prior to a determination of radon concentration (e.g., TLD chips must be analyzed on a TLD reader, or alpha tracks must be measured on a film).

Since a TLD reader was available, the PERM unit developed at EML was chosen by NLO for field use at the DOE-NF site. An additional consideration in the use of the PERM unit was that eight units could be manufactured inexpensively and deployed rapidly in the field. The units were manufactured, deployed and operated, as per EML's instructions.

The sensitivity of the PERM is stated to be 0.03 pCi/l (Table XII), with a relative precision of $\pm 30\%$ (1σ). For four consecutive months (late 1978 to early 1979) all eight PERM units were placed at monitoring station #8 along the west fence line in order to obtain information on the reproducibility of the radon analysis. Results of the studies are given in Table XIII. The weighted average concentration was found to be approximately 3 pCi/l (the concentration guide limit for uncontrolled areas). The overall relative standard deviation (RSD) was found to be $\pm 41.9\%$, by pooled variance. Consultations with EML personnel yielded no apparent cause for the slightly higher error encountered in the NLO PERM units. No efforts have been made to date to determine the precision at the presumed lower limit of detection (0.03 pCi/l) at NLO; however, the precision would be expected to be somewhat worse than that encountered at the 3pCi/l level. Using all of the off-site radon

background data (for the four locations tabulated in Table IV) generated by EML, the individual assay precision (at the 0.23 pCi/l level) was determined to be ±38.1% (RSD).

Several theories have been proposed as to the cause of the relatively poor precision values and they are presently being investigated at NLO.

METEOROLOGICAL CONSIDERATIONS

The effects of meteorological conditions on both radon emission and measurement have been well documented. For this reason monitoring data should only be used as a relative indication of the radon concentration for the sampling period, and not extrapolated to make long range average emission level predictions.

In tests conducted at NLO by M. W. Boback[12] on residues from the DOE-NF site, water (moisture) was found to significantly reduce radon flux emanated from the materials. Residues saturated with water emanated 26% less radon than dry material. A one-half inch water covering resulted in an 80% flux reduction.

The above data combined with information on snow and rain at the DOE-NF site provide a plausible explanation for the small maxima observed in the fence line ambient air levels (Figure 14) and the soil pile flux levels (Figure 17).

Only sporadic weather data is available for the DOE-NF site (most of which was obtained from the NIKE site, approximately one mile northeast

of the DOE-NF site). The Buffalo Airport (approximately 40 miles south) regularly tabulates meteorological information and their 10 year average data[13] correlates well with actual on site measurements (Table XIV). Monthly average temperatures (Figure 24), snowfall (Figure 25), and a wind rose (Figure 26) have been plotted, based on the Buffalo Airport data. It is apparent from Figures 24 and 25 that the temperature exceeds freezing, and the snowcover melts, during the period between March and April, which coincides with the period wherein a small maximum was observed in radon emission rate. The month of maximum average ambient air temperature also correlates well with the month of maximum radon emission rate (July), as well.

As shown in Figure 16, wind direction and speed play a large role in the level of radon at any given location. Upwind measurements, for instance, are typically lower than measurements taken downwind from a radon emitting source. Wind speed will affect the rate at which radon is being dispersed, or transported, to a measurement site. Although the prevailing wind direction at the DOE-NF is from the WSW, 18.5% of the time (Figure 26) winds will be from the NE to SE quadrant, which would cause radon to be detected at the western boundary fence. There appears to be no correlation between wind direction and calendar month. Temperature, snow (or ice) cover and soil moisture content will be the major factors in soil radon emission rates and average conditions will have to be used for developing wind transport theories. The development of a model for predicting average radon levels at some finite location will require development of both a source term and an air transport algorithm. Such a model is beyond the scope of this

report but it is hoped that sufficient data will have been presented here to permit the later development of such a model.

Meteorological conditions affect both the transportation of radon to a receptor site and the rate at which radon is exhaled from soils, residues, buildings, etc. In addition, the rate of radon emission from soil and residues is also influenced by various soil parameters which can only be determined empirically. Major factors to be considered in defining a radon source term for a tailings pile are: the soil bulk density, diffusion coefficient, void fraction, radium concentration and the availability of radon from the radium parent. In addition to the above parameters Countess[14] reported a factor of 10 decrease in radon flux following a 3 cm rain and a reduction of 2-3 orders of magnitude with an ice cover. FBDU[15] also showed that radon levels may vary by an order of magnitude during diurnal periods (with higher levels found at night). The effects of heterogeneously distributed sources, soil air temperature, barometric pressure, and partial overburdens further complicates source term definition to the extent that computer modelling techniques will in all probability be required.

FUTURE WORK

A thorough evaluation of the data collected to date at the DOE-NF site will indicate several areas that need further study. Data concerning the variation in radon exhalation rate of soils, residues and buildings with temperature, barometric pressure, relative humidity and time of day are very meager. This type of information would prove to be very helpful in developing a site-specific model for radon emanation. It is recommended that all future monitoring work refer to grid coordinates employed during the BCL radiological survey to facilitiate comparisons.

At the present time nontechnical resident site personnel collect samples for subsequent laboratory analyses and collect TLD chips for laboratory reading and interpretation. Although this has been a necessary expedient in the past, it is felt that a full-time resident technologist would greatly enhance the reliability of the radon monitoring program at the DOE-NF site.

Acquisition and installation of weather monitoring instrumentation would enable a close correlation between radon emission rates and meteorological variables in effect at the time of measurement. In addition to recording the above meteorological information, a full-time technologist would provide both instrumental measurement conditions and the added dimension of nonroutine collection documentation. Eventually some, or all, of the radon measurement and interpretation could be performed on site by such a technically oriented person.

Another area where further investigation might be indicated is the measurement of radon daughter activities at various locations around the storage site. Some work in this area was performed during the BCL radiological survey.[8] Since radon is normally not in radioactive equilibrium with its daughters when airborne, a great difference in the concentration gradient between them could occur at any given location. Due to the short-lived nature of the radon daughters, an on-site measurement of their activity would be mandatory.

As previously mentioned, work is presently underway to evaluate and improve the existing PERM assay by NLO. Interim radon measurements are being conducted at the DOE-NF site by EML. If the TLD chips were collected and read on-site, several large variables could be eliminated in the PERM assay. Acquisition and deployment of additional PERM units could be accomplished relatively inexpensively and their use would result in enhanced measurement reliability and fewer lost assays. This suggestion is of course contingent upon successful completion of the present PERM unit evaluation.

Should the outcome of the above study be negative an alternative measurement technique will have to be adopted. A field-proven measurement technique (such as the modified Wrenn chamber in use by ORNL) should be chosen to minimize deployment and methods development time. ORNL has agreed to loan NLO a Wrenn-type detector, on an as-available basis, for evaluation purposes. Although initial acquisition cost of a Wrenn-type monitor would be considerably greater than the PERM

unit, it does provide the possibility of automated, continuous operation. Other, less expensive, options would be available if measurements could be performed on site by technical personnel (e.g., Lucas cells).

An extremely useful innovation in the area of radon monitoring would be an interlaboratory radon assay comparison. This would undoubtedly be complicated due to the short 3.8 day half-life of ^{222}Rn. Although most laboratories trace their standardization to a ^{226}Ra standard that has been deemanated, the method of radon deemanation, collection and measurement, often vary from lab-to-lab. This accounts, in part, for the wide variability in radon monitoring data. An inter-laboratory comparison would identify assays containing systematic errors and thereby eliminate them, in addition to providing a data base from which individual radon measurement precisions could be calculated for the individual laboratories.

And finally, preparatory to remedial action to reduce radon emissions, a model of radon exhalation for the site should be prepared and compared to actual measurements at the fence line. Remedial actions, based on FBDU data, were performed on residues in Buildings #413 and #414, as discussed earlier. Test plots were also monitored on the spoil pile by BCL, which had also been coated with the same asphaltic emulsion. Unfortunately, cracks developed in the surface of the asphalt, rendering results useless. Although data to support the use of asphaltic emulsions on exposed residues is somewhat meager, it is

fully expected that equivalent reductions will be achieved to that obtained under indoor conditions, if the emulsion is properly applied. Keeping the spoil pile saturated with water during the summer months should reduce exhalation rates sufficiently to lower annual fence line radon concentrations to acceptable interim levels. Admittedly, this is a stopgap proposal, suitable only until a more permanent solution can be instituted.

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FIGURE 1

^{222}Rn INGROWTH IN PURE ^{226}Ra

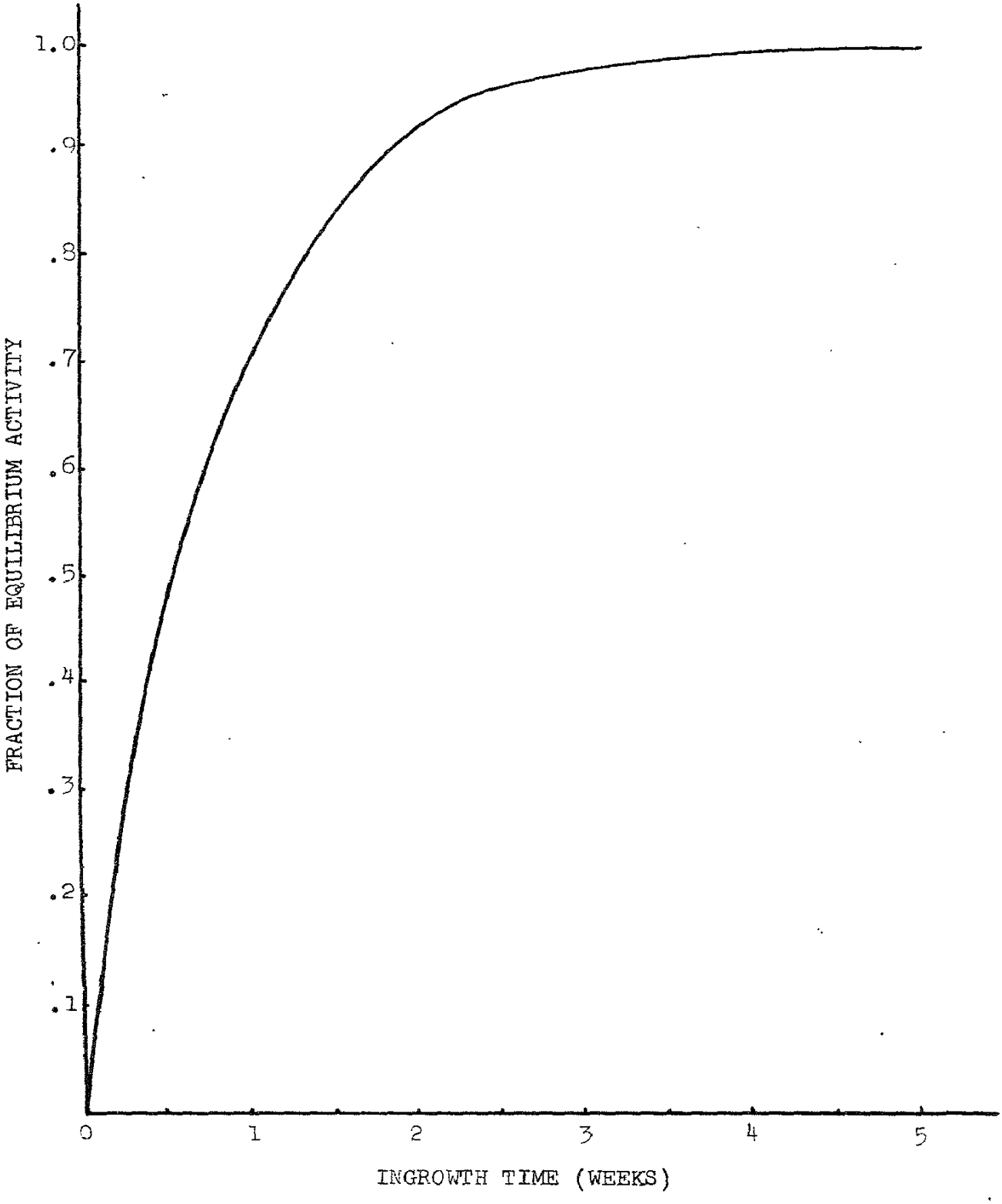
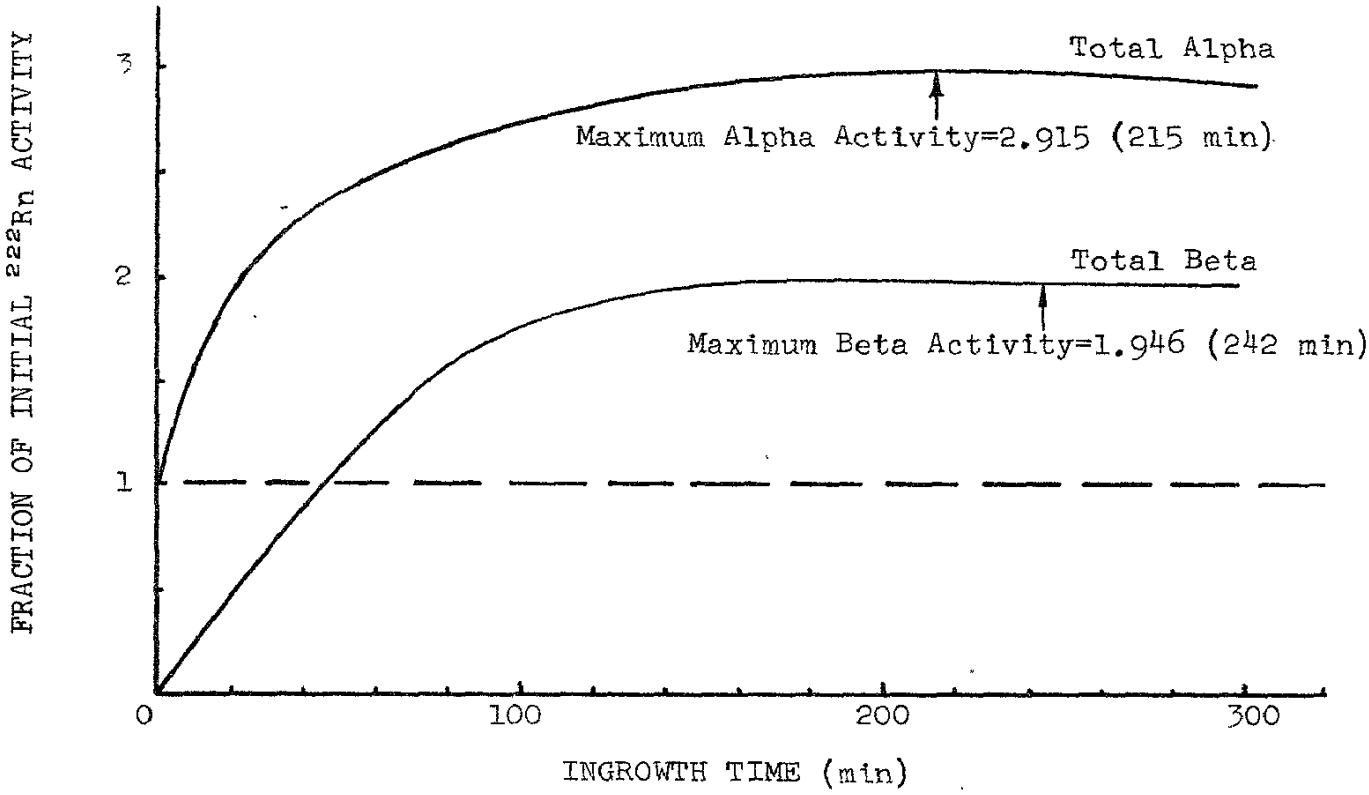


