LAW OFFICES
HICKEY, MELIA & KURFIRST
CHARTERED
SUITE 800
77 WEST WASHINGTON STREET
CHICAGO, ILLINOIS 60602
TELEPHONE (312) 422-9400 FACSIMILE (312) 422-9410
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EPA Region 5 Records Ctr.
383774

RICHARD J. HICKEY

DIRECT DIAL (312) 422-9405
E-MAIL Hickey@HMKlawfirm.com

July 18, 2001

Richard C. Karl
Chief Emergency Response Branch
U.S. EPA
Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Re: Request for Information Pursuant to Section 104 of CERCLA for Lindsay Light Building, 161 Grand Avenue in Chicago, Illinois

Dear Mr. Karl:

Please find enclosed herewith, responses to the Request for Information Pursuant to Section 104 of CERCLA for Lindsay Light Building, 161 Grand Avenue in Chicago, Illinois, together with documentation. In addition, I have enclosed a Document Index with Bates numbering for your convenience.

If you have any questions or comments, please feel free to contact me.

Very Truly Yours,

Richard J. Hickey

Richard J. Hickey

Attachment B
Requests

General Objections: Schmo Brothers, L.L.C. and Opt1, Inc., a/k/a Optimus ("Current Occupant") hereby acknowledge the receipt of the Request for Information Pursuant to Section 104 of CERCLA for Lindsay Light Building, 161 East Grand Avenue, Chicago, Illinois dated April 30, 2001. This Request was forwarded by the United States Environmental Protection Agency, Region 5 ("EPA"). This Response shall be considered a joint response on behalf of two separate and distinct legal entities. Schmo Brothers, L.L.C. is an Illinois limited liability company that was recently formed. Without notice of an environmental hazard or any violation of any state or federal environmental law or regulation, Schmo Brothers entered into a contract to purchase the real property located at the address commonly known as 161 East Grand Avenue, Chicago, Illinois. Schmo Brothers only closed this deal on January 27, 2001 and has owned the property since that time.

Opt1, Inc. is an Illinois corporation authorized to transact business for any lawful purpose under the laws of the State of Illinois. It was formed in 1996 and purchased certain asset from Anheuser Busch, including the name "Optimus". Optimus had been owned by a group of individuals and was then sold to Anheuser Busch. In 1996, the transaction between Opt1 and Anheuser Busch proceeded to closing. Opt's primary business is a post-production house. This is involved with various forms of editing of presentations that are audio or visual. The business is complex and involves a lot of high technology applications. It is not a manufacturing business, and it is not involved with hazard materials.

General Objections: While Schmo Brothers and Opt1 are responding to the request for information submitted by the Environmental Protection Agency, this should not be construed as any waiver of any right of either entity, nor should it be construed as an admission that the Environmental Protection Agency or any agency of the federal government has any authority to investigate or assess the site or to take any actions with regard to the site. Still further, any response should not be construed as an admission or waiver of any rights in any respect whatsoever by any governmental, quasi-governmental, or private party. Still further, these entities assert that their business, the promises on which they own or conduct business, and their investigations are deemed proprietary and confidential, and therefore all responses are considered to be confidential.

1. Identify all persons consulted in the preparation of the answers to these Information Requests.

   Response: Thomas Duff.

2. Identify all documents consulted, examined, or referred to in the preparation of the answers to these Requests, and provide copies of all such documents.

   Response: The documents are believed to already be in possession of the EPA. Attached is a summary of the documents obtained at various times between December 30, 2000 and January 27, 2001.

3. If you have reason to believe that there may be persons able to provide a more detailed or complete response to any Information Request or who may be able to provide additional information or responsive documents, identify such persons, including past employees of Lindsay Light.

   Objection: These entities have no knowledge of any information concerning Lindsay Light other than what has been in the general public media or comments made by governmental employees to representative of Schmo Brothers or Opt1. Without prejudice to this response, these entities have no knowledge of information concerning prior owners or occupiers other than what is apparently within the knowledge of the EPA as reflected by the documents.

4. Identify all persons having knowledge or information about the generation, transportation, treatment, disposal, or other handling of radioactive hazardous substances by you, your contractors, or by prior owners and/operators.

   Objection: This request goes beyond information that would be available to Schmo Brothers or Opt1. Without prejudice to this objection, Opt1 and Schmo Brothers have no knowledge concerning the generation, transportation, treatment, disposal, or other handling of radioactive hazardous substances. Schmo Brothers and Opt1 have not retained any contractor to handle radioactive hazardous substances. As for information concerning prior owners and/or operators, those requests are more properly directed to the prior owners and/or operators.

5. Please provide all known historical information regarding the construction of the 161 Building, including copies of all maps and drawings in your possession.