FIGURE 2

ACTIVITY BUILDUP IN PURE ^{222}Rn



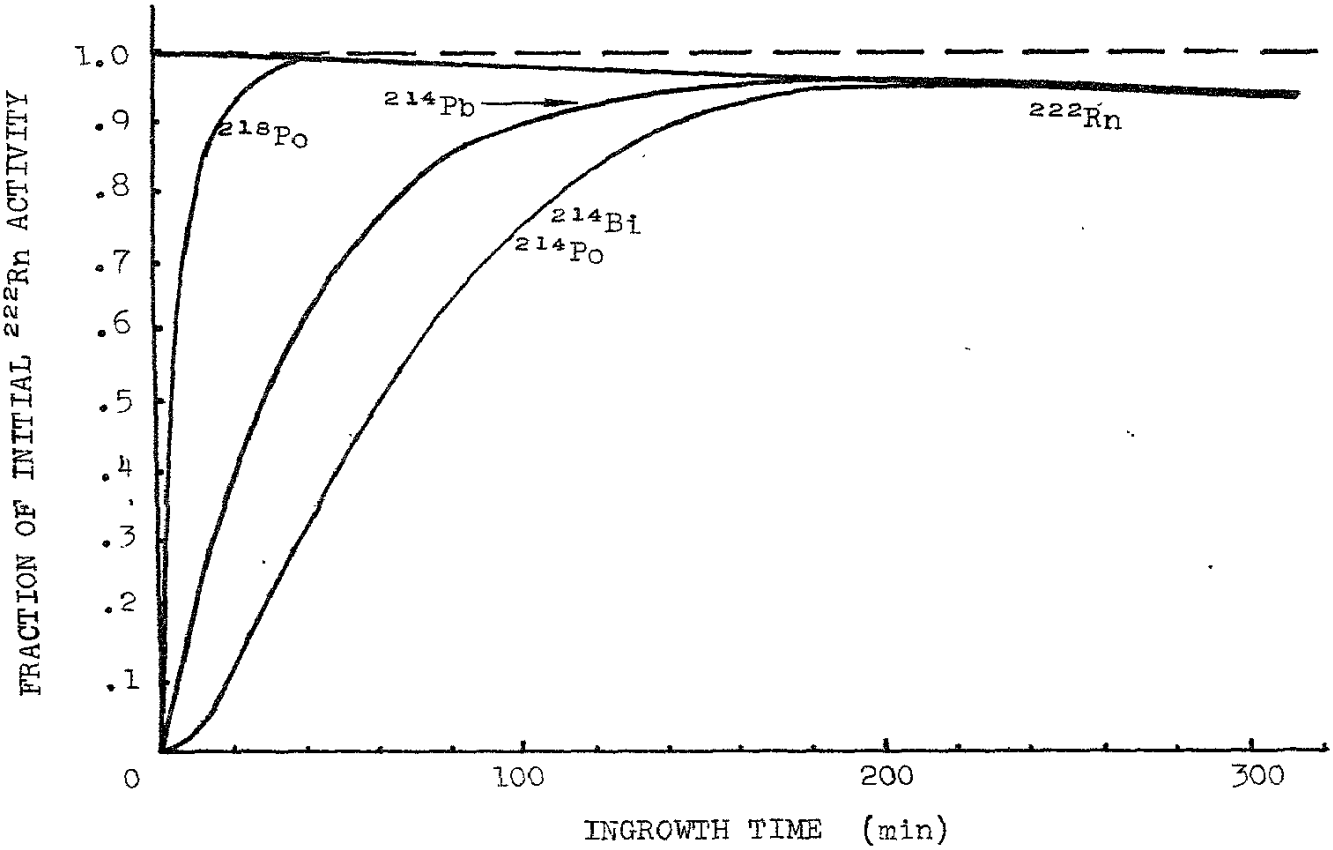


FIGURE 3

DOE-NF ON-SITE RADON MONITORS

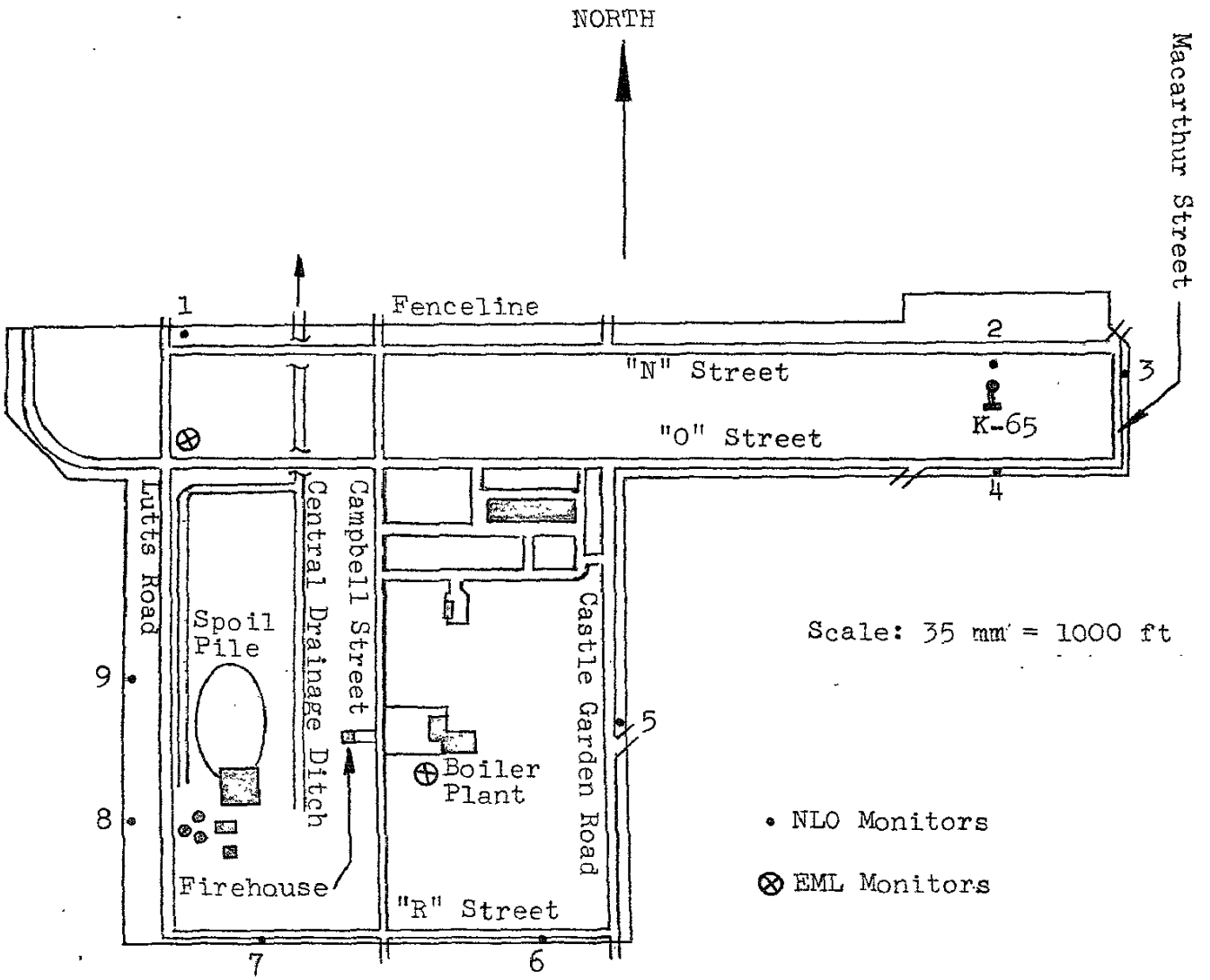


FIGURE 4

EML OFF-SITE (OUTDOOR) RADON MONITORS

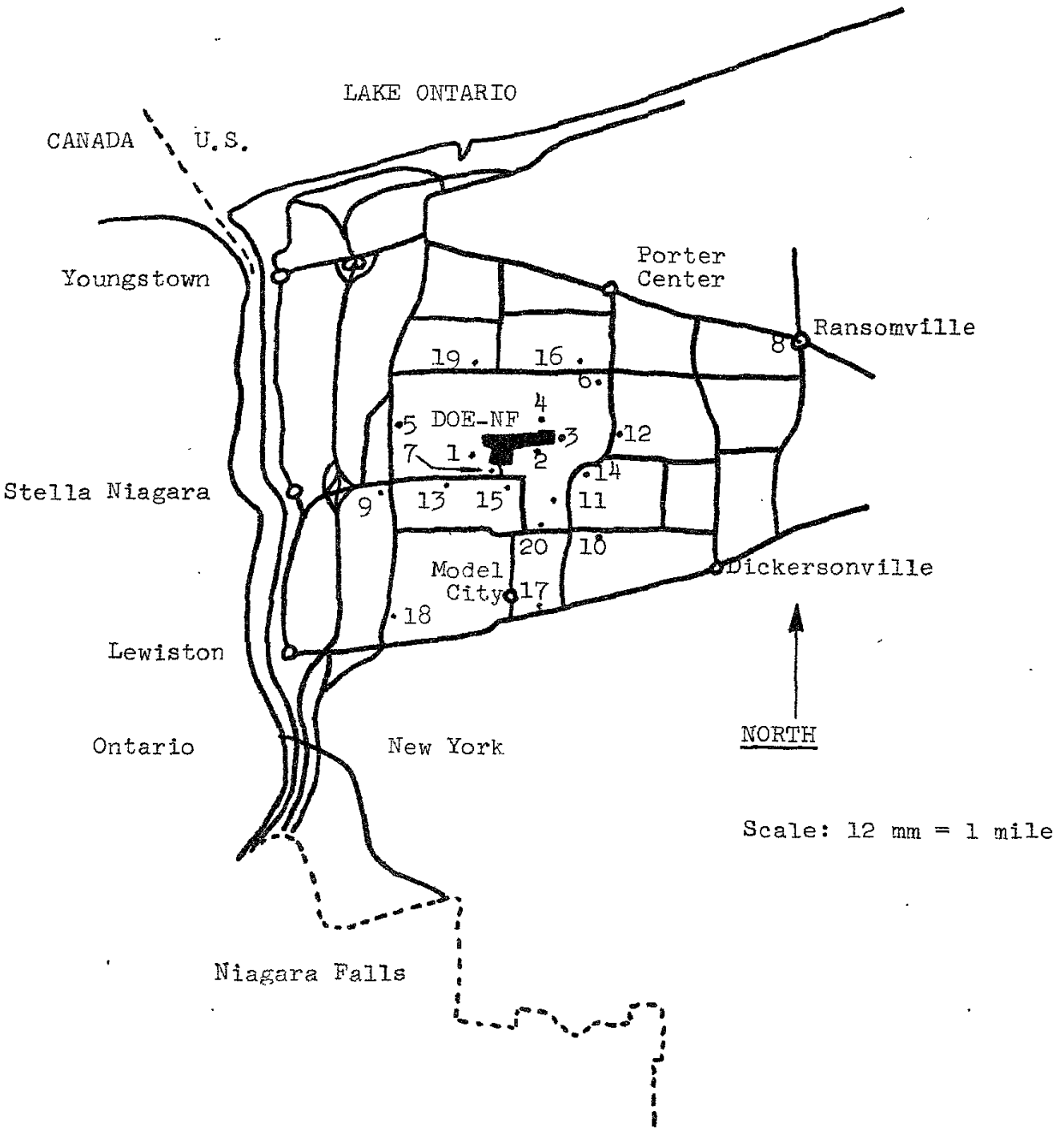


FIGURE 5

AMBIENT AIR RADON MONITOR NO. 1

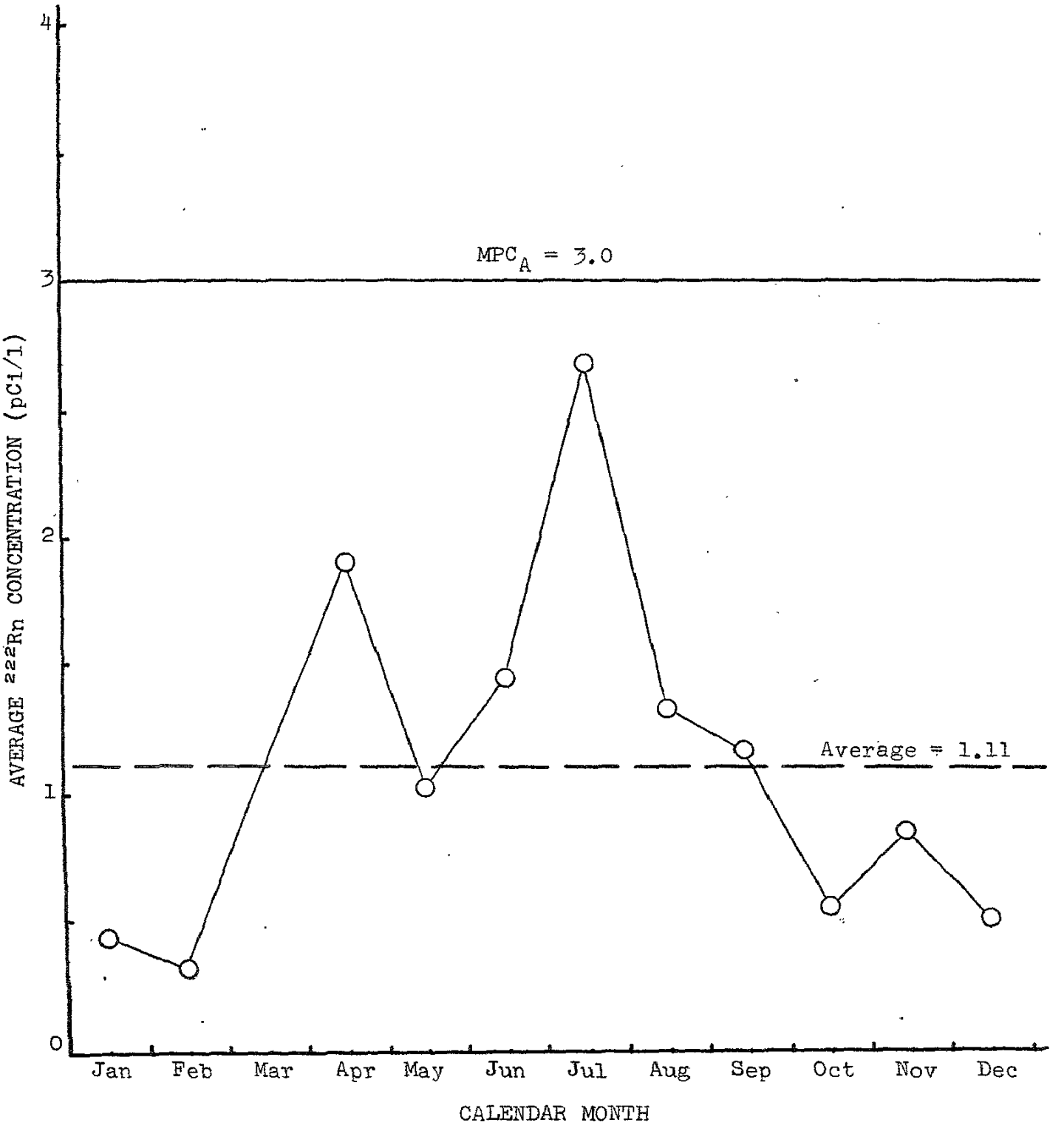


FIGURE 6

AMBIENT AIR RADON MONITOR NO. 2

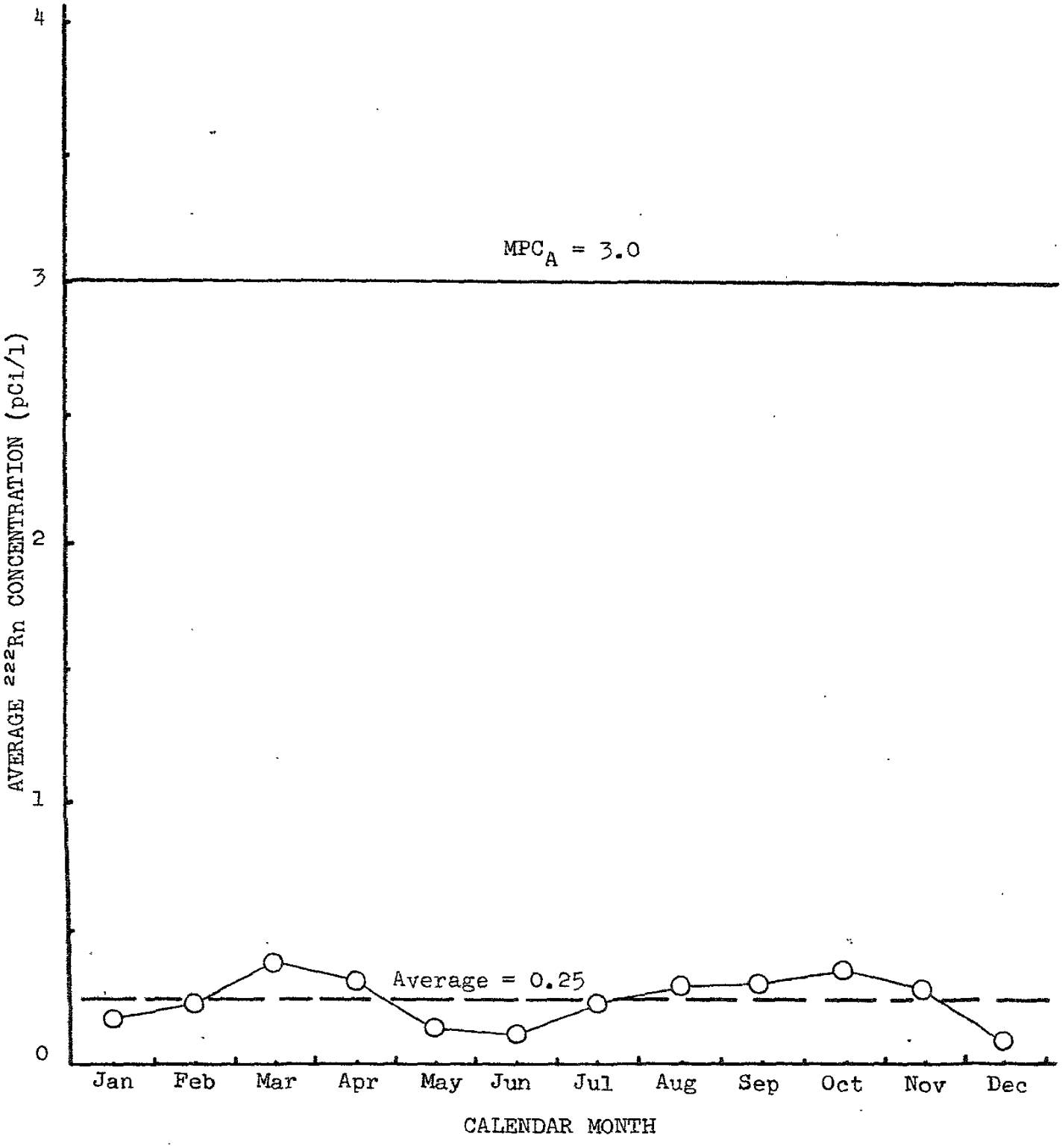


FIGURE 7

AMBIENT AIR RADON MONITOR NO. 3

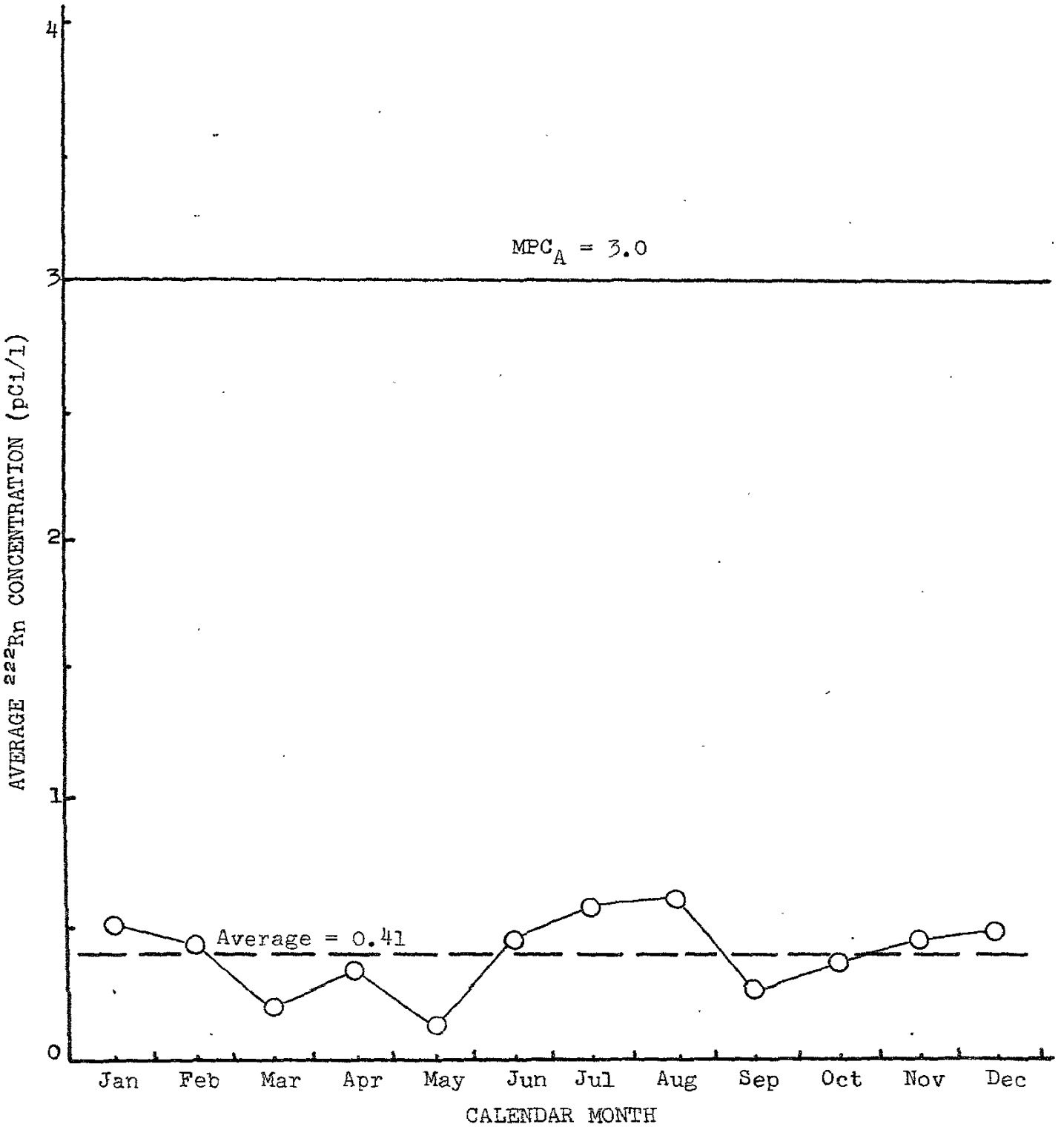


FIGURE 8

AMBIENT AIR RADON MONITOR NO. 4

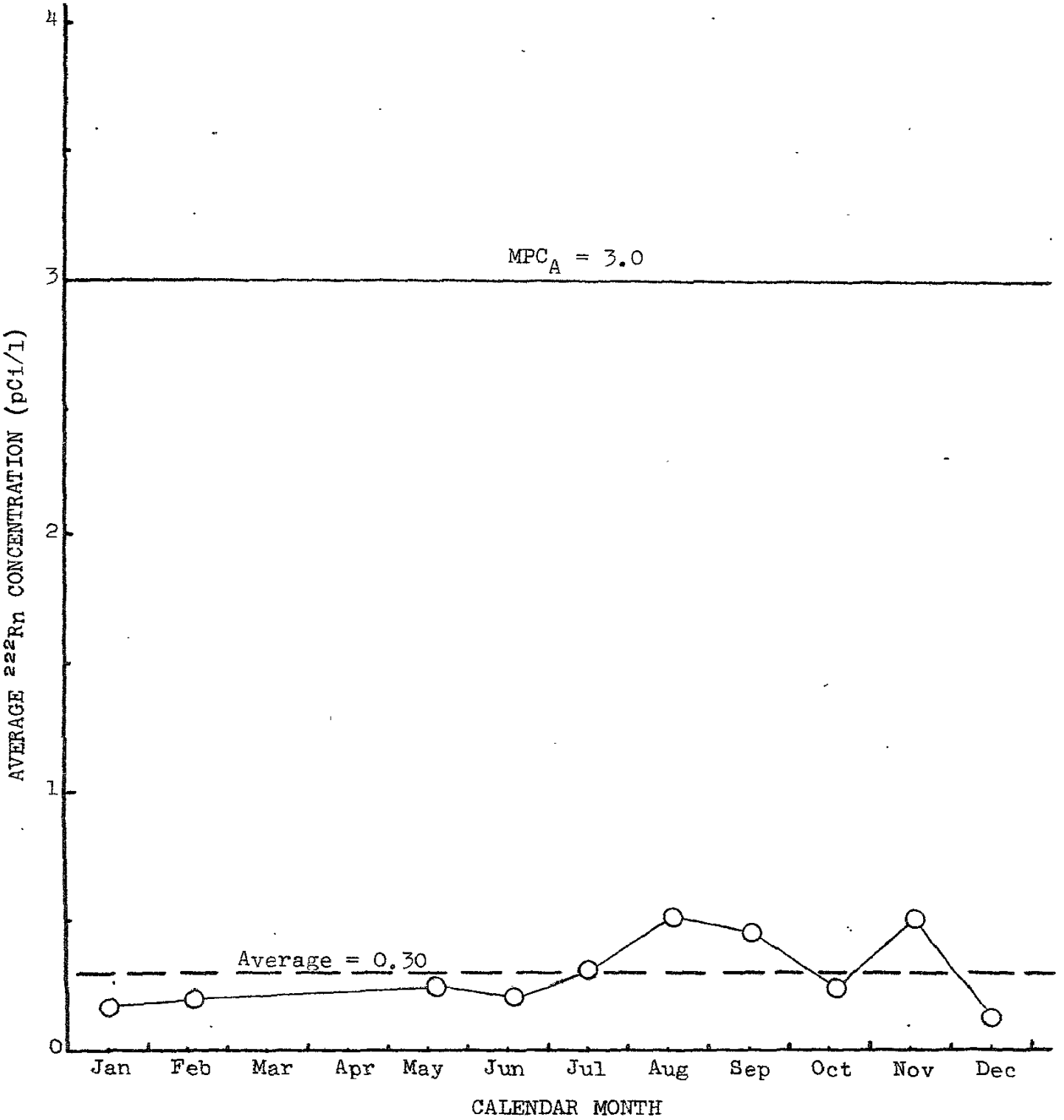


FIGURE 9

AMBIENT AIR RADON MONITOR NO. 5

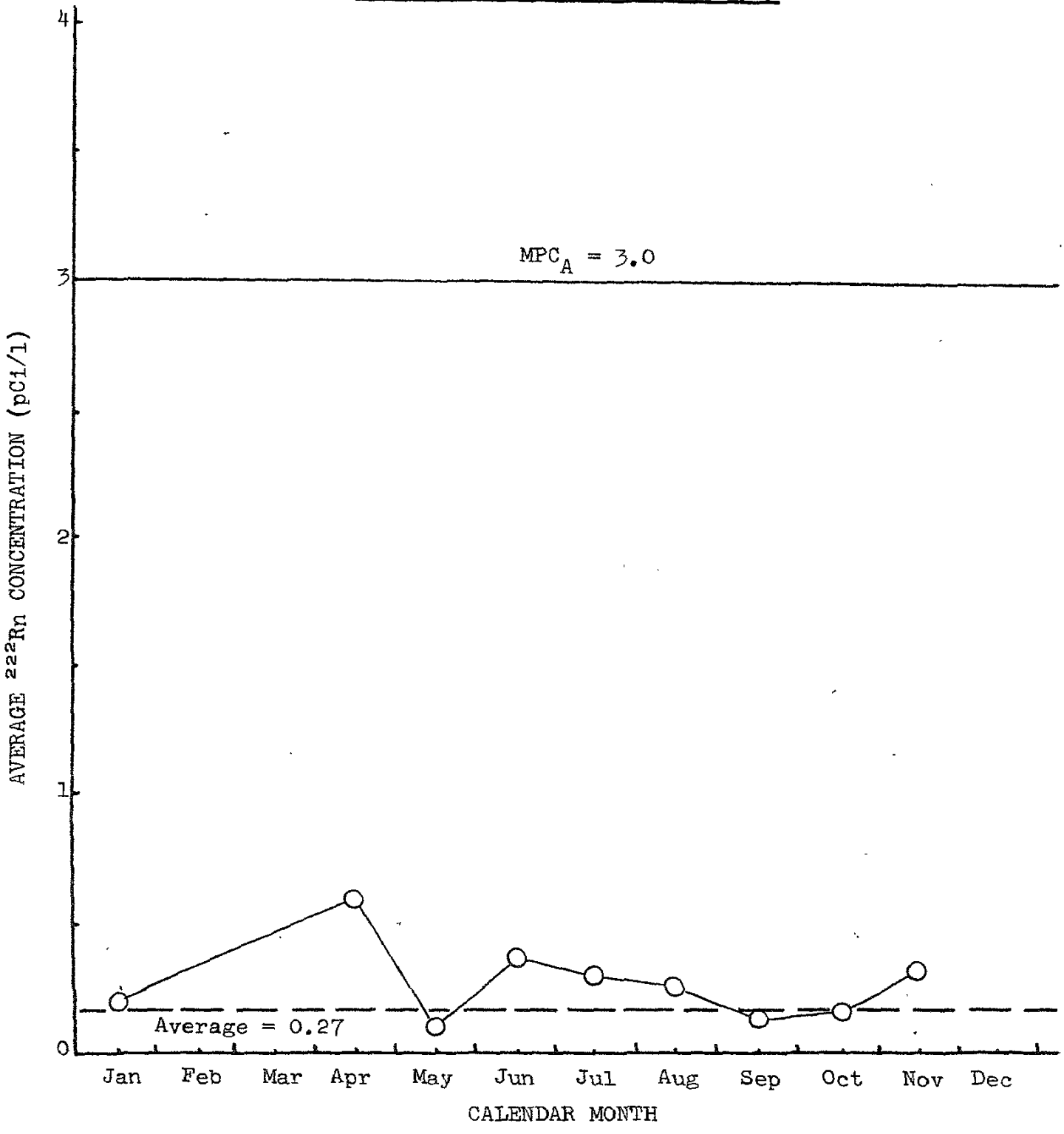


FIGURE 10

AMBIENT AIR RADON MONITOR NO. 6

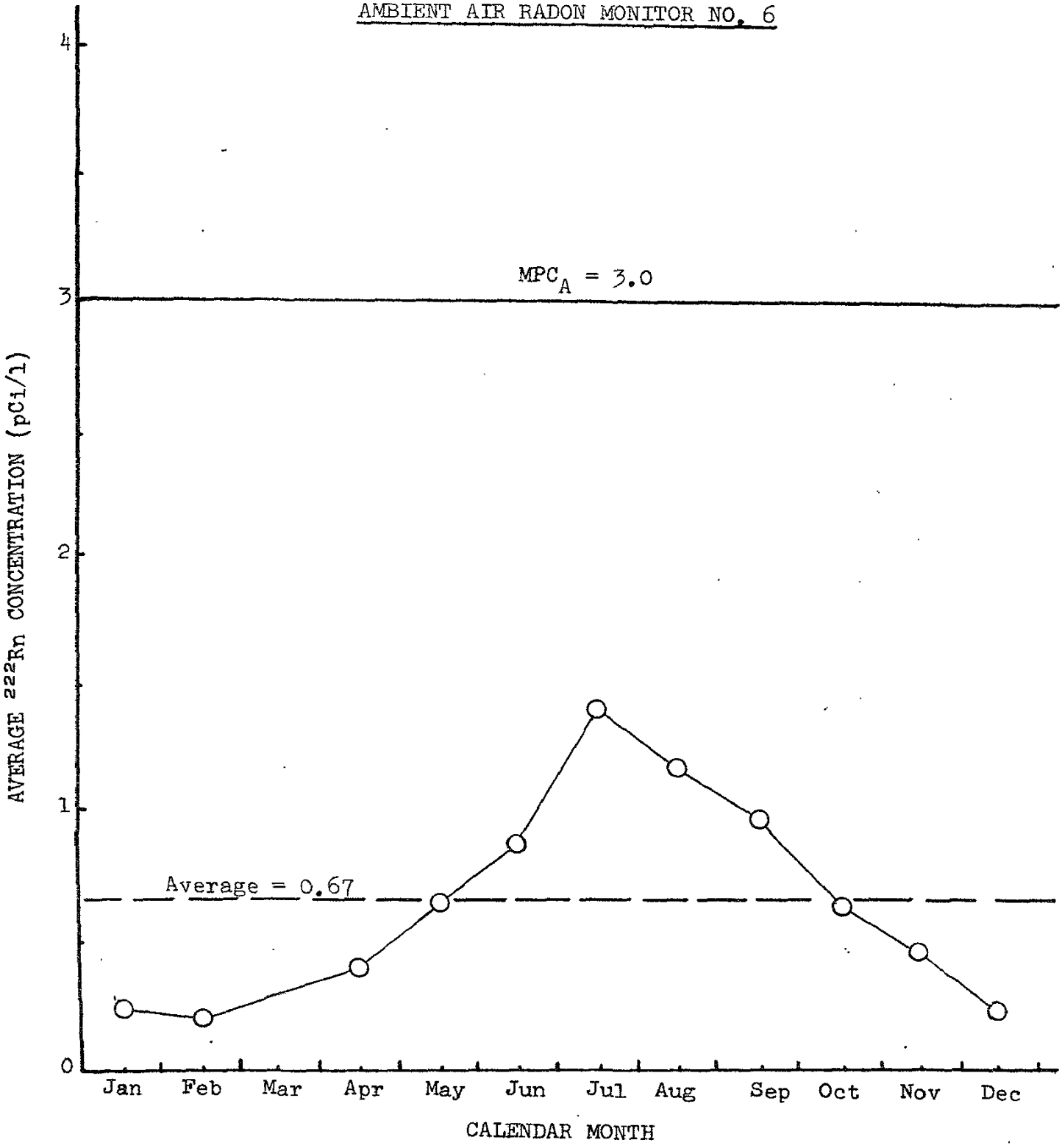


FIGURE 11

AMBIENT AIR RADON MONITOR NO. 7