Response: All information has been previously voluntarily provided to the Environmental Protection Agency and the City of Chicago.

6. Please provide all known historical information about the handling of radioactive hazardous substances, pollutants, or contaminants at the 161 Building including information about the processes used, location of various aspects of the processes within the building, correspondence, minutes, ads, and pictures, etc. relating to activities within the 161 building.

   Objection: This request assumes that Schmo Brothers and Opt1 would have such knowledge, and they have no such knowledge. Again, all knowledge concerning this has been obtained from the documents that were produced at or about the closing of the acquisition of the premises by Schmo Brothers. In addition, information has been supplied by agents of the Environmental Protection Agency.

7. Please provide information regarding any removal or abatement work performed in or around the 161 Building, including but not limited to the chimney, chimney base, or chimney cap that involved radioactive hazardous substances, pollutants, or contaminants. In addition, please identify the location where any radioactive hazardous substances, materials, pollutants or contaminants were disposed.

   Response: Schmo Brothers was not in existence at any time concerning any removal or abatement work at the premises.

   Opt1 leased certain areas of the premises since its incorporation and acquisition of certain business and assets in 1996. However, it was not the role of Opt1 to have any knowledge or participation in any overall building maintenance or construction activities other than specific alterations to the leased premises that were negotiated between the prior landlord and Opt1. Opt1 was informed by the landlord that there would be certain removal of a chimney by Kerr McGee or a contractor retained by Kerr McGee. Opt1 was aware that certain individuals for a contractor came in to perform removal work but has no knowledge as to the name of any such individuals, the company they worked for, what their scope of engagement was, whether that entity complied with its scope of engagement, or what they did with the materials (other than what was revealed in the recently obtained documents).

8. Please provide the name, address, telephone number, and project manager's name of any person and/or contractor(s) that performed any surveys, removals, or abatement work in or around the 161 Building. In particular, please include

information about any contractor(s) which performed work involving radioactive hazardous substances, pollutants, or contaminants.

Response: Neither Schmo Brothers, nor Opt1, have commissioned or participated in any survey, removal, or abatement work in or around the 161 Building other than blocking off the area at the base of the chimney in the basement and cooperating with the EPA and the City of Chicago. When Schmo Brothers purchased the premises, it received a real estate survey, which will be made available to the EPA upon its request. Further, Documents have been listed which were obtained at or about the closing of the acquisition of the premises by Schmo Brothers.

9. Describe in detail all removal/abatement work performed in or around the 161 Building with regard to any work involving radioactive hazardous substances, pollutants, or contaminants, including but not limited to data, tests, analyses, analytical results, Work Plan, Health and Safety Plans, environmental assessments, surveys, and any other information and reports regarding the presence, location, management, and disposal of radioactive hazardous materials, substances, pollutants or contaminants.

   Objection: This is duplicative of No. 7 above. Without prejudice to this objection, see response to No. 7 above

10. Please provide copies of any radiation surveys performed on or in the 161 Building and/or on its land. In addition, please describe in detail where the measurements were taken, the results of the measurements, whether any recommendations were made as a result of the measurements, and when and to whom recommendations were made.

    Response: See Documents listed and documents already in the possession of the EPA.

11. Please describe in detail your relationship with the other recipients of this Request for Information letter prior to any sale or exchange of ownership interest of the 161 Building.

    Response: Schmo Brothers purchased the premises from 161 East Grand Associates. Mr. Ronald Steele was, upon information and belief, a partner in that entity. Neither Schmo Brothers, nor Opt1, have any relationship to Kerr McGee Corporation, River East Chicago, L.L.C., Radiation Safety Services, Inc., or Adco Services, Inc.

12. Please describe in detail your knowledge of the condition of the 161 Building prior to any sale or exchange of ownership interest and the basis for your knowledge.

Response: It was the understanding of Schmo Brothers and Opt1 that an environmental survey had been performed at the building in the early 1990s. There had been some level of a dispute at that time, but as a further analysis was performed, it had been determined that there was no violation of any state or federal environmental law or standard or environmental hazards. Further, despite the fact that there was no violation of any environmental law or standard, the prior owner had work performed on the property to make it even safer. Still further, Schmo Brothers and Opt1 were led to believe that Kerr McGee was involved in the removal of a chimney, but Opt1 did not have knowledge of any details regarding the context of the removal of the chimney. Schmo Brothers would not have purchased the property had there been any knowledge of any environmental hazard.

13. Please describe in detail any dealings you have, or may have had with the other recipients of this Request for Information letter with respect to removal, transportation, or disposal of radioactive wastes, materials, substances, pollutants, or contaminants.

Response: None.