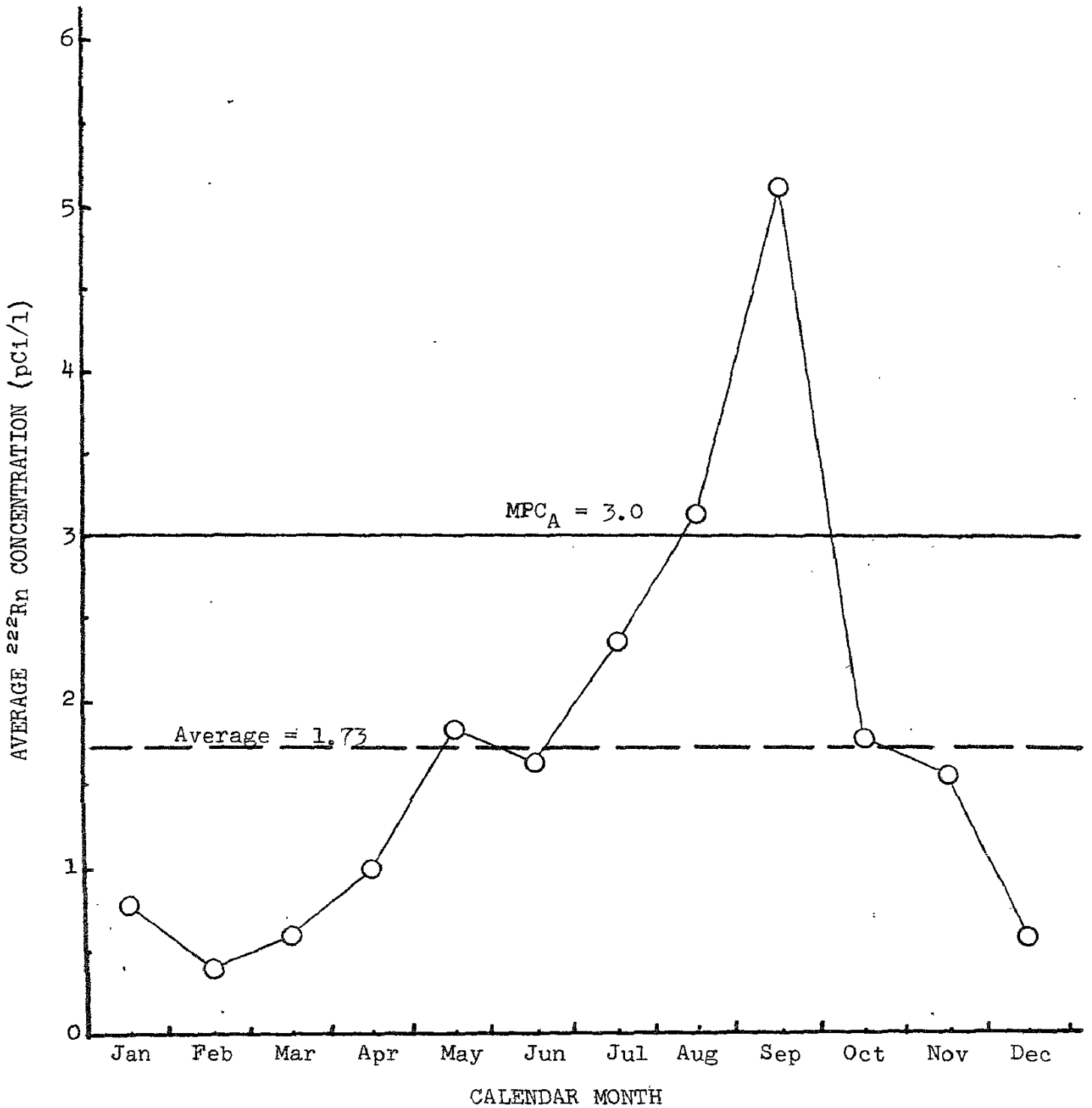


FIGURE 12

AMBIENT AIR RADON MONITOR NO. 8

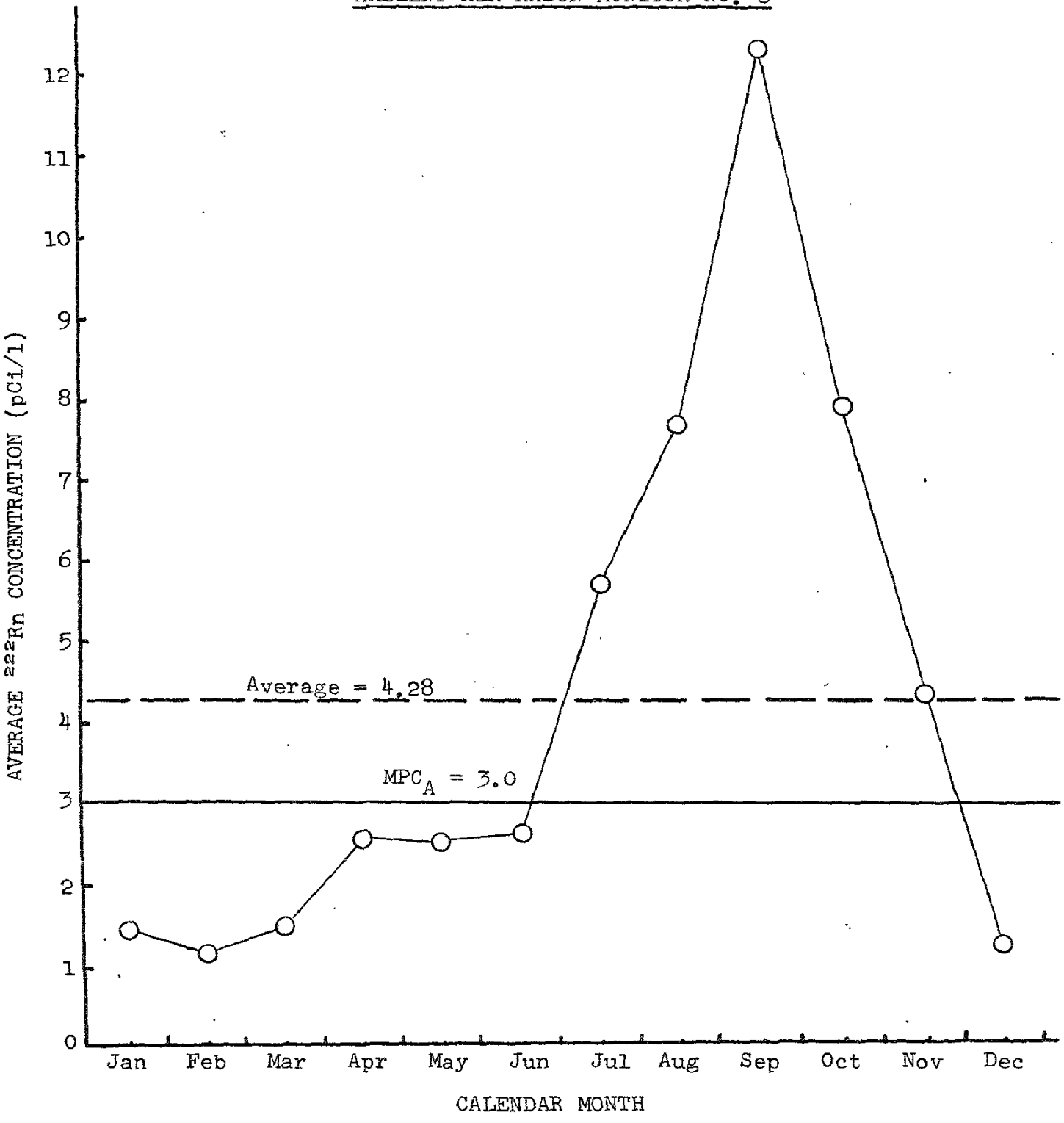


FIGURE 13

AMBIENT AIR RADON MONITOR NO. 9

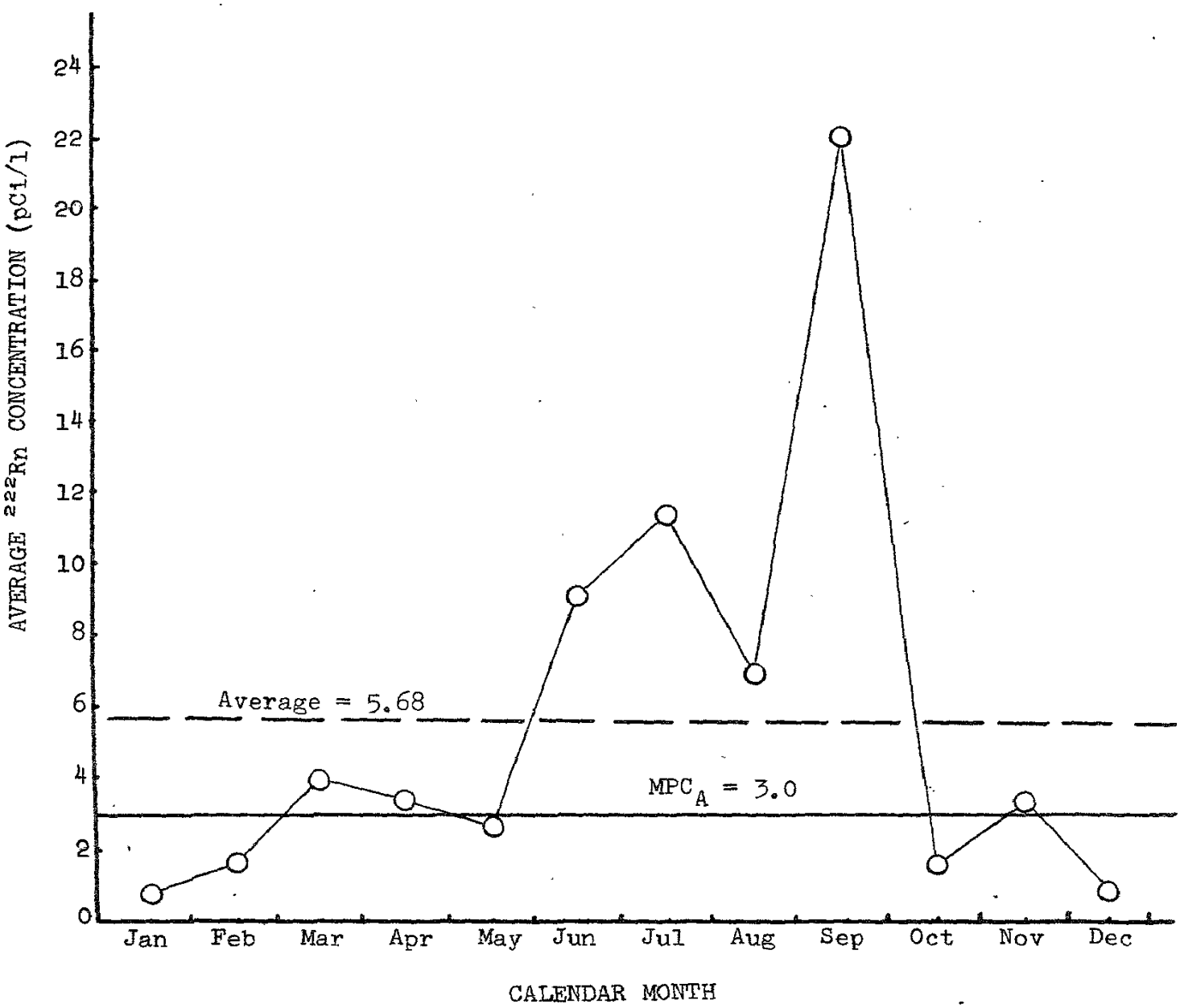


FIGURE 14

DOE - NF SITE ^{222}Rn COMPOSITE

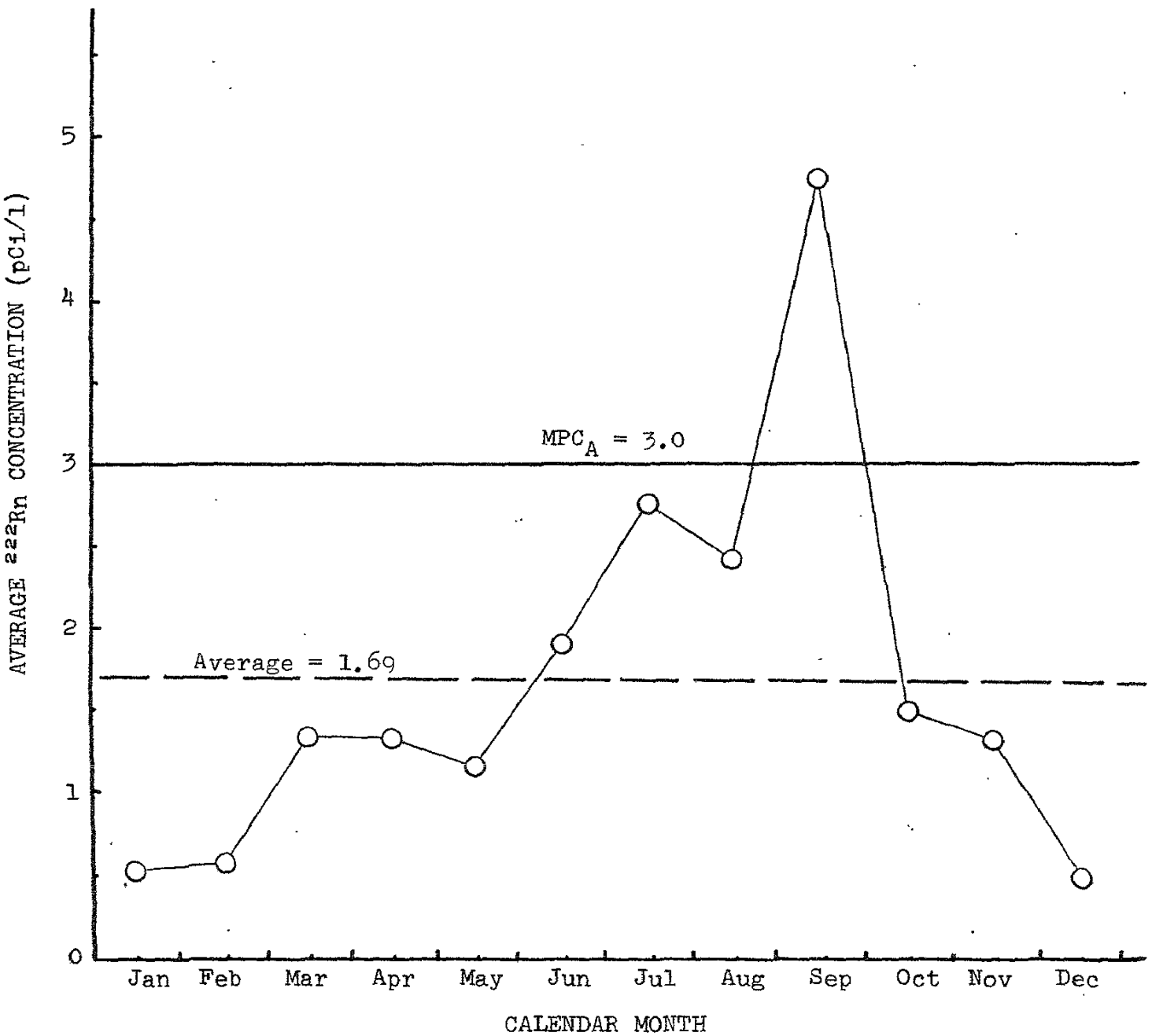


FIGURE 15

SPOIL PILE RADON FLUX MEASUREMENT TRAVERSES

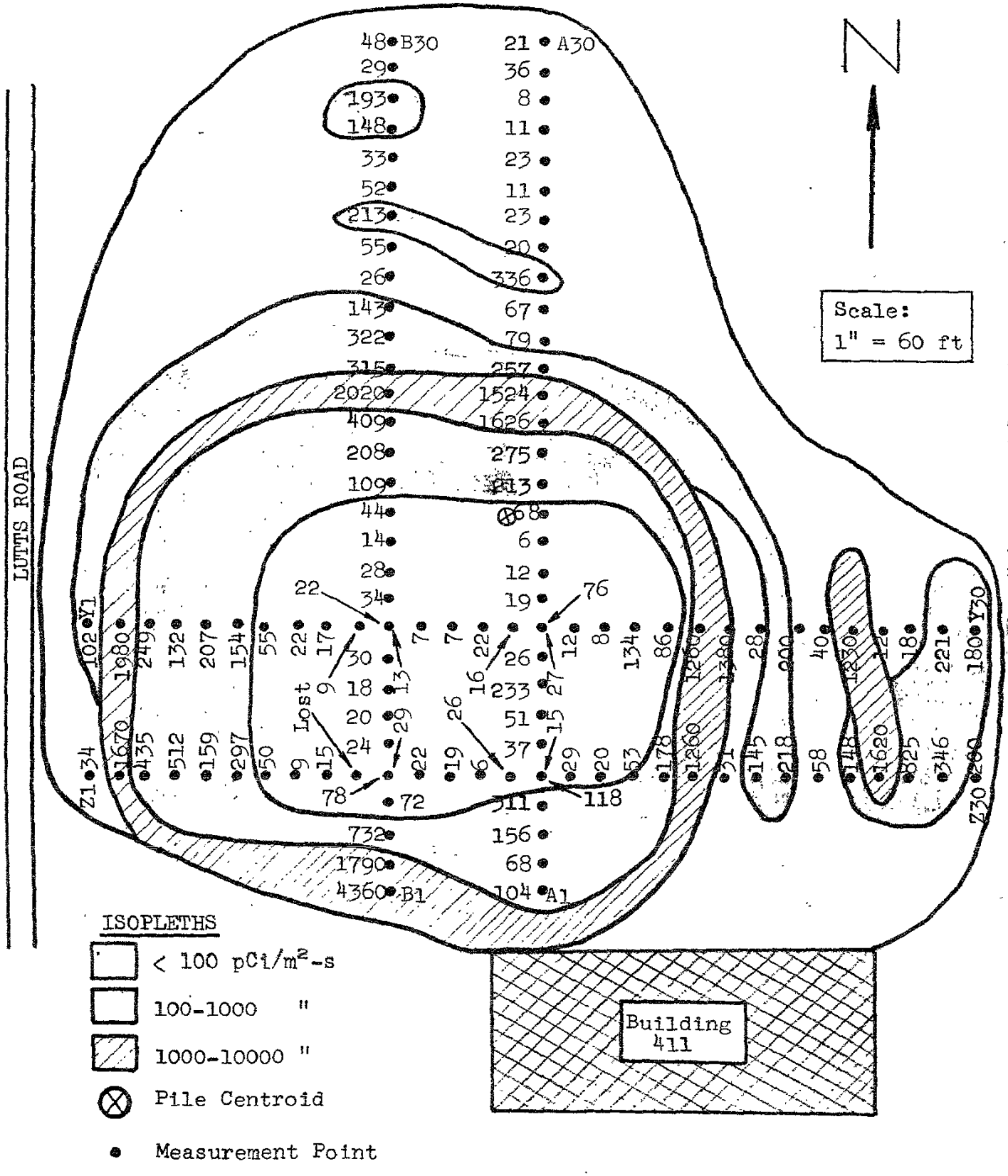


FIGURE 16

DOE - NF FENCELINE RADON PROFILE USING FLASK GRAB SAMPLES

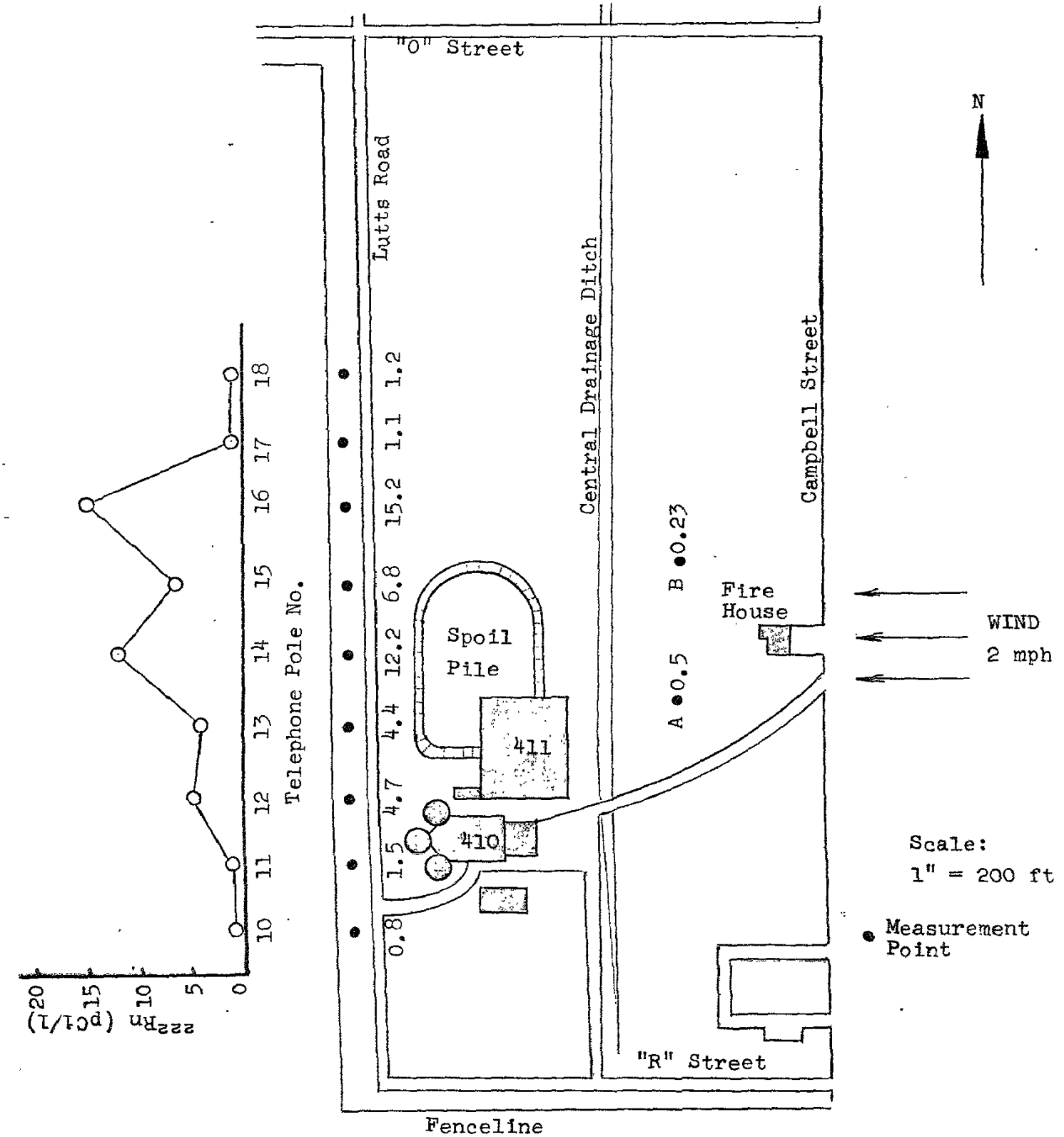


FIGURE 17

1979 SPOIL PILE AREA MONTHLY RADON FLUX VARIATION

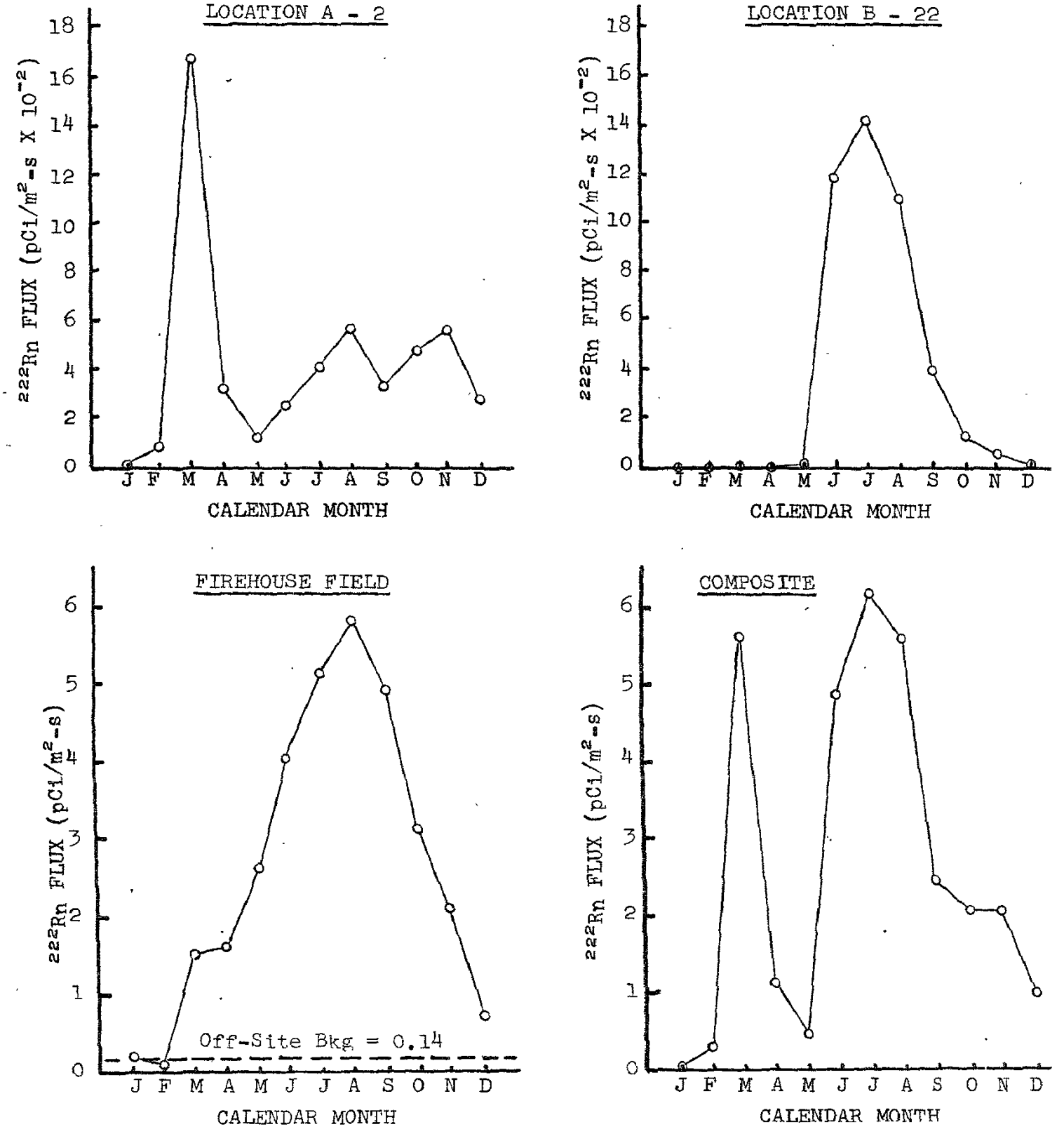


FIGURE 18

WEST FENCELINE (W18.6) SOIL AIR ^{222}Rn PROFILE

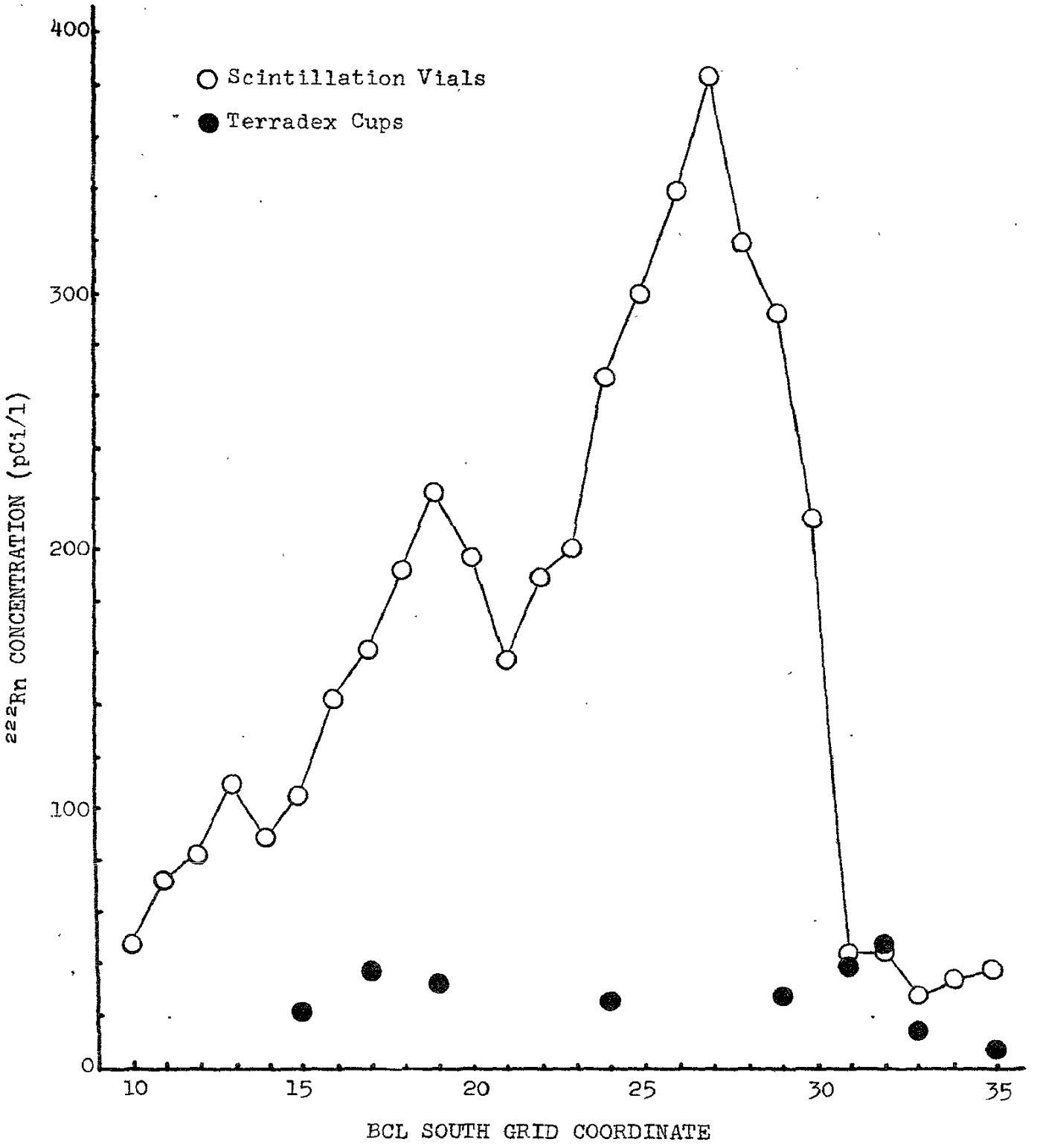


FIGURE 19

LUCAS ALPHA SCINTILLATION SYSTEM

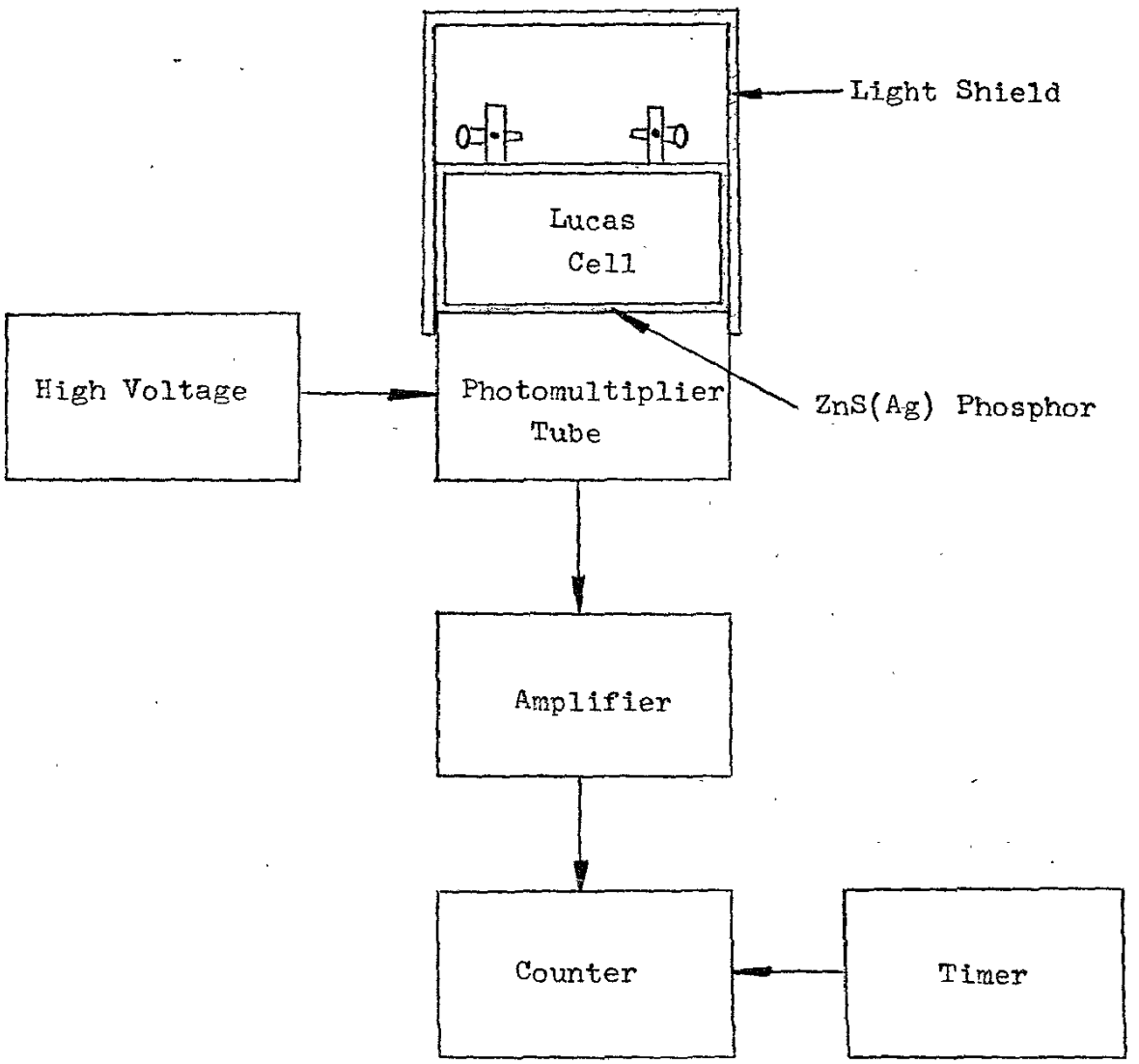
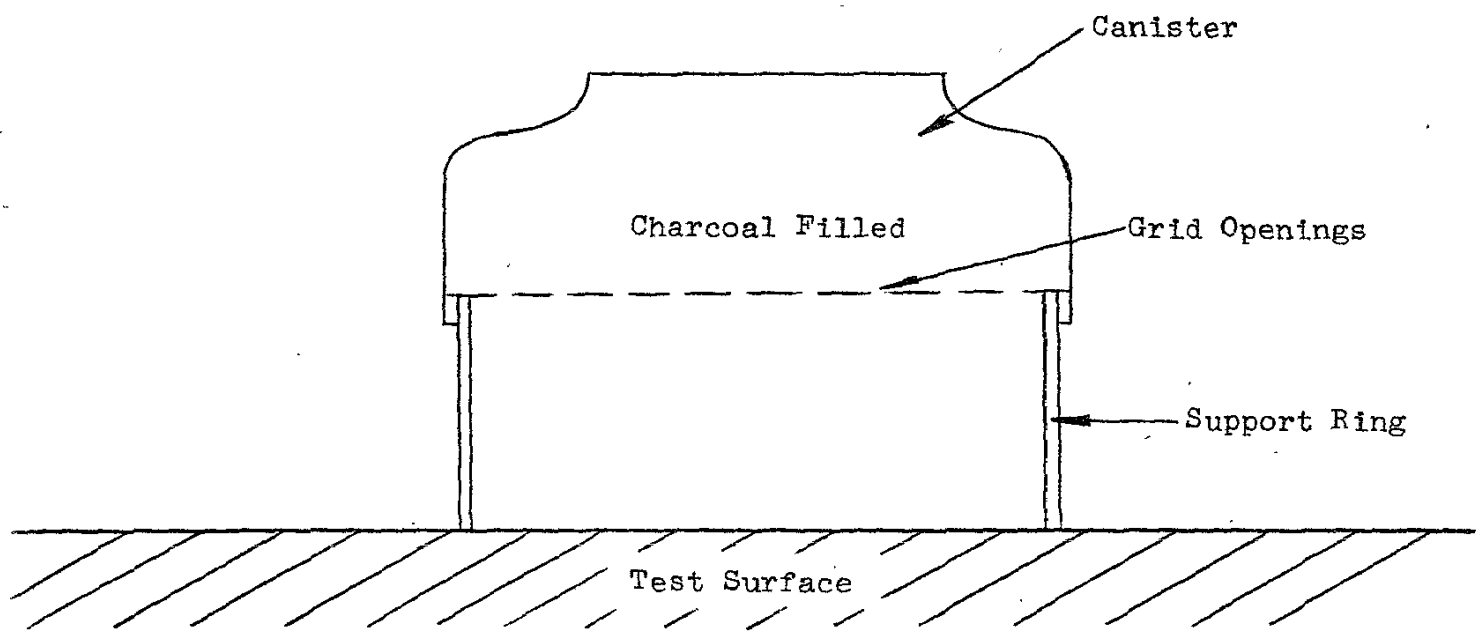


FIGURE 20

CHARCOAL CANISTER SYSTEM IN POSITION FOR ^{222}Rn FLUX MEASUREMENTS



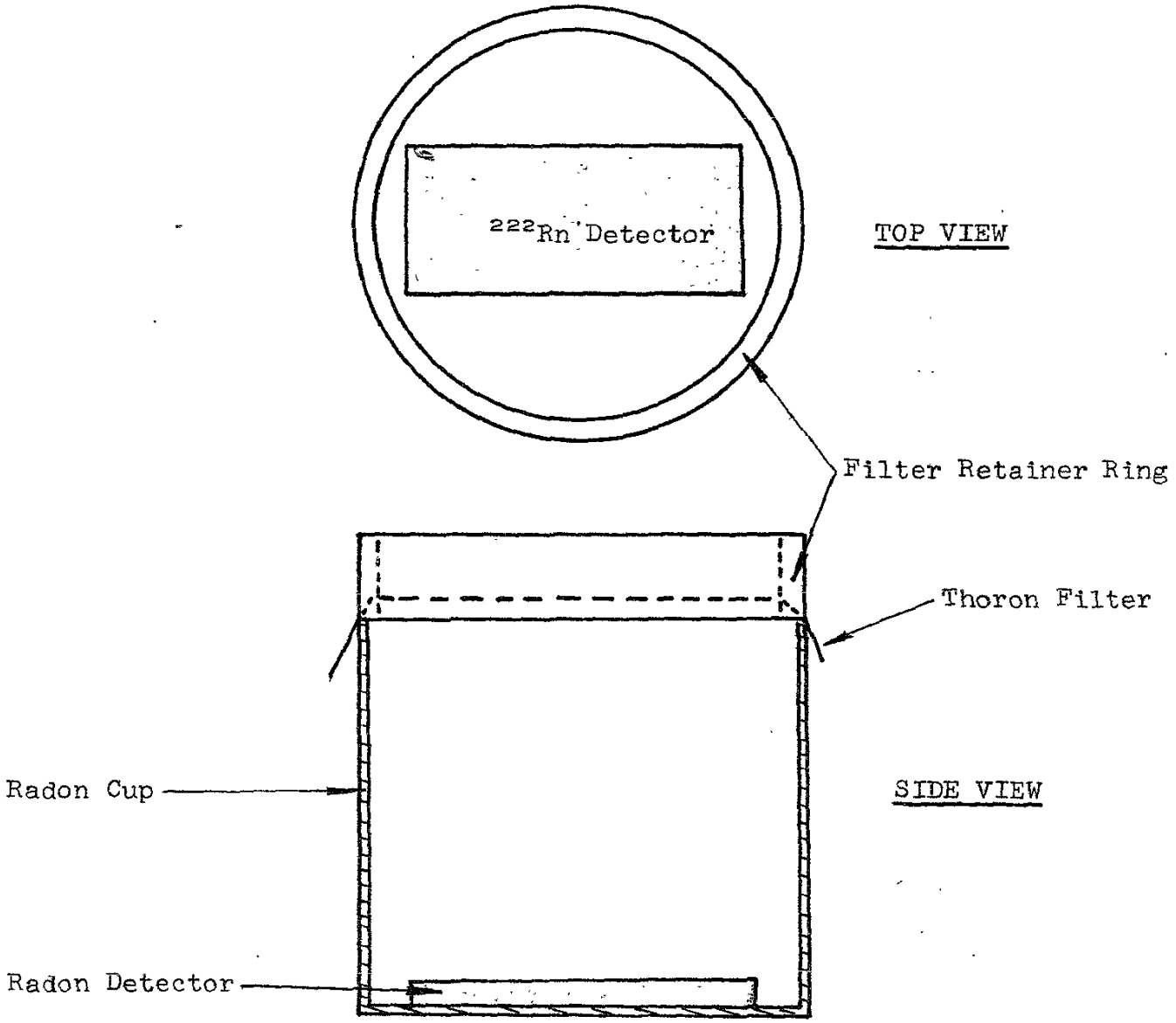


FIGURE 21

TERRADEX CORPORATION'S TRACK ETCH RADON CUP WITH THORON FILTER

FIGURE 22

SCHEMATIC DIAGRAM OF WRENN-TYPE RADON DETECTOR

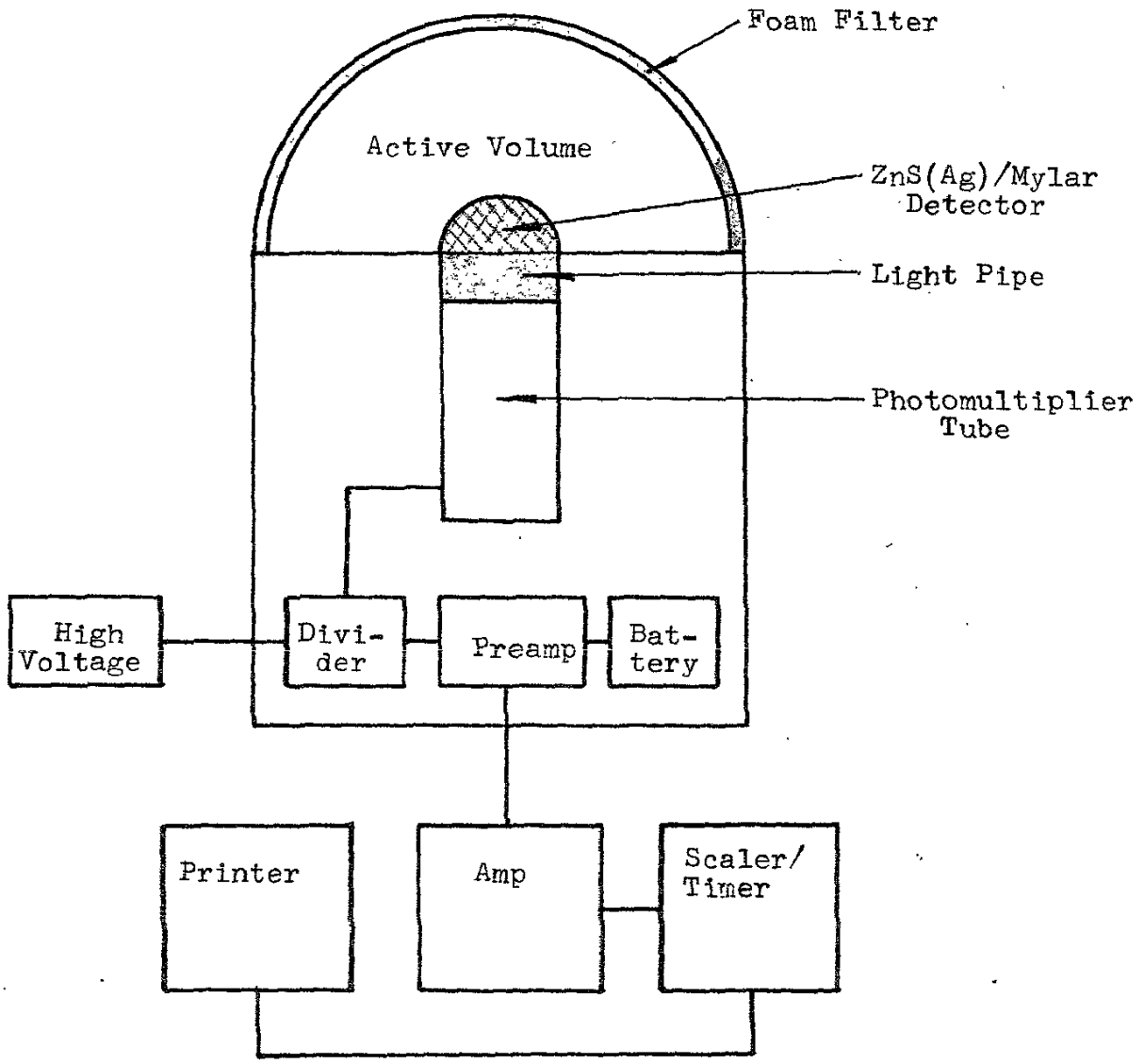


FIGURE 23

CUT-A-WAY VIEW OF PASSIVE ENVIRONMENTAL RADON MONITOR

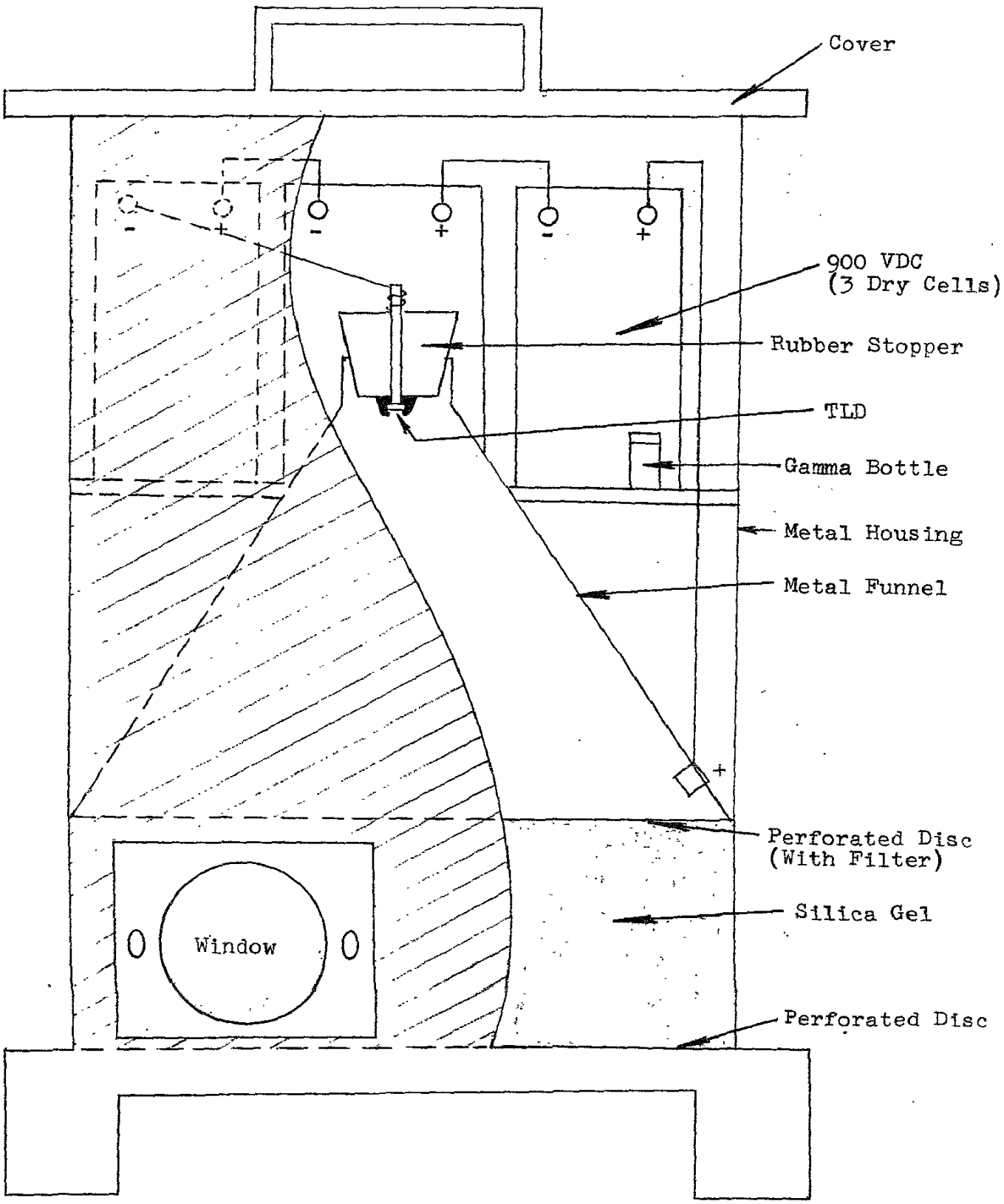


FIGURE 24

MONTHLY AVERAGE TEMPERATURES

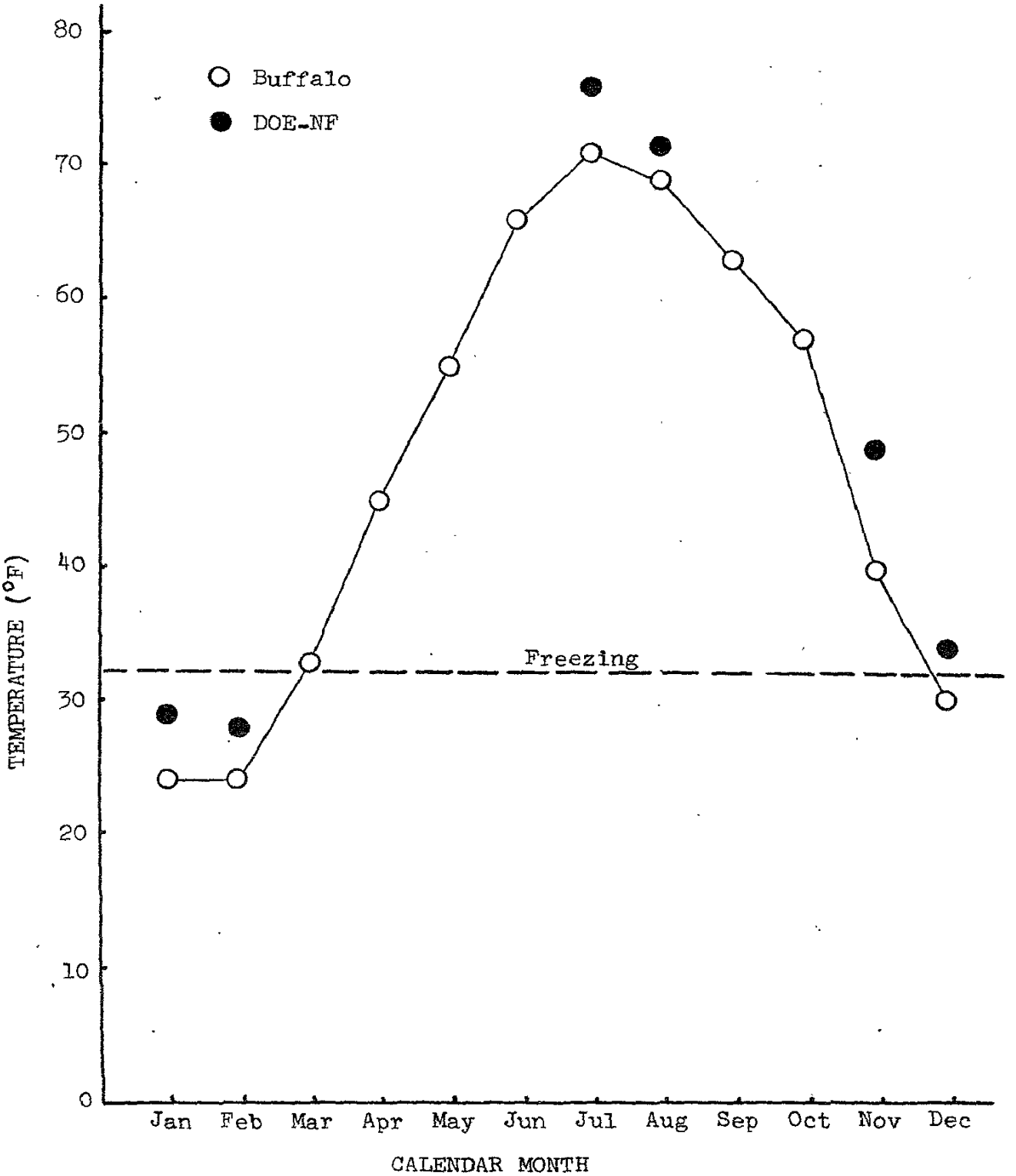


FIGURE 25

AVERAGE ANNUAL SNOWFALL

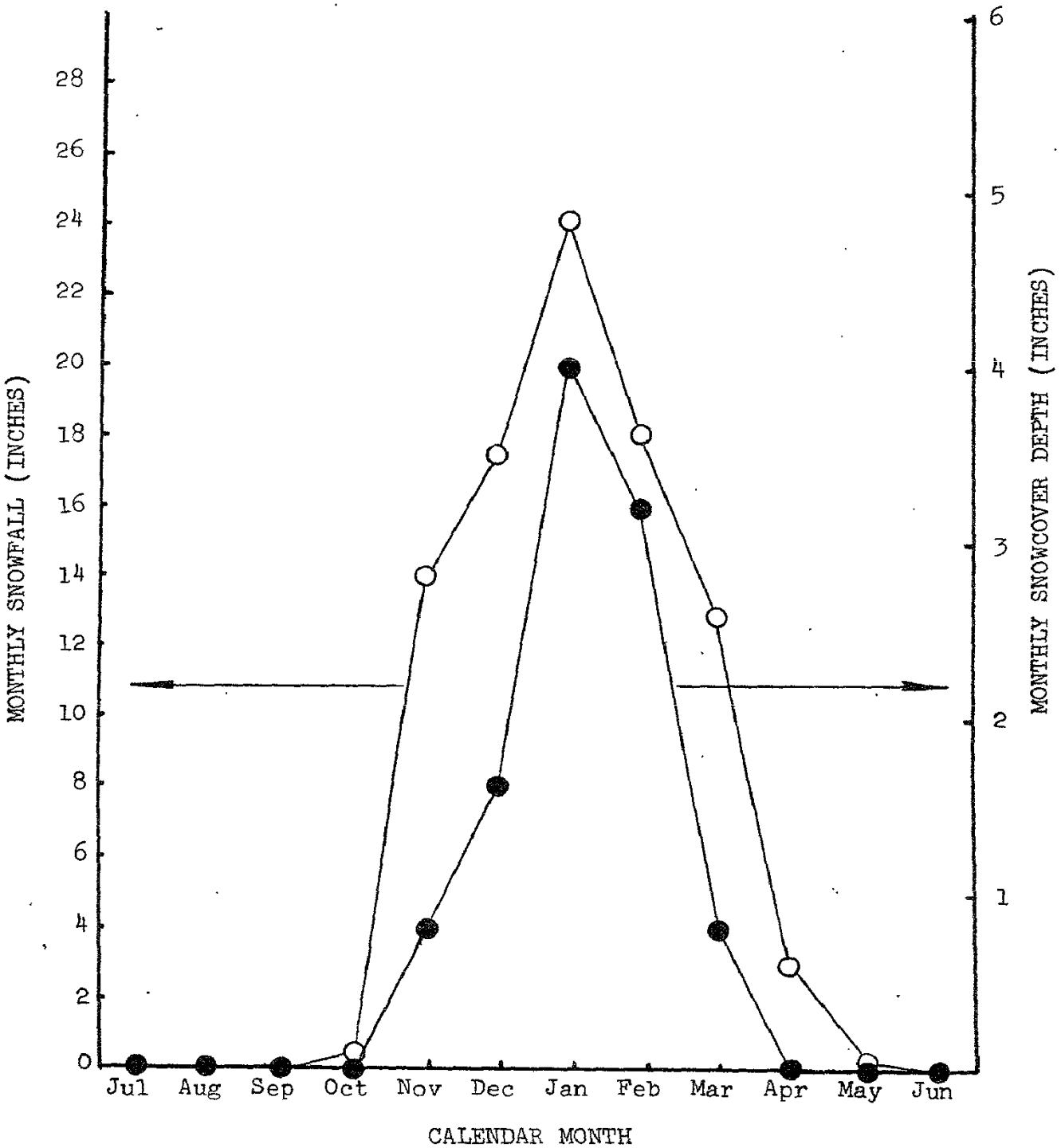
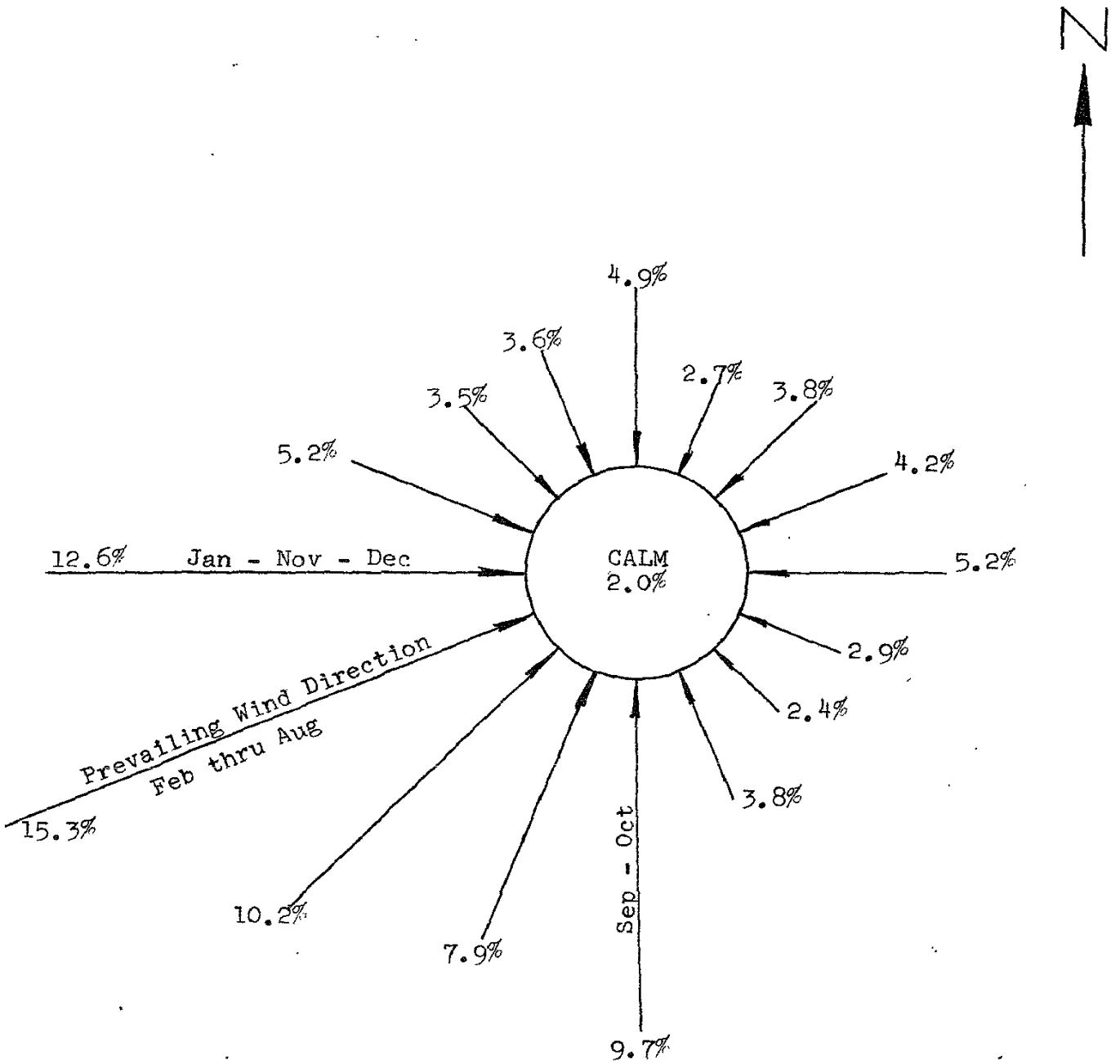
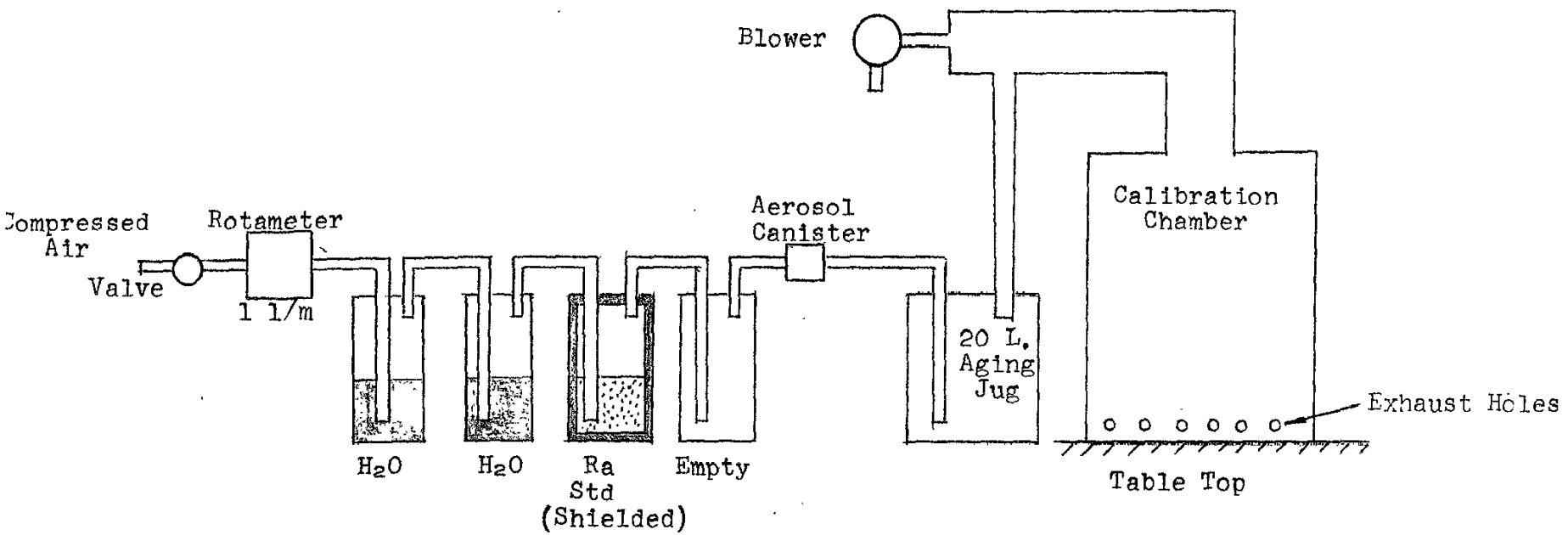


FIGURE 26

BUFFALO NEW YORK WIND ROSE

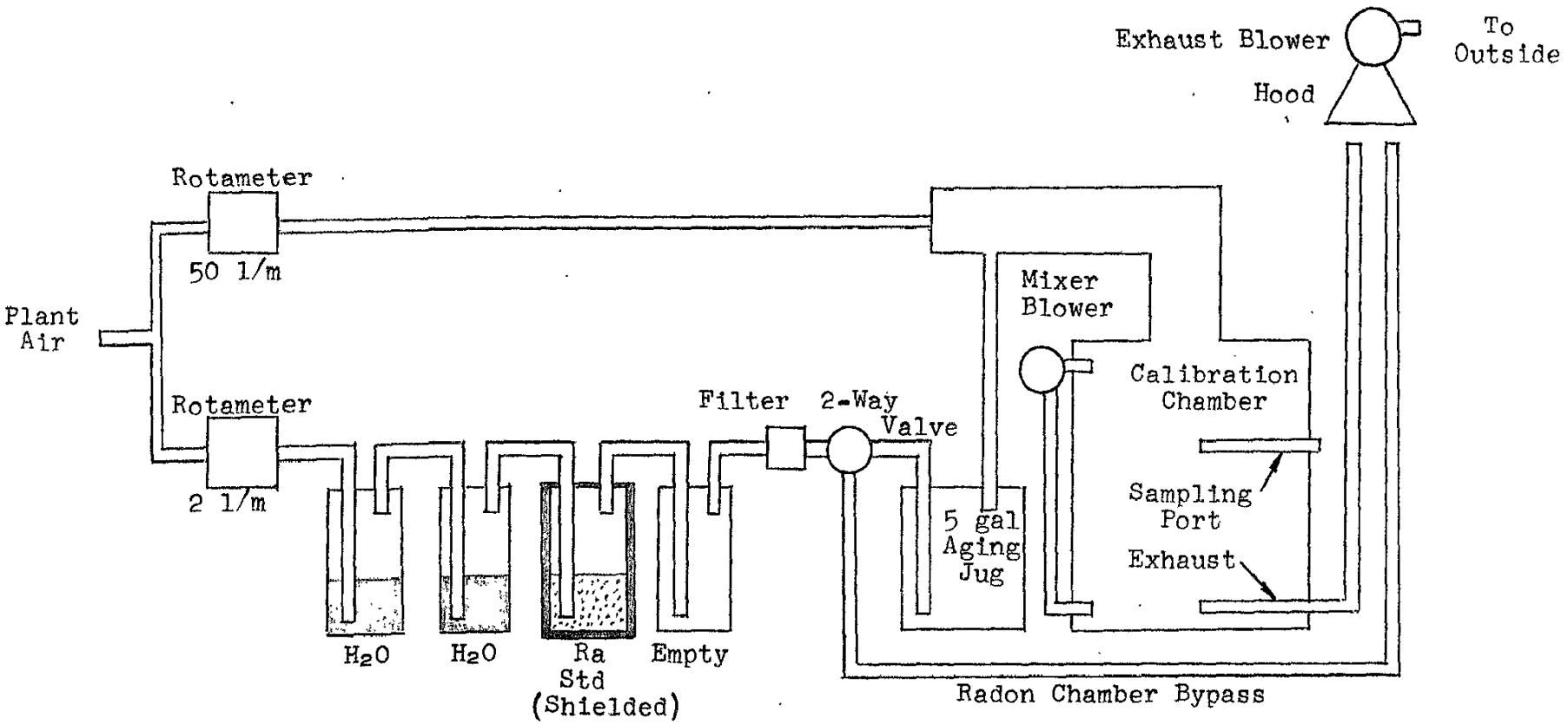


APPENDIX A-1



EML GENERATOR FOR RADON AND RADON DAUGHTERS

APPENDIX A-2



NLO GENERATOR FOR RADON AND RADON DAUGHTERS

TABLE I

RADON DECAY SCHEME

Nuclide	Half-Life		Radiation Emitted
^{226}Ra	1602	years	alpha
^{222}Rn	3.823	days	alpha
^{218}Po	3.05	min.	alpha
^{214}Pb	26.8	min.	beta
^{214}Bi	19.7	min.	beta
^{214}Po	164	μ sec.	alpha
^{210}Pb	21	years	beta

TABLE II

INITIAL RADON MONITORING DATA AT THE DOE-NF SITE

Location*	Radon Concentration (pCi/l)
4	0.7
5	1.0
8	3.5

*See Figure 3

TABLE III

EML CUMMULATIVE ^{222}Rn RESULTS AT THE DOE-NF SITE

(pCi/l)

Map Reference*	Location	All Weekly Measurements to Date Range	Average
	Off-Site, Outdoors		
1	F. Guard Property	0.2 - 2.4	0.5
2	F. Monroe Property	0.03 - 0.8	0.5
3	Chemtrol "A"	<0.03 - 0.6	0.3
4	Chemtrol "B"	<0.03 - 0.8	0.3
5	Lew Port School	0.1 - 0.4	0.2
6	Nike Site	0.1 - 0.5	0.2
7	Radar Station	0.1 - 2.5	0.7
8	Ransomville	0.1 - 0.6	0.2
9	Ganon Residence	0.07 - 0.5	0.2
10	Oliphant Residence	0.07 - 0.4	0.2
11	W. Schultz Residence	0.06 - 0.5	0.2
12	A. Schultz Residence	0.08 - 0.6	0.2
13	Jackson Residence	0.08 - 0.4	0.2
14	Jowdy Residence	0.1 - 0.6	0.3
15	Daul Residence	0.1 - 0.4	0.2
16	Bell Aircraft	0.07 - 0.6	0.3
17	Hanns Residence	0.06 - 0.2	0.1
18	Lombardi's Dairy	0.05 - 0.3	0.1
19	J & T Junkyard	0.1 - 0.8	0.4
20	Fatima Shrine	0.08 - 0.4	0.2
	Off-Site, Indoors		
	Kruger Chevrolet (Ransomville)	0.2 - 1.0	0.5
	Gannon Residence	0.3 - 1.6	0.8
	Oliphant Residence	0.3 - 0.8	0.5
	W. Schultz Residence	0.2 - 0.8	0.4
	A. Schultz Residence	0.3 - 0.9	0.5
	Jackson Residence	0.3 - 1.4	0.7
	Jowdy Residence	0.2 - 1.2	0.6
	Daul Residence	0.1 - 0.7	0.4
	Lew Port School	0.2 - 0.4	0.4
	Fatima Shrine	0.2 - 0.4	0.3
	On-Site, Outdoors		
	"O" Street	0.05 - 2.7	1.0
	Boiler Plant	0.1 - 4.2	1.5

*See Figure 4

TABLE IV

DOE-NF BACKGROUND STATISTICAL COMPARISONS*

Parameter	Site			
	NIKE	Lew Port School	Ransomville	All Three
Location	1 mi NE	2 mi W	4 mi NE	--
Radon Concentration (average)	0.23 ±0.02	0.24 ±0.01	0.21 ±0.02	0.23 ±0.01
No. of Assays	19	25	20	64
Std. Dev. (Individual Measurement)	±0.10	±0.07	±0.09	±0.09
Rel. Std. Dev. (%)	±43.8	±29.2	±44.3	±38.1

*All errors expressed at one standard deviation level; all radon concentrations expressed in pCi/l.