14. Provide information about the site, including any and all additions, demolitions, or changes of any kind on, under, or about the Site, to its physical structures, including but not limited to chimney, chimney base or chimney cap, or to the property itself (e.g., excavation work) since at least 1979 and any planned additions, demolitions, or other changes to the Site.

Response: Objection: this is duplicative of earlier requests. Without prejudice to this objection, see responses to prior requests.

15. If you performed radiation contamination removal or control actions at the 161 Building, please describe in detail what you were contracted to perform and by whom; when you were contracted to perform the work; the actual date you entered into the contract; what work was actually performed; the start date of the work; how long the work took; who disposed of the radioactive substances, pollutants, or contaminants removed; where the radioactive substances, pollutants, or contaminants were disposed; when the radioactive substances, pollutants, or contaminants were disposed; and the amount of waste by activity of each radio nuclide and by total weight or volume of material involved.

Response: Not applicable.

16. Are you or your consultants planning to perform any investigations of the soil, water (ground or surface), geology, hydrology, or air quality on or about the Site, including surrounding sidewalks, alleys, etc.? If so, identify:

a) What the nature and scope of these investigations will be;

b) The contractors or other persons that will undertake these investigations;

c) The purpose of the investigation;

d) The dates when such investigations will take place and be completed; and

e) Where on the Site such investigations will take place.

Objection: This would invade attorney work-product privilege.

17. Identify all leaks, spills, or releases into the environment of any radioactive hazardous substances, pollutants, or contaminants that have occurred at or from the Site from 1990 to the present. In addition, identify:

a) When such releases occurred;

b) How the releases occurred;

c) The amount of each radioactive hazardous substance, pollutants, or contaminants so released, and the amount of waste by activity of each radio nuclide and by total weight or volume of material involved;

d) Where such releases occurred;

e) Any and all activities undertaken in response to each such release or threatened release, including the notification of any agencies or governmental units about the release;

f) Where the contaminated materials as a result of the release were ultimately disposed;

g) Any and all investigations of the circumstances, nature, extent or location of each release or threatened release including, the results of any soil, water (ground and surface), or air testing undertaken; and

h) All persons with information relating to these releases, including any former directors or employees of Lindsay Light.

a) to h) **Response**: None to the knowledge of these entities.

18. Identify all persons with knowledge, information, or documents responsive to question 1-17, above.

    Response: See responses to Nos. 1-17 above and see Documents identified.

19. Provide copies of all documents containing information responsive to question 1-17, above, or in lieu of copies of all relevant documents, provide identification and location of all such documents.

    Response: These respondents will make available for copying any of the Documents identified that the EPA would like copied.

20. Identify the acts or omissions of any persons', other than your employees, contractors, or agents, that may have caused the release or threat of release of radioactive hazardous substances, pollutants, or contaminants, and damages resulting therefrom from 1900 to the present time.

    Objection: This request as phrased is argumentative, and it would imply that there would have been acts or omissions of employees, contractors, or agents of Schmo Brothers and/or Opt1, and there was none. These entities further object to this request, as it would invade attorney work-product privilege.

DOCUMENT INDEX

1.	0002-0004	Notes regarding ownership history of 161 E. Grand (the "Property")
2.	0 0005	Photostatic copies of business cards for: (i) RSSI; (ii) DEM, an environmental contractor; (iii) JMS Environmental Assoc., Ltd.
3.	0 0006	April 2000 Lindsey Light Site Update by EPA
4.	0007-0009	April 19, 2000, Facsimile letter from Ludlum Measurements, Inc., a designer and manufacturer of scientific and industrial instruments (specifically a model three survey Nal Gamma Scintillator Survey Meter.).
5.	0010	12/30/00 Memorandum by Mr. Tom Duff of Opt1
6.	0011-0029	11/17/80 & 11/24/80 EPA Preliminary Report on Property.
7.	0030-0123	May 1981 final report of EPA on a survey of the Property.
8.	0124-0126	July 15, 1981 letter from Radiation Safety Services, Inc. to Chris Ball of Brown & Storch.
9.	0127-0134	Undated Decontamination Activities Report for the Property
10.	0135-0150	July 1982 report by US Nuclear Regulatory Commission, "Guidelines for Decontamination of Facilities and Equipment Prior to Release of Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material"
11.	0151	March 8, 1983 letter from James M. Smith, Optimus, to David Keep, US EPA region V5.
12.	0152-0155	August 9, 1983 letter from Larry Jensen, radiation specialist, US EPA, to James M. Smith, Optimus.