TABLE V

AVERAGE MONTHLY ^{222}Rn MONITORING SUMMARY AT THE DOE-NF SITE

Month \ Year	1978	1979	1980	Monthly Average	1978	1979	1980	Monthly Average
	Station #1				Station #2			
January	--	0.50	0.40	0.45	--	0.05	0.30	0.18
February	--	0.30	0.35	0.33	--	0.12	0.35	0.24
March	--	--	--	--	--	0.40	--	0.40
April	--	1.90	--	1.90	--	0.33	--	0.33
May	0.67	1.37	--	1.02	<0.5	0.27	--	0.14
June	--	1.45	--	1.45	0.09	0.15	-	0.12
July	--	2.68	--	2.68	0.14	0.34	--	0.24
August	1.83	0.83	--	1.33	0.36	0.25	--	0.31
September	1.01	1.32	--	1.17	0.08	0.53	--	0.31
October	0.50	0.58	--	0.54	0.09	0.64	--	0.37
November	0.63	1.05	--	0.84	0.44	0.13	--	0.29
December	0.48	0.54	--	0.51	0.05	0.12	--	0.09
Yearly Average	0.85	1.14	0.38	1.11	0.16	0.28	0.33	0.25
	Station #3				Station #4			
January	--	0.80	0.23	0.52	--	0.08	0.25	0.17
February	--	--	0.45	0.45	--	--	0.20	0.20
March	--	0.20	--	0.20	--	--	--	--
April	--	0.35	--	0.35	--	--	--	--
May	<0.5	0.25	--	0.13	0.31	0.18	--	0.25
June	0.40	0.53	--	0.47	0.08	0.34	--	0.21
July	0.51	0.68	--	0.60	0.58	0.03	--	0.31
August	0.72	0.53	--	0.63	0.28	0.75	--	0.52
September	0.06	0.48	--	0.27	0.11	0.80	--	0.46
October	0.37	0.38	--	0.38	0.07	0.40	--	0.24
November	0.47	0.45	--	0.46	0.45	0.57	--	0.51
December	0.75	0.24	--	0.50	0.08	0.15	--	0.12
Yearly Average	0.41	0.44	0.34	0.41	0.25	0.37	0.23	0.30

--Continued - page 2--

TABLE V

AVERAGE MONTHLY ^{222}Rn MONITORING SUMMARY AT THE DOE-NF SITE

Month \ Year	1978	1979	1980	Monthly Average	1978	1979	1980	Monthly Average
	Station #5				Station #6			
January	--	0.20	--	0.20	--	0.30	0.17	0.24
February	--	--	--	--	--	--	0.20	0.20
March	--	--	--	--	--	--	--	--
April	--	0.60	--	0.60	--	0.40	--	0.40
May	<0.5	--	--	<0.5	0.51	0.80	--	0.66
June	0.37	--	--	0.37	0.35	1.43	--	0.89
July	0.10	0.5	--	0.30	1.10	1.74	--	1.42
August	0.26	--	--	0.26	1.00	1.37	--	1.19
September	0.13	--	--	0.13	0.85	1.13	--	0.99
October	0.16	--	--	0.16	0.41	0.86	--	0.64
November	0.32	--	--	0.32	0.21	0.70	--	0.46
December	--	--	--	--	0.12	0.34	--	0.23
Yearly Average	0.22	0.43	--	0.27	0.57	0.91	0.19	0.67
	Station #7				Station #8			
January	--	1.00	0.58	0.79	--	1.73	1.15	1.44
February	--	0.50	0.30	0.40	--	1.80	0.50	1.15
March	--	0.60	--	0.60	--	1.50	--	1.50
April	--	1.00	--	1.00	--	2.55	--	2.55
May	--	1.84	--	1.84	0.19	4.83	--	2.51
June	0.38	2.90	--	1.64	1.46	4.55	--	3.01
July	1.15	3.58	--	2.37	4.11	7.26	--	5.69
August	3.17	3.08	--	3.13	10.80	4.58	--	7.69
September	6.04	4.15	--	5.10	9.58	15.02	--	12.30
October	1.61	1.94	--	1.78	11.34	4.45	--	7.90
November	1.02	2.10	--	1.56	5.95	2.70	--	4.33
December	0.68	0.50	--	0.59	1.10	1.40	--	1.25
Yearly Average	2.01	1.93	0.44	1.73	5.57	4.36	0.83	4.28

	Station #9				Site Composite
January	--	--	0.78	0.78	0.53
February	--	--	1.70	1.70	0.58
March	--	4.00	--	4.00	1.34
April	--	3.44	--	3.44	1.32
May	--	2.70	--	2.70	1.16
June	--	9.10	--	9.10	1.92
July	--	11.42	--	11.42	2.78
August	--	6.98	--	6.98	2.45
September	--	22.16	--	22.16	4.77
October	--	1.68	--	1.68	1.52
November	--	3.37	--	3.37	1.35
December	0.06	1.69	--	0.88	0.52
Yearly Average	0.06	6.65	1.24	5.68	1.69

TABLE VI

SPOIL PILE ^{222}Rn FLUX MEASUREMENTS FOR 1979

(pCi/m^2-s)

Month \ Location*	1	2	3	Composite
January	16.7	0.6	0.2	5.8
February	86.9	0.6	0.1	29.2
March	1675.0	1.7	1.5	559.4
April	320.0	4.3	1.6	108.6
May	121.3	12.9	2.6	45.6
June	248.8	1193.3	4.0	482.0
July	415.0	1425.0	5.1	615.0
August	567.5	1105.0	5.8	559.4
September	332.5	395.0	4.9	244.1
October	480.0	132.8	3.1	205.3
November	557.5	54.5	2.1	204.7
December	278.3	11.3	0.7	96.8
Average	425.0	361.4	3.2	263.0

*(1) Stake A-2 (Figure 15).

(2) Stake B-22 (Figure 15).

(3) Open field, 75 ft. west of Building #403 (Firehall)

TABLE VII

COMPARISON OF BCL ^{222}Rn SOIL AIR ASSAY TECHNIQUES

(pCi/l)

Grid Coordinates*		Terradex	Scintillation	Average	Percent Difference
S15	W14	308	296	302	-2
S15	W18.6	22	107	65	+66
S17	W16	4644	826	2735	-70
S17	W15	576	749	663	+13
S17	W18.6	44	161	103	+57
S18	W16	1356	757	1057	-28
S18	W15	195	704	450	+57
S19	W18.6	32	222	127	+75
S20	W15	1110	1156	1133	+2
S20	W13	650	434	542	-20
S21	W13	418	912	665	+37
S21	W14	1780	477	1129	-58
S21	W15	437	150	294	-49
S21	W16	428	174	301	-42
S21	W17	201	295	248	+19
S22	W14	276	564	420	+34
S22	W16	231	841	536	-70
S22	W17	1153	824	989	-17
S23	W 9	295	201	248	-19
S23	W11	1401	568	985	-42
S23	W13	160	338	249	+36
S24	W14	67	415	241	+72
S24	W15	58	175	117	+50
S24	W16	484	142	313	-55
S24	W18.6	28	270	149	+81
S25	W 9	152	1393	773	+80
S25	W11	2068	2031	2050	-1
S25	W13	327	81	204	-60
S26	W 9	152	1283	718	+79
S26	W10	1209	1572	1391	+13
S26	W11	685	1846	1266	+46
S26	W12	1814	509	1162	-56
S26	W14	5932	6406	6169	+4
S26	W15	2526	3422	2974	+15
S26	W17	2576	1636	2106	-22
Average ($\|x\|/35$) =		966	912	939	41

*BCL grid laid out in 50 ft. squares - each integer represents the number of squares (in the direction indicated) relative to the center of "0" Street and Campbell Blvd.

TABLE VIII

COMPARISON OF AMBIENT AIR ASSAY TECHNIQUES

(pCi/l)

Grid Coordinates	Scintillation		Average
	Grab	Flow Thru	
S32 E10	2.9	2.0	2.5
S33 E10	2.8	1.8	2.3
S18 W17	10.5	14.6	12.6
S19 W16	370.0	288.5	329.3
S20 W17	30.1	27.2	28.7
S23 W16	16.6	22.0	19.3
S25 W14	49.6	65.5	57.6
S37 W17	3.7	2.2	3.0
S40 W16	2.6	2.3	2.5

TABLE IX

AMBIENT AIR ^{222}Rn LEVELS IN THE SPOIL PILE AREA

(pCi/l)

Grid Coordinates		^{222}Rn	Transect Average
S18	W 9	11.2	
	11	12.9	
	13	14.5	15.3
	15	25.1	
	17	12.6	
S19	W10	20.7	
	12	40.2	107.6
	14	40.3	
	16	329.3	
S20	W 9	13.5	
	11	25.3	
	13	35.7	29.6
	15	45.0	
	17	28.7	
S23	W10	5.2	
	12	8.4	13.4
	14	20.6	
	16	19.3	
S25	W10	28.6	
	12	35.9	35.8
	14	57.6	
	16	21.1	
S29	W14	36.6	28.8
	16	20.9	
		Overall Average	38.4

TABLE X

COMPARISON OF SOIL AIR AND AMBIENT AIR RADON MEASUREMENTS

(pCi/l)

Grid Coordinates	Soil Air(S)	Ambient Air(A)	Ratio (S/A)
S18 W15	450	25	18.0
S20 W15	1133	45	25.2
S20 W13	542	36	15.1
Composite Average (S15-26, W9-18.6) =	939	38	24.7

TABLE XI

AVERAGE RADON LEVELS IN RESIDUE STORAGE BUILDINGS

Building No.	^{222}Rn Range (pCi/l)	Comments
409	0.2 - 0.8	Range over July-September, 1979.
410	3 - 26	Average - 14.6 for August-October, 1979.
411	900 - 2400	Average - 1800 for August-December, 1979.
412	30 - 35	Average - 32.3 for August-December, 1979.
413 (before)*	8000 - 8075	Average - 8038 for August-September, 1979.
413 (after)*	287 - 1800	Average - 288 for December, 1979.
414 (before)*	7060 - 7893	Average - 7477 for August-September, 1979.
414 (after)*	581 - 2130	Average - 584 for December, 1979.
434	4000 - 117,000	Average - 50,000 under top disc.

*Before and after refer to remedial action performed in late September, 1979. October readings were 1800 and 2130 for Bldgs. 413 and 414, respectively. Bldg. 413 had sand, Petromat® and asphaltic emulsion; Bldg. 414 had sand and asphaltic emulsion only.

TABLE XII

COMPARISON OF RADON ASSAY INSTRUMENTS

Investigators	Application Mode*	Operation Principle	Sensitivity (pCi/l)	Comments	References
Lucas	G, C	Alpha scintillation	<0.1	Inexpensive, easy to construct, operate and interpret	16, 17
Fontan, Thomas & LeClare	G, C	Two filter; daughter collection	<0.1	Same as Lucas	18, 19
George & Breslin	C	Two filter; TLD	0.05 (one week)	Same as Lucas; reader required	20, 21
HASL	G, C	Ion chamber	<0.1	Same as Lucas	22
Lucas, APHA	C, L	Activated charcoal with Lucas cell	0.01	De-emanation, collection apparatus required	16, 23
APHA, Jones & Kleppe	C, L	Activated charcoal with NaI(Tl)	0.12	MCA required	23, 24
Bedrosian	C	ZnS over Polaroid Film	200	Most inexpensive	25
Geiger	C	Alpha Track Etch	100	Very inexpensive	26
Sill	L	Large air volume, followed by counting	<0.1	Easy to construct	27
George & Breslin	C	Passive, TLD chip	0.03 (one week or more)	Inexpensive; reader required	21
Wrenn & Spitz	C	Passive - ZnS	0.05	Moderate cost; computerized by ORNL	28, 29

*G = Grab; C = Continuous; L = Long-term

TABLE XIII

PERM RADON ASSAY REPRODUCIBILITY

(pCi/l)

PERM No.	Date 10/19-10/26/78	11/2-11/9/78	12/7-12/15/78	12/28/78-1/4/79
1	1.64	5.8	1.40	4.7
2	0.56	6.7	0.38	1.2
3	0.57	6.0	Lost	Lost
4	0.81	8.0	Lost	0.9
5	--	--	0.53	4.7
6	1.13	3.2	0.76	5.3
7	2.40	6.8	0.47	Lost
8	--	--	Lost	Lost
9	Lost	6.3	--	--
10	Lost	5.3	--	--
Average -	1.19	6.01	0.71	3.36
Std. Dev. -	±0.72	±1.39	±0.41	±2.13
R. S. D. -	±60.8 %	±23.2 %	±58.3 %	±63.3 %

Overall

Weighted Average = 3.15

Std. Dev. = ±1.32

R. S. D. ±41.9 %

TABLE XIV

METEOROLOGICAL SITE COMPARISON*

	Buffalo	DOE-NF
No. of Measurements	29,212	83
Average Annual Temperature (°F)	47.5	47.4
Prevailing Wind Direction (%)	WSW (15.3)	WSW (11.4)
Prevailing Wind Speed (MPH)	15.2	15.1
Relative Humidity (%)	--	48.7
Barometric Pressure (inches Hg)	--	30.10
Annual Precipitation (inches)	36.0	--
Annual Snowfall (inches)	90.5	--

*Buffalo data taken at the Buffalo International Airport for the period covering 1965 to 1974; DOE-NF data covers the period June 28, 1979 to February 15, 1980.

APPENDIX B-1

WEEKLY DOE-NF RADON MONITORING RESULTS (pCi/l)

Collection Period	On-Site Locations[1] 1	2	3	4	5	6	7	8	9	Comments
8/30 - 9/6/77	--	--	--	0.7	1.0	--	3.5	--	--	Original data; EML PERM's and readings.
5/25 - 6/1/78	0.67	<0.5	<0.5	0.31	<0.5	0.51	<0.5	0.19	--	NLO PERM's and readings.
6/ 1 - 6/15	(2)	0.11	0.42	0.15	0.20	0.32	0.76	2.92	--	
6/15 - 6/29	(2)	0.07	0.38	<0.5	0.54	0.37	<0.5	<0.5	--	
6/29 - 8/10	(2)	0.14	0.51	0.58	0.10	1.10	1.15	4.11	--	
8/10 - 8/17	2.04	1.03	1.08	0.82	0.60	1.39	4.05	14.36	--	
8/17 - 8/24	2.03	<0.5	1.05	<0.5	<0.5	1.60	4.66	14.23	--	
8/24 - 8/31	1.43	0.06	0.04	0.01	0.17	<0.5	0.79	3.82	--	
8/31 - 9/ 7	2.27	<0.5	<0.5	<0.5	(2)	1.04	(2)	(2)	--	
9/ 7 - 9/14	0.80	(2)	<0.5	0.19	0.32	1.40	0.74	13.82	--	
9/14 - 9/21	<0.5	<0.5	<0.5	<0.5	<0.5	0.50	14.85	2.81	--	
9/21 - 9/28	0.45	0.24	0.25	0.24	0.18	0.44	2.53	12.10	--	
9/28 - 10/ 5	(3)	(2)	(2)	(2)	0.48	0.81	1.00	4.30	--	NLO PERM's and EML readings.
10/ 5 - 10/12	0.23	<0.5	(2)	<0.5	<0.5	0.05	0.06	1.29	--	NLO PERM's and readings.
10/12 - 10/19	0.60	<0.5	0.04	<0.5	<0.5	0.46	4.81	22.79	--	NLO PERM's and readings.
10/19 - 10/26	--	--	--	--	--	--	--	1.19[4]	--	All 8 PERM's at #8 position; EML readings.
10/26 - 11/ 2	0.66	0.28	0.68	0.21	(2)	0.33	0.58	(2)	--	NLO PERM's and readings.
11/ 2 - 11/ 9	--	--	--	--	--	--	--	6.01[4]	--	All 8 PERM's at #8 position; EML readings.
11/ 9 - 11/16	0.45	<0.5	<0.5	0.63	<0.5	<0.5	2.04	14.32	--	NLO PERM's and readings.
11/16 - 11/22	1.18	0.70	0.82	0.14	0.74	0.29	<0.5	3.25	--	
11/22 - 11/30	0.27	0.63	0.59	0.58	0.21	0.35	(2)	0.22	--	
11/30 - 12/ 7	(2)	(2)	(2)	(2)	--	(2)	0.35	2.48	0.12	No. 5 PERM relocated at position #9.
12/ 7 - 12/15	--	--	--	--	--	--	--	0.71[4]	--	All 8 PERM's at #8 position; EML readings.
12/15 - 12/28	0.48	0.05	0.75	0.08	--	0.12	1.00	0.11	<0.5	NLO PERM's and readings.
12/28/78-1/4/79	--	--	--	--	--	--	--	3.36[4]	--	All 8 PERM's at #8 position; EML readings.
1/8/79	--	--	--	--	0.20	--	--	--	--	EML reported values.
1/22	0.50	0.05	0.80	0.08	--	0.30[4]	1.00	0.10	<0.5	
2/12	0.30	0.07	--	--	--	--	0.30	1.70	--	
2/26	--	0.15[4]	--	--	--	--	0.60[4]	1.85[4]	--	
3/12	--	0.40	0.20[4]	--	--	--	0.60	1.50	4.00	
4/ 2	--	0.25[4]	0.40	--	0.60	--	--	--	5.70	
4/16	--	0.30	0.30	--	--	--	1.00	3.90	1.10	
4/30	1.90	0.50	--	--	--	0.40	--	1.20	--	
5/21	2.50	0.30[4]	--	--	--	--	1.03[4]	4.05[4]	--	

--Continued - page 2--

Collection Period	On-Site Locations(1) 1	2	3	4	5	6	7	8	9	Comments
5/17 - 5/24/79	1.00	0.20(5)	0.30	0.30(5)	--	0.80(5)	4.60(5)	9.50	--	NLO PERM's and readings.
5/24 - 5/31	0.60	0.20(5)	0.20	0.05	--	0.80	1.50(5)	3.30	2.70	↓ ↓
5/31 - 6/ 6	1.40	0.20	0.50	0.30	--	1.50	3.50	4.10	6.10	↓ ↓
6/ 6 - 6/13	2.00	0.20	0.90	0.50(4)	--	1.70	2.10	2.90	6.90	↓ ↓
6/13 - 6/20	1.60	<0.05	0.40	0.40	--	1.20	2.80	10.70	21.50	↓ ↓
6/20 - 6/27	0.80	0.20	0.30	<0.05	--	1.30	3.20	0.50	1.90	↓ ↓
6/27 - 7/ 5	0.90	0.50	0.60	0.60	0.50(5)	1.90	1.50	1.20	9.70	↓ ↓
7/ 5 - 7/11	3.00	0.20	0.70	<0.1	--	1.80	3.20	0.90	6.20	↓ ↓
7/11 - 7/18	2.90	0.30	0.50	0.20	--	3.10	5.40	8.00	7.30	↓ ↓
7/18 - 7/25	4.20	0.40	0.90	0.50	--	0.10	4.30	16.60	27.30	↓ ↓
7/25 - 8/ 2	2.40	0.30	0.70	0.30	--	1.80	3.50	9.60	6.60	↓ ↓
8/ 2 - 8/ 8	0.60	0.40	0.60	0.90	--	(2)	1.20	6.60	6.70	↓ ↓
8/ 8 - 8/15	1.80	0.30	0.80	0.50	--	0.50	0.50	1.40	6.90	↓ ↓
8/15 - 8/22	0.70	0.10	0.60	1.20	--	2.10	7.60	5.40	7.60	↓ ↓
8/22 - 8/29	0.20	0.20	0.10	0.40	--	1.50	3.00	4.90	6.70	↓ ↓
8/29 - 9/ 5	1.10	0.40	0.60	1.00	--	1.20	3.90	4.10	1.00	↓ ↓
9/ 5 - 9/12	1.50	0.70	0.70	0.70	--	1.70	6.10	9.60	2.80	↓ ↓
9/12 - 9/19	0.10	0.40	0.20	0.60	--	0.50	0.70	5.50	1.50	↓ ↓
9/19 - 9/26	1.80	0.60	0.40	0.90	--	1.10	5.90	45.40	25.30	^{222}Rn pumped from Bldgs.
9/26 - 10/ 3	2.10	0.30	0.70	0.70	--	2.50	4.80	10.50	80.20	^{222}Rn pumped from Bldgs.
10/ 3 - 10/10	0.20	1.50	0.10	0.60	--	0.20	0.40	0.30	0.90	NLO PERM's and readings.
10/10 - 10/17	0.80	0.60	0.30	0.40	--	0.50	2.70	13.30	1.20	↓ ↓
10/17 - 10/24	0.90	0.40	0.30	0.10	--	0.60	1.20	3.60	3.80	↓ ↓
10/24 - 10/31	0.40	0.40	0.50	0.20	--	0.50	0.60	0.60	0.80	↓ ↓
10/31 - 11/ 7	1.50	0.10	0.40	0.40	--	0.70	4.00	2.50	2.40	↓ ↓
11/ 7 - 11/14	0.70	<0.1	0.50	0.30	--	0.80	1.00	2.60	1.30	↓ ↓
11/14 - 11/21	1.30	0.40	0.50	1.00	--	0.80	2.10	3.10	1.80	↓ ↓
11/21 - 11/28	0.70	<0.1	0.40	--	--	0.50	1.30	2.60	4.90(4)	No. 4 PERM moved to #9 pos. + 3 EML PERM's.
11/28 - 12/ 4	0.10	0.20	0.20	--	--	0.20	0.20	0.20	2.17(4)	↓ ↓
12/ 4 - 12/12	0.40	<0.1	0.30	--	--	0.40	0.30	0.20	0.37(4)	↓ ↓
12/12 - 12/19	0.40	0.40	0.10	--	--	0.30	<0.1	0.60	1.20(4)	↓ ↓
12/19 - 12/26	1.20	<0.1	0.30	0.20	--	0.40	1.70	5.50	6.90	NLO PERM's and readings.
12/26 - 1/2/80	0.60	<0.1	0.30	0.10	--	0.40	0.30	0.50	0.20	↓ ↓
1/ 2 - 1/ 9	0.40	0.30	0.20	0.40	--	0.30	0.50	2.20	0.80	↓ ↓
1/ 9 - 1/16	0.40	0.30	0.30	0.10	--	0.10	1.20	1.80	1.60	EML PERM's and readings.
1/16 - 1/23	0.40	0.30	0.20	--	--	0.10	0.40	0.40	0.40	↓ ↓
1/23 - 1/30	0.40	--	--	--	--	--	0.20	0.20	0.30	↓ ↓
1/31 - 2/ 7	0.30	0.40	0.30	0.20	--	0.20	0.30	0.20	0.40	↓ ↓
2/ 8 - 2/15	0.40	0.30	0.60	0.20	--	0.20	0.30	0.80	3.00	↓ ↓

NOTES:

(1) See Figure 3 for geographical site locations.

(2) TLD chip lost, broken, or fell out of position.

(3) #1 PERM placed at #8 position; assay was 16.7 pCi/l. EML reported 12 pCi/l.

(4) Average value determined from multiple assays.

(5) EML reported assays.

APPENDIX B-2

EML WEEKLY OFF-SITE RADON MONITORING RESULTS (OUTDOORS)

(pCi/l)

Collection Period	NIKE Site	Radar Station	Lew Port School	Ransomville
9/14 - 9/21/78	0.20	0.40	0.20	0.20
10/ 5 - 10/12	0.30	--	0.30	0.20
11/ 9 - 11/16	--	0.50	--	--
11/22 - 11/30	0.40		0.40	0.40
12/ 7 - 12/15	--	0.30	--	--
12/15 - 12/28	0.20	--	--	--
12/28/78 - 1/4/79	--	0.20	0.20	0.10
1/8/79	--	0.50	--	--
1/22	0.10	--	0.40	0.20
2/12	0.20	0.30	0.20	0.20
2/26	--	0.20	--	--
3/12	0.20	0.20	0.30	0.20
4/ 2	0.10	0.80	0.20	0.10
4/30	0.20	--	0.20	0.08
5/21	0.20	0.30	0.20	0.10
5/24 - 5/31/79	--	0.30	0.20	--
5/31 - 6/ 6	--	--	0.30	--
6/ 6 - 6/13	0.20	--	0.30	0.20
6/13 - 6/20	0.20	--	--	--
6/20 - 6/27	--	0.20	0.30	--
6/27 - 7/ 5	0.20	--	0.30	0.30
7/11 - 7/18	--	--	--	0.30
7/18 - 7/25	0.50	--	0.10	0.40
7/25 - 8/ 2	--	--	0.30	--
8/22 - 8/29	--	2.50	--	--
9/ 5 - 9/12	0.30	2.50	0.20	0.30
9/19 - 9/26	0.20	--	0.20	0.20
10/24 - 10/31	0.20	0.60	0.20	0.10
11/28 - 12/ 4	--	--	0.20	--
12/ 4 - 12/12	--	0.60	0.30	--
1/ 2 - 1/9/80	--	0.20	0.20	0.20
1/23 - 1/30	0.30	0.20	0.20	0.20
1/31 - 2/ 7	0.10	0.10	0.20	0.20

8949

Radon Results, April 1949-September 1951,
***LOOW Radon Breath Sample and Radon Area Sample Results*;**
Samples taken April 7, 1949 through September 24, 1951

FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 973
DATE SENT
DATE RECEIVED 7/26
DATE REPORTED

PLANT: L.O.O.W.

MAILING ADDRESS: P.O. Box 8, Kenmore 17, N.Y.

ROUTE RESULTS TO: R. C. Heatherton

CONSIDERED TO BE UNCLASSIFIED
CONTAINS NO DOD/AEC/DOE/DOD
DATE: 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
149	7-24	9:33 A	J. Schoonmaker			Rn.				✓	0.4×10^{-11}	Curies/liter
139		9:31 A	"								0.5	
120		9:35 A	R. Sutherland							✓	<0.1	
150		9:36 A	"								0.2	
142		9:40 A	C. Bowman							✓	0.1	
133		9:41 A	"								<0.1	
91		9:45 A	R. Dutton							✓	0.5	
119 113		9:46 A	"								0.5	

COLLECTED BY: Heatherton

ANALYZED BY: [illegible]

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2801
DATE SENT
DATE RECEIVED 8/2
DATE REPORTED 8/3

PLANT L.O.O.W

MAILING ADDRESS P.O. BOX 8, KENMORE

ROUTE RESULTS TO R. HEATHERTON

CONFIRMED TO BE UNCLASSIFIED
BY AUTHORITY OF DOE/OSTI
NUCLEAR SCIENCE ABSTRACTS - A.D.D.
Nancy Connelly DATE 5/6/03

TYPE OF SAMPLE BREATH RADON

METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
146	7-31		W Collins		8 37 AM	Rn.				✓	1.1	$\times 10^{-12}$ curies/liter
93			"		8 37 AM						1.1	
											2	
69			J. Dodd		8 29 AM					✓	2.3	
95			"		8 31 AM						2.0	
122			E. WESTERVELT		9 07 AM					✓	0.4	
127			"		9 07 AM						0.6	
43			M. WHITTAKER		8 43 AM					✓	2.4	
116			"		8 45 AM						2.4	

COLLECTED BY W. Collins

ANALYZED BY [illegible]

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 6375
DATE SENT 9/17/51
DATE RECEIVED 9/21
DATE REPORTED

PLANT: AEC Loow
MAILING ADDRESS: P.O. Box 8, Kenmore 17, N.Y.
ROUTE RESULTS TO: R. Heatherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT~~ A.D.D. DATE
Nancy Connelly 5/1/03

TYPE OF SAMPLE: Breath Radon
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
47	9/17/51	8 00 AM	W. Collins			RM					0.3	$\times 10^{-12}$ c/c
141	"	"	" "								0.2	
143	"	8 15 AM	G Fontanarosa								0.4	
161	"		" "								0.4	
93	"	8 30 AM	A. Crown								0.7	
199	"	"	" "								0.7	
106	"	9 45 AM	E Westervelt								0.2	
129	"	"	" "								0.1	

COLLECTED BY: J Schoomaker, Supvr.
ANALYZED BY: [illegible]

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 6376
DATE SENT 9/24/51
DATE RECEIVED
DATE REPORTED 10/1/51

PLANT AEC Lowter
MAILING ADDRESS V O Box 8 Kenmore 17 NY
ROUTE RESULTS TO VS Heatherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT~~, A.D.D. DATE 5/6/03
Nancy Connelly

TYPE OF SAMPLE Breath Radon
METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
32	9/24/51	8:00 AM	Ringwelski, J. mixed			Rn					0.1	$\times 10^{-11}$ μR
99		"									0.3	
144		8:12 AM	Anna Dill								0.1	
64		"									0.1	
195		8:22 AM	GMEAD								0.4	
89		"									0.6	
138		8:33 AM	J Schumacher								0.1	
170		"									0.3	

COLLECTED BY Schoomaker, Supt.
ANALYZED BY [illegible]

SURVEYOR TO RETAIN LAST COPY – RETURN ALL OTHERS TO MEDICAL DIVISION, N.Y.O.O., N.Y.

FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 6390
DATE SENT 10-8-51
DATE RECEIVED
DATE REPORTED 10-15

PLANT: AEC L.O.O.W.
MAILING ADDRESS: P.O. Box 8, Kenmore 7, N.Y.
ROUTE RESULTS TO: R. Heatheeton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT A.D.D. DATE 5/1/03
nancy Connelly

TYPE OF SAMPLE: Breath Radon
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
91		8:00	Feed Davis			Rn					0.3	$\times 10^{-12}$ c/l
136		↑	" "			"					0.4	↓
147		?	William Collins			"					Lost	↓
58		↓	" "			"					0.1	↓
139			A. Crown			"					0.2	↓
50			" "			"					0.1	↓

COLLECTED BY

ANALYZED BY

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 6370
DATE SENT 8/13/51
DATE RECEIVED
DATE REPORTED 8/16

PLANT: A.E.C. LOOW
MAILING ADDRESS: P.O. Box 18, Kenmore, 17, N.Y.
ROUTE RESULTS TO: B Heatherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT~~ A.D.D. DATE 5/4/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
187	8/13/51	8 00 AM	A Crown			Rn		-			12.0	$\times 10^{12}$ c/l
158	"	"	"								14.0	
97	"	8 12 AM	J Ringelski								2.0	
37	"	8 12 AM	"								2.0	
41	"	8 30 AM	H. Betts								1.6	
52	"	"	"								1.7	

COLLECTED BY: J Schoonmaker Asst.

ANALYZED BY: [illegible]

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 6371
DATE SENT 8/20/51
DATE RECEIVED
DATE REPORTED 8/24

PLANT: AEC Loow
MAILING ADDRESS: P.O. Box 8, Kimmore 17, N.Y.
ROUTE RESULTS TO: R Heatherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT~~ A.D.D. DATE: 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
62	8/20/51	8 10 AM	C Amsdill			Rn					2.4	$\times 10^{-11}$ c/c
39	"	"	"								1.7	
148	"	8 20 AM	E Nudo								1.1	
162	"	"	"								1.5	
182	"	8 30 AM	J Schoonmaker								2.2	
69	"	"	"								2.1	

COLLECTED BY: Schoonmaker, Supr
ANALYZED BY: M. F

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 6372
DATE SENT 8/27/51
DATE RECEIVED
DATE REPORTED 8-30

PLANT: AEC Tour
MAILING ADDRESS: Box 8, Kenmore 17, N.Y.
ROUTE RESULTS TO: R. Heatherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
	8/27/51		J Malone			Rn						
			"									
130			A. Crown								5.6	$\times 10^{-12}$ c/c
150			"								6.0	
35			H. Better								0.6	
137			"								0.7	
128			J Ringrelshi								1.3	
82			"								0.6	

COLLECTED BY

ANALYZED BY

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NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 6374
DATE SENT 9/10/51
DATE RECEIVED
DATE REPORTED 9-17

PLANT: AEC LOOW
MAILING ADDRESS: P.O. Box 8, Kenmore 17, N.Y.
ROUTE RESULTS TO: R. Heathenton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT, A.D.D. DATE: 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
151	9/10	8:05 AM	H. Betts			Rn					0.1	$\times 10^{-12}$ c/c
76		"	" "								0.2	
190		8:30 AM	C. Bowman								0.1	
162		8:30 AM	" "								0.6	
74		8:00 AM	E. Nuclo								0.3	
167		"	" "								0.6	

COLLECTED BY: Schoonmaker

ANALYZED BY: N. H.

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NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 6366
DATE SENT
DATE RECEIVED
DATE REPORTED 7/11/51

PLANT: AEC Lacrow
MAILING ADDRESS: P.O. Box 8, Kenmore 17, N.Y.
ROUTE RESULTS TO: V. Heathenton.

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE
METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
00	7/10/51	9 10 AM	J. Ringielski			Pu					1.0	$\times 10^{-12}$ c/c
101	"	"	" "			Pu					0.8	
103	"	9 25 AM	C. Bowman			Pu					0.8	
149	"	"	" "			Pu					1.0	
100	"	10 10	W. Collins			Pu					0.2	
118	"	"	W. Collins			Pu					0.1	

COLLECTED BY: A R Schoonmaker Supv.
ANALYZED BY: R.A.

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UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 6365
DATE SENT
DATE RECEIVED
DATE REPORTED 5/13/51

PLANT: A.E.C. L.O.O.W.
MAILING ADDRESS: P.O. Box 18, Kenmore, N.Y. 917
ROUTE RESULTS TO: R. Heatherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT A.D.D. DATE: 5/4/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
138	7/31/51	8:15 AM	H. Betts			Rn					0.2	$\times 10^{-12}$ c/l
50	"	"	" "			Rn					*	
89	"	8:20 AM	E. Nudo			Rn					0.1	
50	"	"	" "			Rn					*	
91	"	8:40 AM	E. Eduhonis			Rn					0.2	
82	"	"	" "			Rn					0.2	
94	"	8:50 AM	J. Schoonmaker			Rn					0.2	
143	"	"	" "			Rn					0.2	
										*50	0.2	
										*150	0.6	

COLLECTED BY: J. Schoonmaker, Surv.
ANALYZED BY: M.F.

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NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 6363
DATE SENT
DATE RECEIVED
DATE REPORTED

PLANT: A.E.C. LOOW.
MAILING ADDRESS: Po Box 8, Kermore 17, N.Y.
ROUTE RESULTS TO: R. Heatherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT A.D.D. DATE: 5/4/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
100	6/25/51		William Collins			Rn					0.7	$\times 10^{-12}$ c/l
97	"		" "			Rn					0.1	
146	"		Harry Betts			Rn					1.4	
37	"		" "			Rn					1.3	
115	"		Gino Fontanarosa			Rn					0.7	
114	"		" "			Rn					0.5	
00	"		Emil Nudo			Rn					LOST	
01	"		Emil Nudo			Rn					0.2	
74	"		Clarence Amsdill			Rn					LOST	
35	"		" "			Rn					LOST	
~~59~~	~~"~~		~~E. Wetterhelt~~			~~Rn~~						
~~90~~	~~"~~		~~" "~~			~~Rn~~						

COLLECTED BY: J. R. Schoonmaker, Supv.

ANALYZED BY: [illegible]

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NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 6364
DATE SENT
DATE RECEIVED
DATE REPORTED 7/6/57

PLANT: AEC LOOW.
MAILING ADDRESS: PO Box 8, Kenmore, 17, NY
ROUTE RESULTS TO: R Heatherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT~~ A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
59	7/2/57	8 15 AM	J Ringnelski			Rn					LOST	
90	"	"	" "			Rn					0.5	$\times 10^{-11}$ c/l
105	"	9 00 AM	F. Malone			Rn					3.3	
86	"	"	" "			Rn					4.3	
111	"	9 20 AM	E. Westervelt			Rn					0.6	
56	"	"	" "			Rn					0.9	
67	"	9 40 AM	F. Darvin			Rn					0.5	
85	"	"	" "			Rn					0.4	

COLLECTED BY: J M Schoonmaker, Surv.
ANALYZED BY: M C

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FORM N.Y.-99

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NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 6367
DATE SENT
DATE RECEIVED
DATE REPORTED 7/27/51

PLANT: AEC Lowe
MAILING ADDRESS: P.O. Box 8, Kenmore 17, N.Y.
ROUTE RESULTS TO: W. H. Latherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT, A.D.D. DATE: 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
79	7/23/51	8 15 AM	A. Crown			Rn					2.5	$\times 10^{-12}$ c/c
32	"	"	" "			Rn					2.2	
35	"	8 30 AM	E. Nucto			Rn					0.4	
49	"	"	" "			Rn					0.4	
21	"	8 40 AM	G Fontanarosa			Rn					0.4	
133	"	"	" "			Rn					0.3	

COLLECTED BY: Schoonmaker, Supr

ANALYZED BY: M. E.

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NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 6369
DATE SENT 8/6/51
DATE RECEIVED
DATE REPORTED 8-10-51

PLANT: AEC LOOW
MAILING ADDRESS: PO Box 8, Kenmore 17, NY
ROUTE RESULTS TO: VT Heatherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
53	8/6	8 15 AM	E. Mudo			Rn					1.1	$\times 10^{-12}$ c/l
86	"	"	" "			Rn					1.1	
57	"	8 22 AM	G Fontanarosa			Rn					1.6	
71	"	"	" "			Rn					LOST	
30	"	8 32 AM	C. Bowman			Rn					2.2	
111	"	"	" "			Rn					1.2	
67	"	9 32 AM	G Mead			Rn					8.6	
68	"	"	" "			Rn					9.8	

COLLECTED BY: J Schoonmaker, Asst.
ANALYZED BY: M. E.

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UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 6368
DATE SENT
DATE RECEIVED
DATE REPORTED 8-6-51

PLANT: AEC Lodus
MAILING ADDRESS: P.O. Box 18, Kenmore 17, N.Y.
ROUTE RESULTS TO: A Heatherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT A.D.D. DATE: 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon
METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
64	7/30/51	805 AM	H Betts			Rn					0.6	$\times 10^{-12}$ c/c
196	"	"	" "			Rn					1.0	
161	"	815 AM	C Amsdill			Rn					1.9	
143	"	"	" "			Rn					1.9	
155	"	825 AM	J Ringuelski			Rn					Lost	
162	"	"	J Ringuelski			Rn					2.2	
153			M Whittaker			Rn					0.7	
156			" "			Rn					0.4	

COLLECTED BY: J Schoonmaker Supv.
ANALYZED BY: M. F.

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NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 6361
DATE SENT 6/18/51
DATE RECEIVED 6/18
DATE REPORTED

PLANT A.E.C. I.O.O.W.
MAILING ADDRESS P.O. Box 8 Renmore 7, N.Y.
ROUTE RESULTS TO R. Heathcoton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT~~ A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE Breath Radon
METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
116	6/18	?	Schoonmaker			Rn					0.6	$\times 10^{-12}$ c/c
84	6/18		"			Rn					1.4	
142			Bowman			Rn					1.0	
112			"			Rn					1.1	
58			Ringwelski			Rn					0.7	
104			"			Rn.					0.6	
			Westervelt - Leave									

COLLECTED BY [illegible]

ANALYZED BY [illegible]

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FORM N.Y.-99

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NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 6358
DATE SENT 6/11/57
DATE RECEIVED 6/15
DATE REPORTED

PLANT: U.S. Atomic Energy Comm. S.O.W.
MAILING ADDRESS: P.O. Box 8, Kenmore 7, N.Y.
ROUTE RESULTS TO: R. Heathenton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT~~ A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Radon Breath
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
64		8:00 AM	Fontanarosa			Radon					2.1	$\times 10^{-1}$ c/l
53		8:04 AM	"			"					2.1	
46		8:10	Sutherland			"					1.3	
55		8:18	"			"					1.2	
97		8:30	F. Malone			"					7.2	
98		8:32	"			"					3.3	
			Nuclo Animals Leave.									

COLLECTED BY: R. Sutherland
ANALYZED BY: J.M.L.

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FORM N.Y.-99

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NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2896
DATE SENT 5/28/51
DATE RECEIVED 6/1/51
DATE REPORTED 6/1/51

PLANT ACC-Iowa

MAILING ADDRESS P.O. Box 5 Kenmore 17, NY

ROUTE RESULTS TO R. Heatherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE Breath Radon

METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
30	5/30/51		C. Bowman			Rn					0.5	$\times 10^{-7}$ c/l
49	"		" "			Rn					1.0	
125	"		E. Nudo			Rn					1.1	
129	"					Rn					0.6	
	Sick		Schoonmaker									
Annual Leave			Whittaker									

COLLECTED BY R. Lutherland

ANALYZED BY [illegible]

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UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE

MEDICAL DIVISION

70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 6311
DATE SENT 6/6
DATE RECEIVED
DATE REPORTED 6/8

PLANT: L. O. O. W

MAILING ADDRESS: P.O. Box 8 Kenmark N.Y.

ROUTE RESULTS TO: Heathelton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
50	6/6	8:00 am	J. Ringvelski			RN					0.6	$\times 10^{-12}$ c/l
91		"									0.4	
73	"	"	H. Butts								0.3	
143		"									Lost	
36	"	"	A. Crown								1.4	
150		"									1.4	
146	"	4:00 pm	G. Mead								0.2	
57		"									0.3	

COLLECTED BY: Dutchland

ANALYZED BY: [illegible]

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FORM N.Y.-99

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NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2889
DATE SENT 4/23/51
DATE RECEIVED
DATE REPORTED 4/27/51

PLANT: A E C - Lowr
MAILING ADDRESS: P.O. Box 8 Kenmore 17, Ny
ROUTE RESULTS TO: Dick Hilhalen

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
101	4/23/51	8 10 AM	J. Ringulski			Rn					0.2	$\times 10^{-7}$ c/l
87	"	8 12 AM	" "			Rn					0.2	
139	"	8 17 AM	H. Butts			Rn					0.1	
21	"	8 19 AM	" "			Rn					0.1	
91	"	8 25 AM	A. A. Brown			Rn					0.2	
67	"	8 27 AM	" "			Rn					0.2	
88	"		F. Malone			Rn					0.2	
120	"		" "			Rn					0.2	

COLLECTED BY: [illegible]

ANALYZED BY: [illegible]

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FORM N.Y.-99

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NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2887
DATE SENT 4/9/51
DATE RECEIVED 4/16/51
DATE REPORTED 4/16/51

PLANT ACC + LOOW

MAILING ADDRESS Box 8 Kenmore 17 NY

ROUTE RESULTS TO Robt Sutherland

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT~~, A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE Breath radon

METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
90	4/9/51	8:00 am	C. Bowman			Rn					0.2	$\times 10^{-10}$ c/l
93	"	8:02 am	" "			Rn					0.2	
66	"	8:05 am	R. Sutherland			Rn					0.1	
43	"	8:10 am	" "			Rn					0.4	
27	"	8:17 am	H. Betts			Rn					0.3	
50	"	8:19 am	" "			Rn					1.4	
71	"	8:25 am	C. Nudo			Rn					0.1	
94	"	8:27 am	" "			Rn					0.2	
18	"	8:32 am	J. Ringnalski			Rn					0.4	
38	"	8:34 am	" "			Rn					0.2	
24	"	8:40 am	L. Fontanarosa			Rn					0.8	
145	"	8:42 am	" "								0.1	

COLLECTED BY L. Kile

ANALYZED BY M. C.

SURVEYOR TO RETAIN LAST COPY — RETURN ALL OTHERS TO MEDICAL DIVISION, N.Y.O.O., N. Y.

FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2893
DATE SENT 5/7/51
DATE RECEIVED
DATE REPORTED 5/14/51

PLANT AEC-Tonawanda
MAILING ADDRESS P.O. Box 5 Tonawanda, NY
ROUTE RESULTS TO R. Heathcoton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT~~ A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE
METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
21	5/7/51	8:15 am	J. Ringulski			Rn					1.1×10^{-12}	c/l
79	"	8:17 am	" "			Rn					1.1×10^{-12}	
36	"	9:10 am	E. Westervelt			Rn					0.1	
87	"	9:12 am	" "			Rn					0.4	

COLLECTED BY K Kilo

ANALYZED BY [illegible]

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NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
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NEW YORK 23, N. Y.

SAMPLE REQ. No. 2895
DATE SENT 5/14/57
DATE RECEIVED 5/18
DATE REPORTED

PLANT ACC-100W

MAILING ADDRESS P.O. Box 5 Kennewick, Wy

ROUTE RESULTS TO R. Heathcote

COMFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT - A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE Breath Radon

METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
139	5/14/57	8 00 am	H. Betts			Rn					0.2	X15
101	"	8 03 am	" "			Rn					0.2	
117	"	8 10 am	A. Crowe			Rn					1.6	
67	"	8 12 am	" "			Rn					1.4	
85	"	8 20 am	E. Nudo			Rn					0.3	
143	"	8 22 am	E. Nudo			Rn					0.4	
121	"	8 35 am	Wm Collins			Rn					0.8	
123	"	8 37	" "			Rn					0.8	

COLLECTED BY K. Kile

ANALYZED BY

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NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
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NEW YORK 23, N. Y.

SAMPLE REQ. No. 2899
DATE SENT 5/22/51
DATE RECEIVED 5/24/51
DATE REPORTED

PLANT: A.E.C. L.O.O.W.
MAILING ADDRESS: P.O. Box 8, Kenmore 7, N.Y.
ROUTE RESULTS TO: R. Heatherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT-A.D.D.~~ DATE: 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
122			Fred Davis			Rn					0.1×10^{-12}	
115			" "			Rn					0.1×10^{-12}	

COLLECTED BY: R. Smith
ANALYZED BY:

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2897
DATE SENT 5/21/51
DATE RECEIVED
DATE REPORTED 5/21/51

PLANT: A.E.C. L.O.O.W.
MAILING ADDRESS: PO Box 8, Kenmore 7, N.Y.
ROUTE RESULTS TO: R. Heatherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT-A.D.D. DATE: 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
128	5/21/51	8[illegible]	Gino Fontanova			Rn					0.4	$\times 10^{-12}$ c/c
119	5/21/51	"	" "			Rn					0.3	
135	5/21/51	8[illegible]	Joe Ringelski			Rn					0.3	
136	5/21/51	8[illegible]	" "			Rn					0.4	
50	5/21/51	8[illegible]	R. Sutherland			Rn					0.5	
145	5/21/51	8[illegible]	" "			Rn					0.9	

COLLECTED BY: R. S. [illegible]

ANALYZED BY: [illegible]

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UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2886
DATE SENT
DATE RECEIVED
DATE REPORTED 3-6-51

PLANT ACC- 400 W

MAILING ADDRESS P.O. Box 5 Kingston 17, NY

ROUTE RESULTS TO D. Hetherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE Breath Radon

METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS	
86	4/24/51	8 05 am	A. Crowe			Rn					5.4×10^{-12}	c/l	
55	"	8 07 am	A. Crowe			Rn					1.0		3.2
130	"	8 20 am	R. Sutherland			Rn					0.8		
95	"	8 22 am	R. Sutherland			Rn					0.6		0.7
47	"	8 28 am	C. Bowman			Rn					1.1		
63	"	8 30 am	C. Bowman			Rn					1.2		1.2
77	"	8 36 am	K. Kile			Rn					0.9		
81	"	8 37 am	K. Kile			Rn					1.1		1.0
													4\6.1
													1.5

COLLECTED BY K. Kile

ANALYZED BY [illegible]

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2860
DATE SENT
DATE RECEIVED
DATE REPORTED 1-15-50

PLANT AEC-1000W

MAILING ADDRESS P.O. Box 8, Glenmore 17, Ny

ROUTE RESULTS TO W. Halliston

COMPARED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT - A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE Breath Radon

METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
56	1/8/51	4 10 PM	Clair Bowman			Rn					0.6	$\times 10^{-11}$ c/l
95	1/8/51	4 12 PM	Clair Bowman			Rn					0.4	
102	1/8/51	4 20 PM	Gino Fontanesi			Rn					0.7	
43	1/8/51	4 22 PM	Gino Fontanesi			Rn					0.3	

COLLECTED BY

ANALYZED BY

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NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2884
DATE SENT
DATE RECEIVED
DATE REPORTED 12/11/50

PLANT: AEC - Pooo5

MAILING ADDRESS: Box 5 Apollo 17, Pa.

ROUTE RESULTS TO: D. Heathcoton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT~~ - A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
140	12/11/50	8 00 AM	J. Schommer		8 00 AM	Rn					0.7 X 10	-17 c/l
115	"	8 07 AM	J. Schommer		8 07 AM	Rn					0.7 X 10	-17
145	"	8 10 AM	J. Ringwelski		8 10 AM	Rn					0.7 X 10	-17
99	"	8 10 AM	J. Ringwelski		8 10 AM	Rn					Lost	
146	"	3 45 PM	E. Nudo		3 50 PM	Rn					0.1 X 10	-17
131	"	3 51 PM	E. Nudo		3 52 PM	Rn					<0.1 X 10	-17
107	"	3 55 PM	R. Sutherland		4 01 PM	Rn					<0.1 X 10	-17
81	"	4 02 PM	R. Sutherland		4 02 PM	Rn					<0.1 X 10	-17

COLLECTED BY: K. K. [illegible]

ANALYZED BY: [illegible]

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FORM N.Y.-99

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NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2861
DATE SENT
DATE RECEIVED
DATE REPORTED 1-24-50

PLANT: APC - Inoxw

MAILING ADDRESS: P.O. Box E, Ferrum 17 Ny

ROUTE RESULTS TO: D. Hetherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT A.D.D.~~ Nancy Connelly DATE 5/1/03

TYPE OF SAMPLE: Breath Radon

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
78	11/15/51	8 20 AM	A.A. Crowe			Rn					1.5×10^{-17}	c/c
100	11/15/51	8 22 AM	A.A. Crowe			Rn					0.6	
64	11/15/51	8 30 AM	H. Butts			Rn					0.3	
85	11/15/51	8 32 AM	H. Butts			Rn					0.7	

COLLECTED BY: K.A. K.P.

ANALYZED BY: [illegible]

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2876
DATE SENT
DATE RECEIVED
DATE REPORTED 11-6-50

PLANT: AEC-400W
MAILING ADDRESS: P.O. Box 8
ROUTE RESULTS TO: Stormore 17, N.Y. Dick Heathcoton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
58	10/26/50	8:00 AM	Harry Betts			Rn					0.4	$\mu\mu c/l$
90	"	8:01 AM	Harry Betts			"					0.1	
148	"	8:15 AM	Joe Ringuelski			"					0.4	
99	"	8:16 AM	Joe Ringuelski			"					0.4	
107	"	8:30 AM	John Schoonmaker			"					3.3	
47	"	8:31 AM	John Schoonmaker			"					4.5	
131	"	8:45 AM	Clair Bowman			"					0.3	
81	"	8:46 AM	Clair Bowman			"					0.3	
15	"	4:15 PM	J. Dordy			"					0.4	
98	"	4:15 PM	J. Dordy			"					0.5	
60	"	4:00 PM	R. Sutherland			"					3.0	
145	"	4:01 PM	R. Sutherland			"					12.8	

COLLECTED BY: K. G. Kil[illegible]

ANALYZED BY: MF

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2862
DATE SENT
DATE RECEIVED
DATE REPORTED 10/10/50

PLANT: ACC-LOOW

MAILING ADDRESS: P.O. Box 5, Kennmore 17, NY

ROUTE RESULTS TO: D. Hutchinson

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT~~ A.D.D. DATE 5/1/03
Nancy Connally

TYPE OF SAMPLE: Breath Radon

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
52	10/4/50	8/40 AM	John Schumaker			Rn					0.1	$\times 10^{-11}$ C/L
115	10/2/50	8 41 AM	"			Rn					0.1	
62		8 30	J Doody								1.5	
150		8 31									0.2	
44		9 10	Joe Respuleka								<0.1	
60		9 11									0.1	
56		9 00	Clair Bowman								0.1	
67		9 01									0.2	
											8 | 23	
											2 9	

8.5

COLLECTED BY: L. L. Kil.

ANALYZED BY: [illegible]

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2862
DATE SENT
DATE RECEIVED
DATE REPORTED 10/10/50

PLANT ACC- 400W

MAILING ADDRESS P.O. Box 5, Kenmore 17, NY

ROUTE RESULTS TO D. Heathcoton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT~~ A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE Breath Radon

METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
52	10/9/50	9/40 AM	John Schoonmaker			Rn					0.11	$\times 10^{-11}$ c/l
115	10/9/50	8 41 AM	"			Rn					0.1	
62		8 30	J. Doody								1.5	
150		8 31									0.2	
44		9 10	Joe Rengelsko								<0.1	
60		9 11									0.1	
56		9 00	Clair Bowman								0.1	
67		9 01									0.2	

COLLECTED BY K. G. Kil

ANALYZED BY Jette

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NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2863
DATE SENT
DATE RECEIVED
DATE REPORTED

PLANT: AEC - 400 W

MAILING ADDRESS: P.O. Box 8, Kenmore 17, NY

ROUTE RESULTS TO: D. Heathcoton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT, A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
56	10/2/00	9:00 AM	Clair Bowman			Rn					0.1×10^{-12}	c/l.
67	10/2/00	9:01 AM	" "			Rn					0.2	

COLLECTED BY: K. G. Abel

ANALYZED BY:

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2864
DATE SENT
DATE RECEIVED
DATE REPORTED

PLANT: AEC - Lodw

MAILING ADDRESS: P.O. Box 8, Kennore 17, NY

ROUTE RESULTS TO: D. Huthston

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT~~, A.D.D. DATE: 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
62	10/2/00	8 30 AM	J. Moody			Rn					1.5×10^{-12}	c/l
15-D	10/2/00	8 31 AM	" "			Rn					0.7	

COLLECTED BY: H. G. Feil

ANALYZED BY:

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

DATE REC'D

PLANT: AEC - Lowe

MAILING ADDRESS: P.O. Box 5, Kenmore 17, NY

ROUTE RESULTS TO: D. Heatherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
44	11/2/60	9:10 AM	Joe Ringnelski			Rn					<0.1	$\times 10^{-12}$ c/l
60	10/21/60	9:11 AM	" "			Rn					0.1	

COLLECTED BY: K. A. Kirb

ANALYZED BY:

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2841
DATE SENT
DATE RECEIVED 8/11
DATE REPORTED 8/18/50

PLANT: LOOW

MAILING ADDRESS: P.O. Box 8 Kenmore 17 NY

ROUTE RESULTS TO: R Heathertons

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT~~ A.D.D. DATE 5/1/03
Nancy Connelly

TYPE OF SAMPLE: Breath Radon

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
~~23~~	8/14	9:10 A	Wm. Collins - (recheck)			Rn					4.3×10^{-14}	curies/liter
7		9:11	Janitor & Laundryman								2.5	
114		9:15 A	K. Kile -								5.4	
124		9:16	Maintenance Foreman								5.8	
103		9:26	E Westervelt (recheck)								1.6	
100		9:27	Property Clerk								1.0	
110		9:42	F. Davis								6.0	
56		9:43	Guard								5.2	

COLLECTED BY: R Heathertons

ANALYZED BY: [illegible]

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RESTRICTED

THE UNIVERSITY OF ROCHESTER
SCHOOL OF MEDICINE AND DENTISTRY
POST OFFICE BOX 287, STATION 3
ROCHESTER 7, NEW YORK

DATE SENT
DATE RECEIVED
REPORTED

ATOMIC ENERGY PROJECT
(ADMINISTERED BY THE DEPARTMENT OF RADIATION BIOLOGY UNDER CONTRACT WITH THE U. S. ATOMIC ENERGY COMMISSION)

UNCLASSIFIED

April 28, 1949

W-7401 eng 49

Mr. Merril Eisenbud
U. S. Atomic Energy Commission
New York Operations Office
P. O. Box 30, Ansonia Station
New York 23, New York

Dear Merril:

Enclosed are the results of the analyses of the radon samples taken at Lake Ontario Ordnance Works on April 7 and 8, 1949. These results were given to Mr. Paul Klevin via telephone on April 22, 1949.

Sincerely,

Russell Hayes

Russell Hayes

RH:kf
Ok encl.: 1
cc-1. & 2. Mr. Eisenbud w/encl.
3. DO, U. of R. w/encl.
4. File w/encl.
5. R. File
6. Dr. Howland

DEPARTMENT OF ENERGY DECLASSIFICATION REVIEW
1ST REVIEW-DATE: 5/1/03
AUTHORITY: ☐ DC ☒ DD
NAME: Nancy Connelly
2ND REVIEW-DATE: 05/24/10
AUTHORITY: DD
NAME: Betty N. Harris
DETERMINATION (CIRCLE NUMBER(S))
1. CLASSIFICATION RETAINED
2. CLASSIFICATION CHANGED TO:
3. CONTAINS NO DOE CLASSIFIED INFO
4. COORDINATE WITH:
5. CLASSIFICATION CANCELED
6. CLASSIFIED INFO BRACKETED
7. OTHER (SPECIFY):

WITH ATTACHMENTS/ENCL

UNCLASSIFIED

[redacted]

[redacted]

Results of Air Sample Measurements

Plant: Lake Ontario Ordnance Works

UNCLASSIFIED

Sample No.	Bulb No.	Date Taken	Location	Micromicrocuries/l	% of Tolerance**
A-33	R-17	4/7/49	At intersection between siding & igloo.K-65 storage No drums moved.	9 ± 2	9 ± 2
A-34	R-71	4/7/49	Inside igloo before storing drums-K-65 storage	11 ± 2	11 ± 2
A-35	R-15	4/7/49	At intersection between railroad siding and igloo. 36 drums moved to igloo-K-65 storage.	12 ± 2	12 ± 2
A-36	L-12	4/7/49	Same as above - 60 drums moved	below 7	below 7
A-37	L-2	4/7/49	Same as above - 96 drums moved	" 5	" 5
A-38	R-70	4/7/49	Center of drum storage on dock at railroad siding. 48 drums on dock. K-65 storage.	78	78
A-39	R-59	4/7/49	Same as above. 36 drums on dock - K-65 storage	9 ± 3	9 ± 3
A-40	B-215	4/8/49	Open air storage for drums from first cars. 60 drums remaining in area. K-65 storage.	42	42
A-41	R-64	4/7/49	In railroad car. 24 drums removed. K-65 storage	591	591
A-42	R-65	4/7/49	In railroad car. 48 drums removed. K-65 storage	175	175
A-43	B-111	4/7/49	In railroad car. 72 drums removed. K-65 storage	288	288
A-44	L-11	4/7/49	In railroad car. 96 drums removed.(Car empty)))	21 ± 3	21 ± 3
A-45	R-72	4/7/49	Inside igloo. 48 drums stored. K-65 storage	1060	1060
A-46	R-96	4/7/49	Inside igloo. 80 drums stored. K-65 storage	2540	2540
A-47	R-97	4/7/49	Inside igloo. 96 drums stored. K-65 storage	2920	2920
A-48	R-86	4/8/49	Inside igloo. 267 drums stored. K-65 storage	2580	2580
A-49	B-210	4/8/49	At igloo door. 267 drums stored inside.K-65 storage	1630	1630

[redacted] UNCLASSIFIED

**-Based ontolerance figure of 100 micromicrocuries per liter.

[redacted]

Results of Air Sample Measurements

UNCLASSIFIED

Plant: Lake Ontario Ordnance Works

Sample No.	Bulb No.	Date Taken	Location	Mz micromicrocuries/l	% of tolerance**
A-50	B-106	4/8/49	Inside igloo. 226 drumsstored inside-K-65 storage	2320	2320
A-51	R-85	4/8/49	Inside igloo. 156 drums stored inside.K-65 storage	4140	4140
A-52	B-201	4/7/49	Inside railroad car. No drums removed	1000	1000
A-53	B-101	At door of	igloo. 96 drumsstored inside. K-65 storage	1750	1750
A-54	B-100	4/8/49	Inside igloo. 96 drums stored. K-65 storage	7080	7080
A-55	B-212	4/8/49	Open air storage for dums from first car. Canvas cover just removed.	388	388
	B-99	4/8/49	Broken in transit.		

**-Based on tolerance figure of 100 micromicrocuries per liter.

[redacted]

UNCLASSIFIED

8952

Radon Results, August 1949-March 1951, *LOOW Radon Air Sample Results*
Samples taken August 17, 1949 through March 7, 1951

FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No. 5273
DATE SENT
DATE RECEIVED
DATE REPORTED 3-13-51

PLANT Lake Ontario Ord. Wks.
MAILING ADDRESS U.S.A.E.C. P.O. Box 8 Kenmore 17 N.Y.
ROUTE RESULTS TO Heatherton

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT~~ A.D.D. DATE
Nancy Connelly 5/7/03

TYPE OF SAMPLE Air Radon
METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
5	3-7-51	2:45 p	350' NW of tower	—	—	Rn					0.2×10^{-11}	c/l
25		2:50	600' NE " "								<0.1	
000		3:10	500' SW " "								0.2	
16		3:00	350' SE " "								0.5	
3		2:55	600' SE " "								0.5	
23		3:05	850' SE " "								0.2	
13		3:20	2400' SE " "								0.6	
62		3:45	3400' SE " "								0.4	
			Wind direction → SE									
			" velocity → 500 fpm.									

COLLECTED BY Heatherton

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FORM N.Y.-99

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Nancy Connelly 5/7/03

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N.Y.

SAMPLE REQ. No.
DATE SENT
DATE RECEIVED
DATE REPORTED 3-13-51

PLANT Lake Ontario Ord. Wks.
MAILING ADDRESS USAEC
P.O. Box 8 Kenmore 17 N.Y.
ROUTE RESULTS TO Heatherton

free

TYPE OF SAMPLE Air Radon
METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
5	3-7-51	2:45 p	350' NW of tower	—	—	Rn					0.2×10^{-11}	c/l
25		2:50	600' NE " "								<0.1	
000		3:10	500' SW " "								0.2	
16		3:00	350' SE " "								0.5	
3		2:55	600' SE " "								0.5	
23		3:05	850' SE " "								0.2	
13		3:20	2400' SE " "								0.6	
62		3:15	3400' SE " "								0.4	

Wind direction → SE
" velocity → 500 fpm.

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Nancy Connelly 5/7/03

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2849
DATE SENT
DATE RECEIVED
DATE REPORTED 1-5-50

PLANT: LOOW

MAILING ADDRESS: PO Box 8, Kenmore 17, N.Y.

ROUTE RESULTS TO: HEATHERTON

free

TYPE OF SAMPLE: AIR RADON

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
15	1-3	2:15 P	In upper section of tower, 15' from top			Rn					7.7×10^{-8}	c/l
~~7~~												
29	"	2:15 P	Same as #15			"					7.7×10^{-8}	c/l
2	"	2:20 P	Same as #15 except 5' from top			"					3.0×10^{-8}	c/l
5	"	2:20 P	Same as #2			"					7.9×10^{-8}	c/l

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ANALYZED BY: [signature]

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Nancy Connelly 5/7/03

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2877
DATE SENT
DATE RECEIVED
DATE REPORTED 10-13-50

PLANT: LOOW

MAILING ADDRESS: P.O. Box 8, KENMORE 17 N.Y.

ROUTE RESULTS TO: HEATHERTON

TYPE OF SAMPLE: Air Radon

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
56	11-6-50	10^50 A	In boiler house at K-65 storage tower			Rn					4.0×10^{-11}	c/l
											0.4×10^{-10}	
62	"	10^52 A	At bottom of elevator shaft on side of tower			"					4.3×10^{-10}	
											4.3×10^{-10}	
52	"	10^55 A	Center of thaw-house. 32 drums on east conveyor, 42 on west con.			"					8.4×10^{-11}	
											0.8×10^{-10}	
150	"	11^00 A	Center of unloading platform. Taking off empties, cover & paint			"					6.9×10^{-11}	
											0.7×10^{-10}	

COLLECTED BY: Heatherton

ANALYZED BY: JMF

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2849
DATE SENT
DATE RECEIVED
DATE REPORTED 1-5-50

PLANT LOOW

MAILING ADDRESS

ROUTE RESULTS TO PO Box 8, KENMORE 17, N.Y. HEATHERTON

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
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Nancy Connelly 5/7/03

TYPE OF SAMPLE AIR RADON

METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
15	1-3	2:15 P	In upper section of tower, 15' from top			Rn					2.7×10^{-8}	c/l
~~2~~												
29	"	2:15 P	Same as #15			"					2.7×10^{-8}	c/l
2	"	2:20 P	Same as #15 except 5' from top			"					3.0×10^{-8}	c/l
5	"	2:20 P	Same as #2			"					1.7×10^{-8}	c/l

COLLECTED BY HEATHERTON

ANALYZED BY

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UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2877
DATE SENT
DATE RECEIVED
DATE REPORTED 10-13-50

PLANT: LOOW

MAILING ADDRESS: P.O. Box 8, KENMORE 17 N.Y.

ROUTE RESULTS TO: HEATHERTON

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
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Nancy Connelly 5/7/03

TYPE OF SAMPLE: Air Radon

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
56	11-6-50	10^50 A	In boiler house at K-65 storage tower			Rn					4.0×10^{-11}	c/l
62	"	10^52 A	At bottom of elevator shaft on side of tower			"					4.3×10^{-10}	
52	"	10^55 A	Center of thaw-house. 32 drums on east conveyor, 42 on west con.			"					8.4×10^{-10}	
150	"	11^00 A	Center of unloading platform. Taking off empties, cover + point			"					6.9×10^{-11}	

COLLECTED BY: Heatherton

ANALYZED BY: M.F.

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Nancy Connelly 5/7/03

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2851
DATE SENT
DATE RECEIVED
DATE REPORTED 9/7/50

PLANT: LOOW

MAILING ADDRESS: PO Box 8 Kenmore 17 N.Y.

ROUTE RESULTS TO: Heatherton, F.F.P.P.

Wind Direction -> NE
" Velocity 700 fpm

TYPE OF SAMPLE: Air Radon

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
21	8/29	9 55A	40' NE of NE corner of office Building	—	—	Rn.					—	$\times 10^{-13}$ c/c
11	"	9 56A	Visitors Office in NE corner of office Bldg	—	—	"					—	
6	"	9 58	Laundry Room in SE corner of office Bldg.			"					5.8	
1		10 02	Center of road 50' S.W. of SW corner of office Bldg.			"					—	
13		10 20	In field between water treatment Area & office Bldg 300' NE			"					—	
26		10 27	At Guard station at gate 500' SE of water treatment area			"					0.3	
23		10 32	Center of road 300' SW of area			"					—	
17		10 38	" " 300' NW "			"					—	

COLLECTED BY: Heatherton

ANALYZED BY:

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Nancy Connelly 5/7/03

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2838
DATE SENT
DATE RECEIVED
DATE REPORTED 9/7/50

PLANT: LOOW

MAILING ADDRESS: PO Box 8 Kenmore 17, NY

ROUTE RESULTS TO: Heatherton, Epp

Wind direction → NE to E
" velocity = 600 fpm

TYPE OF SAMPLE: Air Radon

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	~~SAMPLING~~ ~~RATE~~ ~~TIME~~	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
8	8-29	10:59 A	In center of road 150' NE of tower		Rn					—	$\times 10^{-12}$ c/l
29		11:04	Center of intersection 400' NE of tower		"					—	
25		11:10	Center of road 500' N of intersection		"					—	
27		11:30	Center of railroad siding half-way between tower & intersection of road ways where K-65 is stored Sample # SW side of tower		"					6.6	
4		11:44	Center of road 400 E. of tower & thaw-house halfway between intersections		"					5.6	
19		11:46	Railroad siding 150' E of end of road way where K-65 is stored		"					1.1	
30		12:00	In field 200' E of drums		"					5.8	
10		12:07	In roadway running SW to NE 400' SW of Sample #30		"					7.4	

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ANALYZED BY:

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FORM N.Y.-99

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Nancy Connelly 5/7/03

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2839
DATE SENT
DATE RECEIVED
DATE REPORTED 9/7/50

PLANT: LOOW
MAILING ADDRESS: P.O. Box 8 Kenmore 17, NY
ROUTE RESULTS TO: Hetherton, Epp

Wind Direction → SW
Wind Velocity: 600 fpm

TYPE OF SAMPLE: Air Radon
METHOD OF DETERMINATION:

	SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
(1)	3	8-29	1:15 P	At road intersection 200' NE of concentrated K-65 Storage			Rn					0.2	$\times 10^{-12}$ c/c
(2)	24	"	1:25	In center of road 200' SE of concentrated K-65 storage			"					—	
(3)	2	"	1:35	In center of road 150' N of K-65 concentrated storage			"					0.3	
(4)	16		3:45	50' ~~NE~~ SW of office building same location as sample 24 wind shifted to East			"					4.6	

COLLECTED BY: RH

ANALYZED BY:

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FORM N.Y.-99

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HERBERT SCHMIDT A.D.D. DATE
Nancy Connelly 5/7/03

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2846
DATE SENT
DATE RECEIVED
DATE REPORTED 9/11/50

PLANT: LOOW

MAILING ADDRESS / ROUTE RESULTS TO: P.O. Box 8, Kenmore 17, N.Y.

Wind direction ⇒ NE
" velocity = 160 fpm

TYPE OF SAMPLE: Air Radon

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
~~[illegible]~~											–	
129	9-7	11:35	Center of RR siding to loc. house			Rn					1.0×10^{-12}	c/c
			100' NE of second switch								–	
115		11:45	Road intersection 500'			"					0.5	
			ENE of tower								–	
50		11:50	RR intersection with			"					43.	
			roadway 500' SE of tower								–	
54		11:52	150' off roadway on rail-			"					2.9	
			road siding								–	
9		12:00	300' N. of intersection NE of tower			"					0.4	
36			300' W. of " NE " "								0.8	
318		12:10 p	RR siding 150' East of			"					35.	
			car unloading								–	
52		1:10 p	In roadway 50' S of K-65 storage			"					0.1	
			wind shifted → SE, velocity 500 fpm									

COLLECTED BY: Rodd

ANALYZED BY: E. J.

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DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT~~ A.D.D. DATE
Nancy Connelly 5/7/03

FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2844
DATE SENT
DATE RECEIVED
DATE REPORTED 9/11/50

PLANT: LOOW

MAILING ADDRESS / ROUTE RESULTS TO: P.O. Box 8, KENMORE 17, N.Y.

wind direction → NE.
" velocity = 140 fpm

TYPE OF SAMPLE: Air Radon

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
37	9-7	10^10 A	In roadway 30' east of office building	–		Rn.					0.1×10^{-12}	c/c
											–	
87		10^12 a	In roadway 30' SW of office Building			"					0.1	
											–	
142		10^42	Outside guard shack at main gate			"					0.3	
											–	
42		10^45	At curve in road SW boundary of property			"					0.1	
											–	
68		10^50	Center of road along west boundary. Directly west of office			"					0.2	
							5±				–	
43		10^55	Center of road in front of building 722-300' North of office Building			"	open				0.6	
											–	
											–	

COLLECTED BY: RPH

ANALYZED BY: E.J.

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FORM N.Y.-99

CONFIRMED TO BE UNCLASSIFIED
DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT A.D.D. DATE
Nancy Connelly 5/7/03

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2845
DATE SENT
DATE RECEIVED
DATE REPORTED 9/11/50

PLANT: LOOW

MAILING ADDRESS / ROUTE RESULTS TO: P.O. Box 8, Kenmore 17, N.Y.

wind direction > ENE
" velocity: 160 fpm

TYPE OF SAMPLE: Air Radon

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
11	9-7	11:00	At road intersection in front			Ra					0.3×10^{-12}	c/c
			of building 717. 300' N. of storage								–	
12		11:05	Between buildings 703 & 718			"					0.3	
			200' NE of K-65 storage							–	–	
72		11:15	Center of road SW of tower			"					0.4	
			halfway between tower & 718								–	
15		11:18	Center of R.R. siding to Thaw-			"	Stopcock open				0.5	
			house halfway between switch								–	
			& thawhouse platform								–	
20		11:25	In field 200' S. of roadway			"					0.6	
			150 E of K 65 stored in Road								–	
			running NE to tower								–	
77		11:30	Center of RR siding to locomotive			"					1.3	
			house. 100' SW of 1st switch								–	

COLLECTED BY: DAH

ANALYZED BY: E.J.

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FORM N.Y.-99

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DOE/OFFICE OF DECLASSIFICATION
HERBERT SCHMIDT A.D.D. DATE
Nancy Connelly 5/7/03

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 1227
DATE SENT
DATE RECEIVED
DATE REPORTED 9/15/49

PLANT: LAKE ONTARIO ORDNANCE WORKS

MAILING ADDRESS

ROUTE RESULTS TO

TYPE OF SAMPLE: AIR (RADON)

METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS (curies/liter)
B325	8/30	2:30 pm	In air stream from fan			Rn						
			blowing out from igloo. Fan									
			mounted indoor & just started								1.6×10^{-8}	
326	8/31	4:00 pm	In air stream from fan									
			blowing out from igloo. Fan									
			has been running continuously	$25\frac{1}{2}$ hrs.							4.3×10^{-9}	
327	9/1	3:00 pm	"	$48\frac{1}{2}$ hrs.							3.6×10^{-9}	

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FORM NY-100

UNITED STATES ATOMIC ENERGY COMMISSION
OFFICE OF NEW YORK DIRECTED OPERATIONS
RADIOLOGICAL LABORATORY
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

RL Nº 990

PLANT: 200W

LOCATION:

ROUTE RESULTS TO:

SAMPLE RECORD No.

TYPE: Air

MEASURED WITH: ON

SAMPLE NO.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	RESULTS curies	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.
13-300	9/2/49	2:00P	Inside igloo, Fan off 12 hrs. prior to sampling			Rn	2.8×10^{-8}				
13-301	"		" "				1.7×10^{-8}				
13-302			Same, but 2 feet in front of igloo				2×10^{-12}				

COLLECTED BY:

COUNTED BY: John Harley

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DOE/OFFICE OF DECLASSIFICATION
~~HERBERT SCHMIDT~~ A.D.D. DATE
Nancy Connally 5/2/03

FORM N.Y.-99

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~~HERBERT SCHMIDT~~ A.D.D. DATE
Nancy Connelly 5/7/03

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REG. 297
DATE SENT
DATE RECEIVED
DATE REPORTED 9/1/49.

PLANT: LAKE ONTARIO ORDNANCE WORKS
MAILING ADDRESS
ROUTE RESULTS TO

TYPE OF SAMPLE: AIR - FLASK SAMPLE
METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
B 223	8/17	1:00PM	Outside in front of igloo door to igloo closed			Radon				XPL 4.3	4.3×10^{-10}	curies/liter
R 79	8/17	1:00AM	Inside igloo, center at 5ft.							1100	1.1×10^{-7}	
R 83	8/17	1:00AM	Inside igloo, center 5ft. above floor level							4200	4.2×10^{-7}	
L-10	8/19	2:15pm	In center of igloo. Door open 2 days prior to sampling							70	7×10^{-9}	
L-13	8/19	2:15	"	This value Known to be low						1.3 ×	1.3×10^{-10}	
B-110	8/19	2:15	6ft. in front of igloo. Door open							1	10^{-10}	

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Nancy Connelly 5/7/03

UNITED STATES AT[illegible]IC ENERGY COMMISSION
NEW YOR[illegible]RATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 902
DATE SENT
DATE RECEIVED
DATE REPORTED 11/16/49.

PLANT: LAKE ONTARIO ORDNANCE
MAILING ADDRESS: P.O. BOX 8, KENMORE 17, N.Y.
ROUTE RESULTS TO: M. EISENBUD, W HARRIS, H. BLATZ, R. HEATHERTON

TYPE OF SAMPLE: AIR - RADON
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
B-340	9/28	11:05A	AIR IN CENTER OF IGLOO AT START OF K-65 UNLOADING. FAN JUST TURNED OFF			RN.					30 x Tol	*
B-341	9/28	1:35P	AIR IN CENTER OF IGLOO 48 DRUMS REMOVED			RN.					1900 x Tol.	
B-342	9/28	2:35P	AIR IN CENTER OF IGLOO. 96 DRUMS REMOVED			RN.					42600 x Tol.	

COLLECTED BY: R. HEATHERTON AEC TONAWANDA AREA

ANALYZED BY: [illegible]

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~~HERBERT SCHMIDT~~ A.D.D. DATE
Nancy Connelly 6/7/03

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 297
DATE SENT
DATE RECEIVED
DATE REPORTED 9/1/49.

PLANT: LAKE ONTARIO ORDNANCE WORKS
MAILING ADDRESS
ROUTE RESULTS TO

TYPE OF SAMPLE: AIR - FLASK SAMPLE
METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
B 223	8/17	1:00 PM	Outside in front of igloo door to igloo closed			Radon					4.3×10^{-10}	curies ~~liter~~
R 79	8/17	1:00 PM	Inside igloo, center at 5 ft.								1.1×10^{-7}	
R 83	8/17	1:00 PM	Inside igloo, center 5 ft. above floor level								4.7×10^{-7}	
L-10	8/19	2:15 pm	In center of igloo. Door open 2 days prior to sampling								7×10^{-9}	
L-13	8/19	2:15	"	This value known to be low							1.3×10^{-10}	
~~B 110~~	8/19	2:15	6 ft. in front of igloo. Door open								10^{-10}	

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ANALYZED BY E. Sartenson

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Nancy Connelly 5/7/03

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2885
DATE SENT 2/19/51
DATE RECEIVED 2/27/51
DATE REPORTED 3/1/51

PLANT: U.S.A.E.P. - LOOW
MAILING ADDRESS: P.O. BOX 8 Binghamton 17, NY
ROUTE RESULTS TO: D. H. Cathcart

TYPE OF SAMPLE:
METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
12C	2/19/51	8 05 AM	Joe Ringulski			Rn					0.7	$\times 10^{-12}$ c/l
86	2/19/51	8 07 AM	Joe Ringulski			Rn					0.7	
82	2/19/51	8 12 AM	Harry Butts			Rn					LOST	
51	2/19/51	8 15 AM	Harry Butts			Rn					0.3	
83	2/19/51	8 22 AM	Emil Nudo			Rn					0.5	
69	2/19/51	8 25 AM	Emil Nudo			Rn					0.3	
90	2/19/51	8 32 AM	Gino Fontanarosa			Rn					0.4	
39	2/19/51	8 35 AM	Gino Fontanarosa			Rn					0.1	

COLLECTED BY: K. A. K. P.

ANALYZED BY: M. H.

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[redacted]

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THE UNIVERSITY OF ROCHESTER
SCHOOL OF MEDICINE AND DENTISTRY
POST OFFICE BOX 287, STATION 3
ROCHESTER 7, NEW YORK

ATOMIC ENERGY PROJECT
(ADMINISTERED BY THE DEPARTMENT OF RADIATION BIOLOGY UNDER CONTRACT WITH THE U. S. ATOMIC ENERGY COMMISSION)

May 23, 1949

W7401 eng 49

Mr. Merril Eisenbud
U. S. Atomic Energy Commission
New York Operations Office
P. O. Box 30, Ansonia Station
New York 23, New York

Dear Merril:

Enclosed with this letter are the results of the analyses of the radon samples taken at Lake Ontario Ordnance Works on May 12, 1949.

Sincerely yours,

Russell Hayes

Russell Hayes

RH:kf
encl.: 1
cc-1. & 2. Mr. Eisenbud w/encl.
3. DO, U. of R. w/encl.
4. File w/encl.
5. R. File
6. Dr. Howland

UNCLASSIFIED

DEPARTMENT OF ENERGY DECLASSIFICATION REVIEW

1ST REVIEW-DATE: 5/7/03	DETERMINATION [CIRCLE NUMBER(S)]
AUTHORITY: ☐ DC ☒ OD	1. CLASSIFICATION RETAINED
NAME: Nancy Connelly	2. CLASSIFICATION CHANGED TO:
	3. CONTAINS NO DOE CLASSIFIED INFO
2ND REVIEW-DATE: 05/28/03	4. COORDINATE WITH:
AUTHORITY: OD	5. CLASSIFICATION CANCELED
NAME: Betty Harris	6. CLASSIFIED INFO BRACKETED
	7. OTHER (SPECIFY):

WITH ATTACHMENTS/ENCL

[redacted]

[redacted]

Results of Air Sample Measurements

Plant: Lake Ontario Ordnance Works,

UNCLASSIFIED

Sample No.	Bulb No.	Date Taken	Location	Mz Micromicrocuries	% of tolerance **
	B-200	5/12/49	In storage buildingcontaining L-30 (Tails from Linde Step I). On platform at center of building.	818	818
	B-206	5/12/49	In storage building containg L-30 (Tails from Linde Step I). On platform at north end.	680	680
	B-207	5/12/49	In storage cuilding containing L-30 (Tails from Linde Step I). On platform at south end.	893	893

**-Based on tolerance figure of 100 micromicrocuries per liter.

UNCLASSIFIED [redacted]

[redacted]

Results of Air Sample Measurements

Plant: Lake Ontario Ordnance Works,

UNCLASSIFIED

Sample No.	Bulb No.	Date Taken	Location	Mz Micromicrocuries	% of tolerance **
	B-200	5/12/49	In storage buildingcontaining L-30 (Tails from Linde Step I). On platform at center of building.	818	818
	B-206	5/12/49	In storage building containg L-30 (Tails from Linde Step I). On platform at north end.	680	680
	B-207	5/12/49	In storage cuilding containing L-30 (Tails from Linde Step I). On platform at south end.	893	893

**-Based on tolerance figure of 100 micromicrocuries per liter.

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[redacted]

9074

Radon Results, October 1952, *LOOW Radon Results*
Samples taken October 14, 1952

FORM N.Y.-99
REV. 2/4/52

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
HEALTH AND SAFETY DIVISION
P. O. BOX 30, ANSONIA STA.
NEW YORK 23, N. Y.

SAMPLE REQ. No. A 2473
DATE SENT
DATE RECEIVED
DATE REPORTED 10-28-52

PLANT L OOW

MAILING ADDRESS Model City, NY

TYPE OF SAMPLE Masks

METHOD OF DETERMINATION

ROUTE RESULTS TO Klevin

ANALYZE FOR Radon

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	SAMPLING TOTAL	SAMPLE TAKEN	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS $\times 10^{-10}$ %
#1	10/14	2 15 pm	Pre Operation Sample in front of monitor	–	–						0.015
#2	10/14	2 25 pm	Downwind of monitor 100' EAST	–	–						0.006
#3	10/14	2 35	Downwind of monitor 250' EAST	–	–						0.009
#4	10/14	2 45	Downwind 500' EAST	–	–						0.010

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ANALYZED BY

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U. S. GOVERNMENT PRINTING OFFICE: 1952—O-938101

9078

Heatherton, 1950a, *Lake Ontario Ordnance Works Air Radon and Dust Survey August-September 1950*; R. C. Heatherton; November 6, 1950

F. M. Belmore, Dir[illegible] Production Division November 13, 1980

Merril Eisenbud, Director, Health and Safety [illegible]

LAKE ONTARIO ORDNANCE WORKS

SUBJECT: MSE:WRK:mc

We are transmitting herewith our report - [illegible] - 1. This report covers an environmental radon and dust survey of the Lake Ontario Ordnance Works during [illegible] and September 1980. The purpose of this study was to determine background levels of radon and dust prior to the use of the "[illegible]" for K-65 storage.

Although the radon at this site was found to be much higher than normal background, it is still well within the MAC except in isolated unfrequented locations. The one difficulty which can be anticipated is that these relatively high radon levels may make it difficult to obtain accurate breath air radon samples.

Enclosures:
(Report - 4 copies)

RECEIVED

LAKE ONTARIO ORDNANCE WORKS

AIR RADON AND DUST SURVEY
AUGUST - SEPTEMBER 1950

by

R. C. Heatherton
Industrial Hygiene Branch
Health and Safety Division

Issued: November 6, 1950

Distribution:

1 - File ✓
2 - Tonawanda Sub-office
3 - " " "
4 - Production (F. Belmore)
5 - "
6 - File

U. S. Atomic Energy Commission
New York Operations Office
Health and Safety Division

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Results	1
Discussion	1, 2
Conclusions	2

APPENDIX A

Figures 1 and 2

APPENDIX B

Sample Record Sheets

PURPOSE

Air radon and dust samples were collected at Lake Ontario Ordnance Works on August 29 and 30, 1950. Additional air radon samples were taken September 7. The purposes of the survey were to determine the source or sources of high air radon levels indicated by high breath radon results, and to determine background levels for reference before K-65 storage in the tower was begun.

RESULTS

The average value of 20 air radon samples collected September 7 was 4.4×10^{-12} curies/liter. Individual samples were from 0.1×10^{-12} to 43.0×10^{-12} curies/liter. Sixteen air radons taken August 29 were from 0 to 7.4×10^{-12} curies/liter. The latter results are questionable because of the reduced activity of the samples at the time they were counted.

The alpha activity of the air dust samples was from 0 to 3 disintegrations per minute per cubic meter of air.

Locations and results of air radon samples are shown in figures 1 and 2. As seen in these figures, the K-65 which is stored in drums along roadways and in an open area about 600 feet east of the office building is the greatest source of radon. Highest radon concentrations occur a few feet downwind from the greatest concentrations of K-65. As might be expected samples collected farther downwind contained less radon as did upwind and crosswind samples.

DISCUSSION

At the present time, our division accepts 10^{-10} curies/liter as the maximum allowable concentration for radon in the air. There is some evidence in favor of lowering the MAC to 10^{-11} curies/liter. The American Standards Association has recommended this lower value and it probably will be adopted by the Atomic Energy Commission.

According to our best available information, the air radon at LOOW is not of sufficient concentration to be hazardous to people in the area. The highest sample obtained was less than half of our present maximum allowable concentration value (4.3 x the A. S. A. value). The MAC is for continuous exposure. It is most unlikely that anyone would remain in areas of high radon concentration for extended periods.

The average sample value for air radon is not meant to be an area average. Sampling locations were selected so that about one-half the samples would be taken downwind from a source. It is believed the average would be different if a random sampling method were used.

Disregarding the question of health hazard from exposure, the air radon is sufficiently higher than normal background to require special care in collecting breath samples. Erroneous results may be had when samples are submitted by workers who have been in the area inhaling a considerable quantity of radon prior to sampling.

Air radons collected August 29 were delayed in shipping so that by the time they were received for counting, they had decayed to 25% or less of their original activity.

Eleven general air samples for dust were taken at various locations in the office and tower areas. These were both indoor and outdoor samples.

CONCLUSIONS

Air radon at LOOW before K-65 was dumped in the tower was much higher than normal background. The chief source of radon is K-65 stored in drums. Highest radon concentrations occur a few feet downwind from this source. Dispersion of the gas is fairly rapid. No health hazard is anticipated because of the radon but it may effect breath sample results. The air dust levels are low.

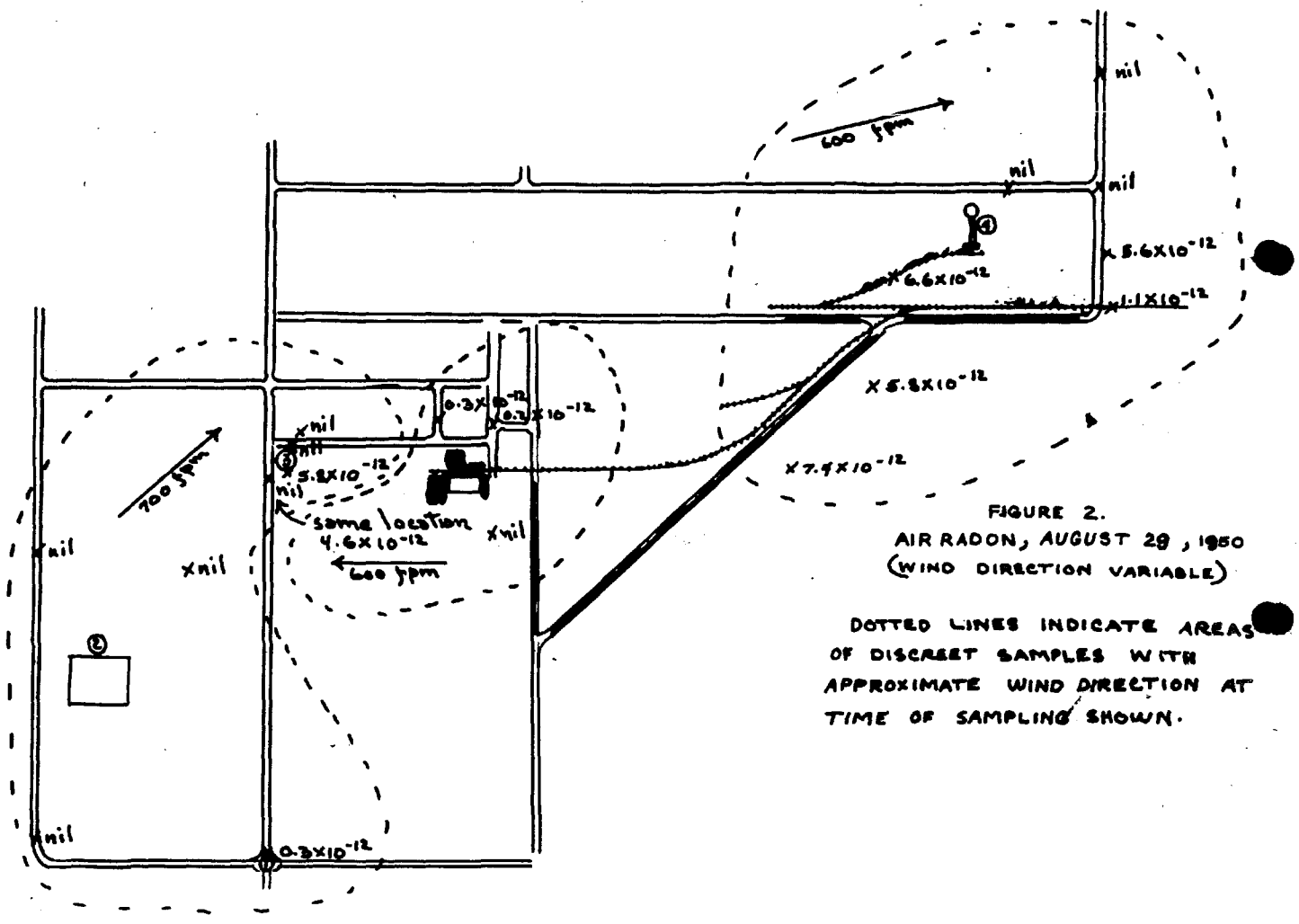
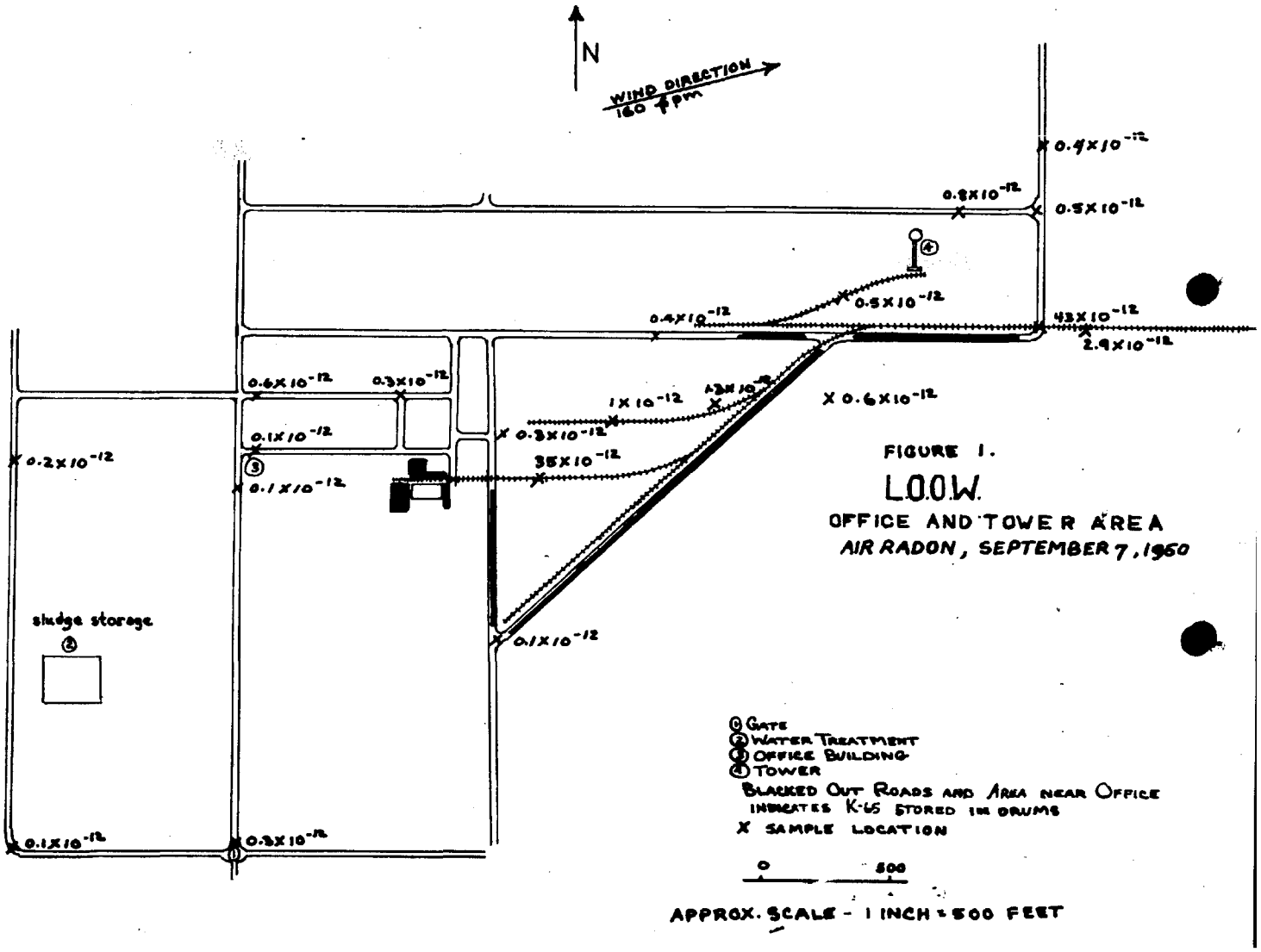


FIGURE 2.
AIR RADON, AUGUST 29, 1950
(WIND DIRECTION VARIABLE)

DOTTED LINES INDICATE AREAS OF DISCREET SAMPLES WITH APPROXIMATE WIND DIRECTION AT TIME OF SAMPLING SHOWN.


N
WIND DIRECTION
160 ¶PM
0.4X10^-12
0.8X10^-12
0.5X10^-12
0.5X10^-12
0.4X10^-12
43X10^-12
2.9X10^-12
0.6X10^-12
0.3X10^-12
1X10^-12
X 0.6X10^-12
0.1X10^-12
X 0.3X10^-12
35X10^-12
0.2X10^-12
0.1X10^-12
sludge storage
0.1X10^-12
0.1X10^-12
0.3X10^-12
FIGURE 1.
L.O.O.W.
OFFICE AND TOWER AREA
AIR RADON, SEPTEMBER 7, 1960
① GATE
② WATER TREATMENT
③ OFFICE BUILDING
④ TOWER
BLACKED OUT ROADS AND AREA NEAR OFFICE INDICATES K-65 STORED IN DRUMS
X SAMPLE LOCATION
0
500
APPROX. SCALE - 1 INCH = 500 FEET

APPENDIX B

FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2846
DATE SENT
DATE RECEIVED
DATE REPORTED 9/11/50

PLANT: LOOLU

MAILING ADDRESS: P.O. Box 5, Kenmore 17, N.Y.

ROUTE RESULTS TO

Wind direction → NE
" velocity = 160 fpm

TYPE OF SAMPLE: Air Radon

METHOD OF DETERMINATION

SAMPLE NO.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
[redacted]											–	
✓ 129	9-7	11 35	Center of RR siding to loc. house			Rn					1.0×10^{-12}	c/l
			100' NE of second switch								–	
✓ 115		11 45	Road intersection 500'			"					0.5	
			ENE of tower								–	
✓ 50		11 50	RR intersection with			"					43.	
			roadway 500' SE of tower								..	
✓ 54		11 52	150' off roadway on rail-			"					2.9	
			road siding								–	
✓ 9		12 00	300' N. of intersection NE of tower			"					0.4	
✓ 36			300' W. of " NE "			"					0.8	
✓ 18		12 10 p	RR siding 150' East of			"					35.	
			unloading								–	
52		1 10 p	In roadway 50' S of K-65 storage			"					0.1	
			wind shifted → SE, velocity 500 fpm									

COLLECTED BY: RCH

ANALYZED BY: E.J.

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2844
DATE SENT
DATE RECEIVED
DATE REPORTED 9/11/50

PLANT: LCCW

MAILING ADDRESS: P.O. Box S, Kenmore 17, N.Y.

ROUTE RESULTS TO

wind direction → NE
velocity = 140 fpm

TYPE OF SAMPLE: Air Radon

METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
37	9-7	10:10 A	In roadway 30' east of office building	-	-	Rn.					0.1×10^{-12}	c/c
											–	
87		10:12 A	In roadway 50' SW of office building			"					0.1	
											–	
142		10:42	Outside guard shack at main gate			"					0.3	
											–	
42		10:45	At curve in road. SW boundary of property			"					0.1	
											–	
68		10:50	Center of road along west boundary. Directly west of office			"					0.2	
											–	
43		10:55	Center of road in front of building 722-300' North of office building			"					0.6	
											–	
											–	

COLLECTED BY: RGH

ANALYZED BY: E.J.

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FORM N.Y.-99

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NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2845
DATE SENT
DATE RECEIVED
DATE REPORTED 9/11/50

PLANT: LOOW

MAILING ADDRESS: P.O. Box 8, Kenmore 17, N.Y.

ROUTE RESULTS TO

wind direction → ENE
" velocity = 160 fpm

TYPE OF SAMPLE: Air Radon

METHOD OF DETERMINATION

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
11	9-7	11:00	At road intersection in front			Rn					0.3×10^{-12}	c/c
			of building 717, 300' N. of storage								–	
12		11:05	Between buildings 705 + 718			"					0.3	
			200' NE of K-65 storage								–	
72		11:15	Center of road SW of tower			"					0.4	
			Roadway between tower + 718								–	
15		11:18	Center of RR siding to thaw-			"	Stopcock Open				0.5	
			house roadway between switch								–	
			+ thawhouse platform								–	
80		11:25	In field 200' S. of roadway			"					0.6	
			150 E of K-65 stored in Road								–	
			running NE to tower								–	
79		11:30	Center of RR siding to locomotive			"					1.3	
			house. 100' SW of 1st switch								–	

COLLECTED BY: RCH

ANALYZED BY: E.J.

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2837
DATE SENT
DATE RECEIVED
DATE REPORTED 9/7/50

PLANT: LOOW

MAILING ADDRESS: PO Box 8 Kenmore 17 N.Y.

ROUTE RESULTS TO: Heatherton, F.E.P.P.

Wind Direction → NE
" Velocity: 700 fpm

TYPE OF SAMPLE: Air Radon

METHOD OF DETERMINATION:

SAMPLE NO.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
21	8/[illegible]	9 53A	40' NE of NE corner of office Building	—	—	Rn.					—	x10⁻[illegible]
11	"	9 56A	Visitors Office in NE corner of office Bldg	—	—	"					—	
6	"	9 58	Laundry Room on SE corner of office Bldg.			"					5.8	
1		10 02	Center of road 50' S.W. of SW corner of office Bldg.			"					—	
13		10 20	In field between water treatment Area & office Bldg 300' NE			"					—	
26		10 27	At Guard station at gate 560' SE of water treatment area			"					0.3	
23		10 32	Center of road 300' SW of area			"					—	
17		10 35	" " " 300' NW "			"					—	

COLLECTED BY: Heatherton

ANALYZED BY:

SURVEYOR TO RETAIN LAST COPY — RETURN ALL OTHERS TO MEDICAL DIVISION, N.Y.O.O., N. Y.

FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2838
DATE SENT
DATE RECEIVED
DATE REPORTED 9/7/50

PLANT: LOOW

MAILING ADDRESS: PO Box 8 Kenmore 17, NY.

ROUTE RESULTS TO: Heatherton, Epp

Wind direction ⟹ NE to E
" velocity = 600 fpm

TYPE OF SAMPLE: All Radon

METHOD OF DETERMINATION:

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	~~SAMPLING~~ ~~[illegible]~~	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
8	8:29	10:59 A	In center of road 150' NE of tower		Rn.					—	$\times 10^{-12}$ g/l
29		11:04	Center of intersection 400' NE of tower		"					—	
25		11:10	Center of road 500' N of intersection		"					—	
27		11:20	Center of railroad siding half-way between tower & intersection of road ways where K-65 is stored Sample SW side of tower		"					6.6	
4		11:24	Center of road 400 E of tower & the aux. house halfway between intersections		"					5.6	
19		11:46	Railroad siding 150' E of end of road way where K-65 is stored		"					1.1	
30		12:00	In field 200' E of drums in roadway running SW to NE		"					5.8	
10		12:02	400' SW of Sample #32		"					7.4	

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FORM N.Y.-99

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2839
DATE SENT
DATE RECEIVED
DATE REPORTED 9/7/50

PLANT: LOOW

MAILING ADDRESS: P.O. Box 8 Kenmore 17, NY

ROUTE RESULTS TO: Heatherton, Epp

Wind Direction → SW
Wind Velocity = 600 fpm

TYPE OF SAMPLE: Air Radon

METHOD OF DETERMINATION:

	SAMPLE NO.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
1	3	8-29	1:15 P	At road intersection of concentrated K-65-Storage	200'	NE	Rn					0.2×10^{-10}	c/l
2	24	"	1:25	In center of road 200' SE of concentrated K-65 storage			"					—	
3	2	"	1:35	In center of road 150' N of K-65 concentrated storage			"					0.3	
4	16		3:45	50' SW of office building same location as sample 2 wind shifted to East			"					4.6	

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MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2840
DATE SENT
DATE RECEIVED 9-1-50
DATE REPORTED 9-22-50

PLANT: LOOW

MAILING ADDRESS: P.O. Box 8, Kenmore 17, N.Y.

ROUTE RESULTS TO: Heatherton, Epp.

TYPE OF SAMPLE: Air Dust

METHOD OF DETERMINATION: Scient

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
				cum	min							
S-546	8-30	9²⁷a	G.A. Center of Visitors	.020	65	[redacted]	.5096			1	2	8/m³
			office, used as health &									
			safety office formerly.									
S-547		9³⁵a	G.A. Center of laundry	.020	60		.4704			1	2	
			room SE corner of Bldg.									
S-548		9³⁵a	G.A. Center of Forbes	.020	90		.7056			1	1	8/m³
			room, East side of office bldg									
S-549		9⁴³a	G.A. Lunch Room	.020	80		.6272			1	1	
			in office bldg. SW corner.									
S-550		12⁰⁰N	Control	—	—					0	0	
S-551		12¹⁰P	G.A. 10' from NE corner	.020	80		.6272			0	0	
			of office bldg.									
S-552		1³²	G.A. outside 20' East	.020	60		.4704			0	0	
			of office building									

COLLECTED BY: R.H.

ANALYZED BY: Ed J Thornton

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FORM N.Y.-99

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MEDICAL DIVISION
70 COLUMBUS AVENUE
NEW YORK 23, N. Y.

SAMPLE REQ. No. 2842
DATE SENT
DATE RECEIVED 9-1-50
DATE REPORTED 9-22-50

PLANT: LOOW

MAILING ADDRESS: P.O. Box 8 Kenmore 17 N.Y.

ROUTE RESULTS TO: Heatherton Epp

TYPE OF SAMPLE: Air Dust

METHOD OF DETERMINATION: Scint

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING RATE	SAMPLING TIME	ANALYZE FOR	QUANTITY	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS VALUE	RESULTS UNITS
S553	8-30	3:35p	G.A. Tower area 50' East of tower	.020	60.0		.4704			0	0	8/m3
S554	8-31	9:45a	G.A. Thawhouse platformat tower. S side by railroad siding	.020	150.0		1.176			0	0	
S555	"	9:46a	G.A. Thawhouse platform. West end.	.020	150					1	.8	
S-556	"	12:15p	G.A. Thawhouse platform. Inside shield partition	.020	90.0		.7056			1	1	
S-557	"	12:30p	G.A. Tower area. Center of bldg. house	.020	90.0		.7056			0	0	
S-558	"	3:40p	Control	—	—					0	0	

COLLECTED BY: RH

ANALYZED BY: Ed. J. Thornton

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Unknown author, 1960, *Radiation and Radon Survey of Operations of K-65 Tower*; Author's name is illegible; November 1960

[redacted] This document consists of 15 pages
No. 4 of copies, series A

LOOK - 2

LAKE ONTARIO ORDNANCE WORKS

RADIATION, RADON AND DUST SURVEY OF OPERATIONS ESSENTIAL TO THE [illegible] OF K-65 IN THE TOWER

by

Richard C. Mathewson
Industrial Hygiene Branch
Radiological Safety Division

Issued: November [illegible], 1944

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This do[illegible] National [illegible] its [illegible] in any m[illegible] limited a[illegible] ties under a[illegible]

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[redacted]

Purpose

1. To measure the radiation exposure at each phase of the operation.

2. To determine the radiation exposure to each individual under present conditions of operation.

3. To estimate the radiation exposure to each operator under ideal usage of the present equipment.

4. To uncover sources of high radiation exposure so that recommendations may be made for eliminating overexposure.

5. To determine air radon and dust levels in order to estimate personnel exposure to these air contaminants.

Results

From the radiation study, it is estimated that each laborer will receive a minimum of 324 mr of gamma radiation per week under present operating conditions. Beta radiation will contribute another 100 mrep/week to each man's exposure making a total of 425 mrep beta-gamma/week. This estimate assumes that:

1. The tower will be operating at capacity.

2. The present staff of six men will do all the labor connected with the operation.

3. The K-65 stored on the premises will give off radiation of the same intensity as the material used for this study.

Table I gives the operation breakdown and the exposures expected for each job. If the amount of K-65 dumped in one week is more than 50% of the capacity of the tower, or if handling the material, a significant reduction in radiation

exposure is anticipated.

Minor improvements can be made which will reduce exposures to approximately 265 mr of gamma and 70 mrem of beta per week. This average exposure (315 minimum per week) would still exceed the maximum allowable exposure of 500 mrem/wk total radiation. To reduce radiation exposures further will require either additional manpower or better equipment for handling the K-65.

Men working at the tower are exposed to approximately 0.8×10^{-10} curies per liter of radon under normal operating conditions. Occasional short term exposures to 4.3×10^{-10} curies/liter are likely to occur. Our present MAC value for air radon is 10^{-10} curies/liter but 0.1×10^{-10} curies/liter is widely recommended and is likely to be adopted as an AEC tolerance.

Results of the dust study will not be available for several days. When the samples have been analyzed for radium and total alpha activity, a separate report will be issued for that part of the survey.

Discussion

The following assumptions and calculations are made in determining the exposures in Table I:

✓ 1. Assume the tower is operating efficiently for 24 hours a day and five days a week. Approximately 1200 drums will be dumped in one week.

Time cycle (1 drum) = 6 minutes = 10 drums/hr. — 6/hr

✓ 24 x 5 = 120 hours per week

120 x 10 = 1200 drums per week = ideal capacity.

120 x 6 = 720

2. Assume three carloads of K-25 are received each week and the rest of the drums dumped will be from the backlog now stored along the roadways at LGDP.

3. Current shipments are 96 drums/carload.

5 x 96 drums per carload = 480/week

The remaining 960 drums will be loaded from the roadways on a truck and hauled to the tower.

10 truckloads x 48 drums per load = 960 drums

960 + 480 = 1440 drums per week = expected capacity.

4. Assume six men do all the work and perfect rotation of the men.

2 men/shift x 3 = 6 men per day

3 cars/week/6 = 1/2 car per man

18 truckloads/week/6 = 3 truckloads per man

1440 drums/week/6 = 240 drums/man.

5. Normal maintenance time of 12 hours per week is presumed.

6. Assume similar material is handled.

On the basis of the above assumptions, the figures presented in Table I are drawn. It should be pointed out, however, that several factors may mitigate to increase the maximum capacity while the chance of a reduction beyond that stated, is small. Some of these factors include:

1. Uneven distribution of pressure-load on tower.

2. Substantial increase in maintenance time and other time spent near the tower.

3. Handling of considerably "[illegible]" material.

4. Possible substantial increase in radiation from tower as K-25 level rises.

Radiation exposures for the different jobs were measured with pocket dosimeters. Other exposures were estimated from radiation measurements made in work areas with survey meters. Both ionization chamber and Geiger counter type instruments were used for these measurements.

Table II contains exposure data for a man operating a lift truck in unloading a carload of K-65. The man not only wore a pocket meter in front but meters were also taped to his back and to each arm above the elbow.

Measured radiation for the man removing the lids from 55 drums from behind a shield was 35 mr to the chest and to the left arm which is the side more often toward the drums. Measured radiation for a man loading the truck with 48 drums was 15 mr. The same exposure can be assumed for unloading. The measured radiation from the K-65 being handled was about average for current material. Some of the older material is two to three times "hotter".

Time studies were made of the various jobs. Times given in Table I are average and seem reasonable. However, time assumed for maintenance of equipment is for efficient operation. Under present operating conditions, much more time is spent on this phase of the work. If a man enters the thaw house or the elevator shaft or ascends to the top of the tower, short term exposures to 100 mr/hr or more of gamma radiation are expected. A man working to free a drum on the conveyor, elevator, or dumper may receive many times this exposure.

On the basis of the present operating scheme, it would be possible to reduce average exposures to some extent. Use of the eight-inch concrete barrier instead of the one-inch steel shield presently being used would reduce the gamma radiation exposure per man [illegible] mr per week. Eliminating any necessity for leaving K-65 on the dock by improved dumping and provision of additional

[redacted]

storage space would reduce the gamma radiation exposure another 40 mr per man per week. The total estimated reduction resulting from these modifications is 130 mrep/ of beta-gamma/week. Thus the predicted average exposure could be lowered from 455 mr/hr to 315 mr/hr.

The original plans for the tower included the eight-inch concrete barrier to shield the man removing locking ring and lids from 5-55 drums. To enable a man to do this work from behind the barrier required the design and installation of a mechanical pin and lid remover. The design detail for the mechanism was to be worked out by the Engineering Division. The concrete barrier was installed; the mechanism has not been installed. A recommendation has been made (report of November 1, 1959) for an improved dumping mechanism. Extension of the railroad siding to provide additional storage space for empty drums (recommendation #6, report of November 1, 1959) will not fulfill the requirements for space for full drums since these must be stored away from work areas.

The fact that the exposures given in Table I are a minimum obtainable under best conditions, and also the improbability of noticing any appreciable reduction with a smaller workload substantiated in the exposure records of individuals for the first six weeks of tower operation. In this time, about 3000 drums of 5-55 were dumped. The tower was therefore operating at 30% of its rated capacity. For this period, film exposures for five to six men averaged 340 mrep/ of beta-gamma, with gamma radiation accounting for 70% of the total exposure.

Both pocket dosimeters and film badges are worn continuously during working hours. Complete film and pocket meter data are given in Table III. Although individual film and pocket meter results vary over a wide range, the average film and pocket meter readings compare closely. The beta exposure on the badge is probably due to scattered radiation or soft gamma which does not penetrate the walls of the pocket chamber.

Some radiation measurements made at the tower are given in Table IV. These measurements were made after 2000 drums of K-65 were dumped. This material, if leveled, would extend to a height of 12 feet above the tower floor which is 4 to 5 feet above the ground level. The material is probably piled in the middle but extends up a few feet up the wall on all sides.

As more material is dumped higher radiation in the vicinity is expected. Radiation at the outer surface of the tower is not expected to increase in proportion to the radiation at greater distances.

Recommendations

It is believed that adoption of the minor improvements numbered 1, 2, and 3 will reduce the average exposure to 315 mrem minimum beta-gamma per week under ideal operating conditions. Major improvements numbered 4 and 5 will reduce radiation so that with unusual exceptions no one would receive an average exposure in excess of 500 mrem/week. The recommended improvements are:

1. More shielding for the man [illegible] the lids from drums and/or installation of a lid removing mechanism. (Recommendation #16)

2. Improved dumping or sloping mechanism at the top of the tower so that drums are not returned with [illegible] K-65 (Recommendation #10 - Nov. 1, 1952).

[redacted]

3. Storage facilities (either shielded or remote from work stations) for full drums of K-65 which cannot be dumped because the drums are badly damaged or the material is very wet (Recommendation #19). This may be accomplished either by:

a. Shielding a section of the loading platform on the west end for temporary storage of full drums, or preferably,

b. Cutting a hole in the west wall or north wall at the west end and extending the platform to accommodate 9 or 10 drums. The platform addition should extend far at least 40 feet beyond the present platform and should be no wider than 8 feet. It may be as narrow as 4-1/2 feet. The wall opening should be wide enough to permit the lift truck to pass through with reasonable clearance.

4. Use of crane with magnet or remotely operated hitching device for loading and unloading the truck. Adoption of this improvement would require the purchase of additional equipment. Two cranes would be needed; one for loading, another for unloading on the platform.

5. Hiring of additional labor - In view of past exposure records and assumptions for perfect operation, it is believed a reduction of exposure by one-third will be needed to provide a narrow margin of safety. It is recommended that three more laborers be hired for the K-65 storage operation (Recommendation #20).

Summary

The estimated minimum average exposure which may be expected to six laborers at LOOW while K-65 is being stored in the [illegible] under present operating

[redacted]

schedules is 438 mrep/ beta-gamma/week. This assumes almost perfect operation with a minimum amount of maintenance required. Since near perfect operation cannot be expected, adoption of recommendations numbered 9, 10, 18, 19, and 20 is necessary before exposures can be reduced to the point that no one receives an average exposure in excess of 300 mrep/week for any three-month period.

[redacted]

TABLE I

JOB BREAKDOWN FOR MAIN WAY (ONE WEEK)

Description of Work	Time Required To do WORK	Expected Gamma Radiation Exposure
1. Unload 1/2 car	8.75 hrs	15 mr
2. Load and unload truck 3 times, transport load.	4.0 "	90 "
3. Remove lids from 55 drums	[illegible] "	50 "
4. Remove empty drums from conveyer, dump residue, replace lids, paint, load in cars or on truck.	14.0 "	70 "
5. Maintenance of Equipment	[illegible] "	50 "
6. Watching controls	14.0 "	30 "
Total	58.75 hrs	[illegible] mr

[redacted]

TABLE II

RADIATION DATA OBTAINED WHILE UNLOADING A [illegible] OPERATING SITE TRUCK.

No. of Drums Removed	Radiation Measured at 6 feet: Number of [illegible]	Radiation Measured at 6 feet: Edge of Platform	Pocket Meter Readings Combined Dosimeter: Front	Pocket Meter Readings Combined Dosimeter: Back	Pocket Meter Readings Combined Dosimeter: Right Arm	Pocket Meter Readings Combined Dosimeter: Left Arm
0	125 mr/hr	140 mr/hr	15	3	5	6
8	70	35	20	7	*	9
16	50	15	25	10	16	10
24	30	12	31	13	18	17
32	-	[illegible]	32	13	26	20
40	19	24	34	26	27	24
48	3	6	40	32	34	25

* No reading taken.

TABLE III

FILM AND POCKET METER DATA

All readings are mrem/week.

Week Begin.	Film Badge Beta	Film Badge Gamma	Film Badge Total	Pocket Meter
	100	210	400	240
	150	200	350	240
9-18	75	250	325	290
	220	230	450	315
	290	440	730	430
	110	-	110	160
9-25	160	300	460	190
	250	440	690	325
	260	440	700	325
	140	300	440	325
	180	200	380	250
10-2	200	180	380	325
	200	340	540	300
	200	240	440	325
	70	260	325	120
	80	170	250	105
10-9	90	280	370	215
	95	210	305	155
	80	210	290	100
	75	170	245	120
	140	140	280	95
10-16	180	270	450	210
	120	160	280	160
	-	110	110	112
	55	80	135	120
10-23	100	190	290	250
	90	260	350	302
	100	180	280	245
	65	110	175	147
Average	120	222	342	254

Average Pocket meter gamma to film gamma ratio -- 1.06

Average Pocket meter gamma to film total emission ratio -- 0.69

[redacted]

TABLE IV

RADIATION MEASUREMENTS AT TOWER

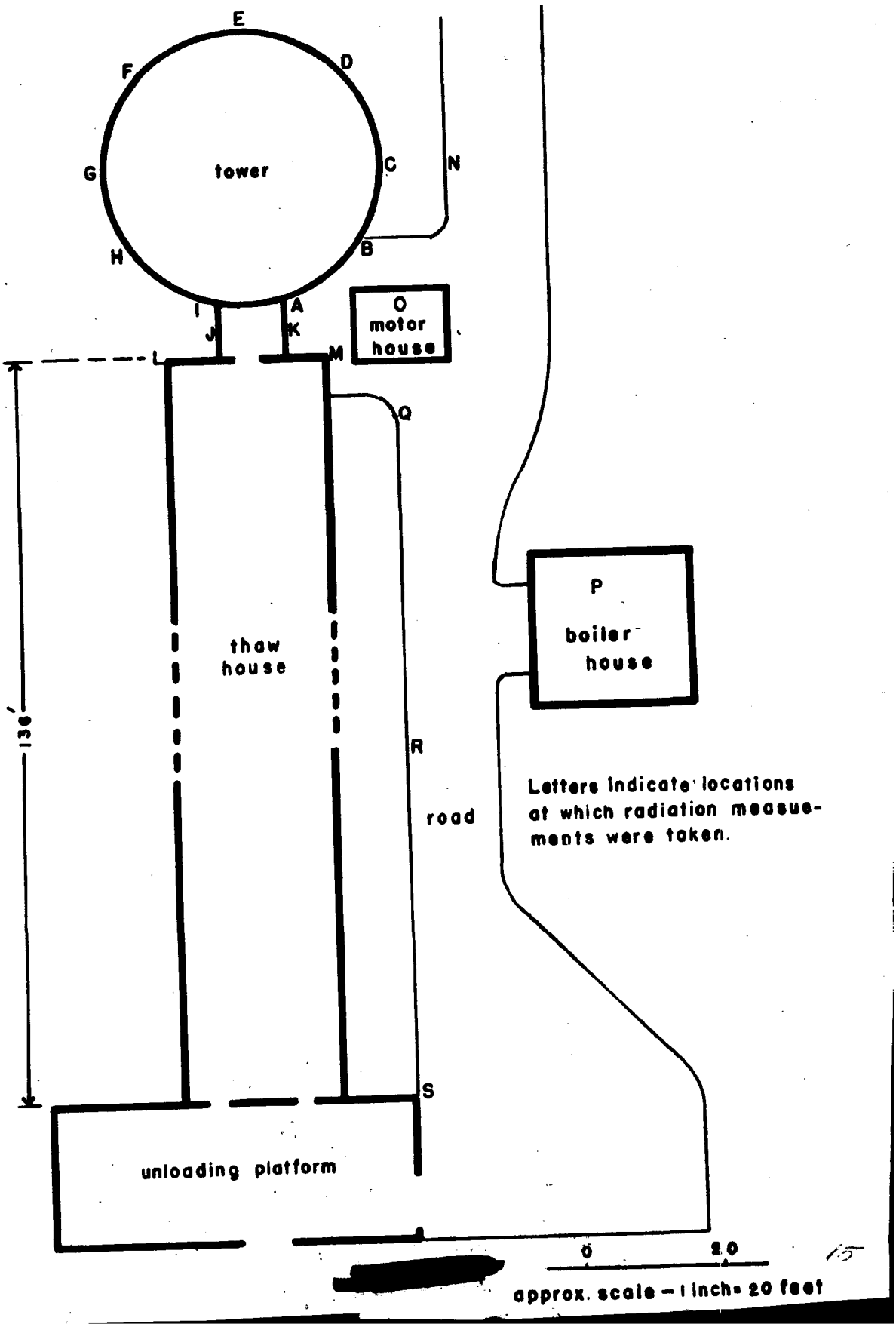
Locations as shown in Figure I.
Readings A through H taken on surface of structure.
All readings are mr/hr of gamma

Instrument	Ion. Chamber		Geiger Counter	
Height above ground level	6'	8'	6'	8'
Location				
A	13	[illegible]	9	14
B	11	12	8	11.5
C	[illegible]	11	7.5	9.5
D	[illegible]	11	8	10
E	10	11	8	10
F	11	12	8	11.5
G	10	12	8.5	8.5
H	11	12	11	10.5
I	20	[illegible]	17.5	17.5
Average around base of tower	11.5	[illegible]	9.3	11.1
Height above ground	4'		4'	
J	15		15	
K	14		14	
L	11.5		8	
M	10		7	
N	[illegible]		5.5	
O	[illegible]		[illegible]	
P	[illegible]		3.0	
Q	4.0		3.5	
R	3.		7	
S	2		3.5	

[redacted]

Figure 1.

L.O.O.W. - K-65 STORAGE TOWER



[redacted]