13.	0156-0159	January 31, 1984 letter regarding radioactive thorium radiation from TT Kaon, the Commissioner, City of Chicago, Department of Inspectional Services to Mr. Smith of Optimus (note that 0158-0159 is an additional copy of the same letter)
14.	0160-0165	February 21 or 24, 1984, US EPA memo re Property from Larry Jensen, Air and Radiation Branch, to Gary Gulezian, Chief Regulatory Analysis Section.
15.	0166-0187	April 9, 1984 RSSI report: radiological aspects of the February 1984 remodeling of [the Property]
16.	0188	April 11, 1984 letter from Eli A. Port, RSSI to Ron Klyber of 161 E. Grand Associates.
17.	0189	June 22, 1993, letter from Ronald A. Steele, manager of 161 E. Grand Associates, to Terry Liaboe of RSSI.
18.	0190	June 30, 1993 letter from Ronald A. Steele, manager of 161 E. Grand to Terry W. Liaboe, Vice-President of RSSI.
19.	0191-0229	August 2, 1993 "Site Assessment Report for [the Property]" by Ecology and Environment, Inc.
20.	0230-0232	October 22, 1993 letter from Jodi Traub, acting associate division director, US EPA to Ron Steele, Property building manager.
21.	0233-0235	May 9, 1994 letter from Eli A. Port, RSSI to Ron Steele.
22.	0236-0237	May 9, 1994 letter from OSHA to 161 East Grand (the Property).
23.	0238	May 10, 1994 letter from Eli Port, RSSI, to Ron Steele, the Property manager.
24.	0239-0243	OSHA Regulations
25.	0244-0246	June 1, 1994 letter from US Department of Labor, OSHA to Ron Steele, Property manager.

26.	0247	July 9. 1996. facsimile from Ron Steele. Property manager to Vernita Simmons.
27.	0248-0250	October 20. 1999, fax cover sheet from Ron Steele. Property manager, to Eli Port of RSSI, attaching draft letter to Illinois Department of Nuclear Safety.
28.	0251	June 21, 2000, letter from Ron Steele. Property manager, to Diane at Kerr McGee.
29.	0252-0253	June 23. 2000, facsimile letter from Ron Steele, Property manager, to Diane Bell, at Kerr McGee.
30.	0254-0255	May 24, 2000, letter from Ron Steele to Dan White, Senior Project Manager of Kerr McGee Corporation regarding waste clean-up.
31.	0256-0260	Flow level radioactive waste manifests and agreements.
32.	0261	November 30, 1999, letter from George Christianson, Vice-President of Kerr McGee to Ron Steele, Property manager.
33.	0262	May 17, 2000 invoice by George Christianson, Vice-President Kerr McGee.
34.	0263-0264	May 2000 issue of EPA answers to questions most often asked by residents.
35.	0265-0275	US EPA article: "Radiation: Risks and Realities"
36.	0276-0291	Initial draft of RSSI's April 9, 1984 report titled "Radiological Aspects of the February '84 Remodeling of the [Property]"
37.	0292	Second floor area floor plan for the Property.
38.	0293-0295	E-mail from Eli Port, RSSI to ?.
39.	0296	Table of Gamma ray exposure unsupported with any other documentation.

40.	0297	January 10, 1984 US EPA Memo regarding the Property from David Keep, Director Air Management Division to Basil Constantelos, Director of Waste Management Division
41.	0298	"Daily Log of 161 East Grand Activities"
42.	0299-0304	Additional copy of Decontamination Activities Report for 1981 decontamination.
43.	0305-0306	Additional copy of ADCO Services, Inc., disposal invoice.
44.	0307	A copy of April 23, 1984 letter from Eli Port of RSSI to Ron Klyber at 161 East Grand.
45.	0308-0312	August 31, 1992 letter from Bryan J. Bagg, of RSSI, to Matthew Babich, Optimus, regarding survey results and demolition project performed on August 17, 1992.
46.	0313	February 24, 1984 memo regarding telephone conversation between Larry Jensen of the US EPA and Eli Port of RSSI.
47.	0314	October 9, 1981 letter from Eli Port, RSSI, to Chris Ball, Brown & Storch.
48.	0315-0316	October 27, 1999 fax from Ron Steele, Property manager, to Eli Port, RSSI.
49.	0317-0318	March 2, 2000 letter from Dan White, Kerr McGee, to Eli Port, RSSI.

161 E. Grand
Ownership History

161 E. Grand Associates (LaSalle Trust) (Bought 1978)

↑

Chicago Home For The Friendless (Charity) (Bought 1952(?))

Now: Child & Family Care Services 427-8790

Managed By Howard Stocker Co (Originally) Carl Kerner
(944-7373)

↑

Abe Samuels (Speed-O-Print) C (Trust)

** Lindsey Light Company (Original Owners) (Polution Source)

↓

Bought By American Potash

↓

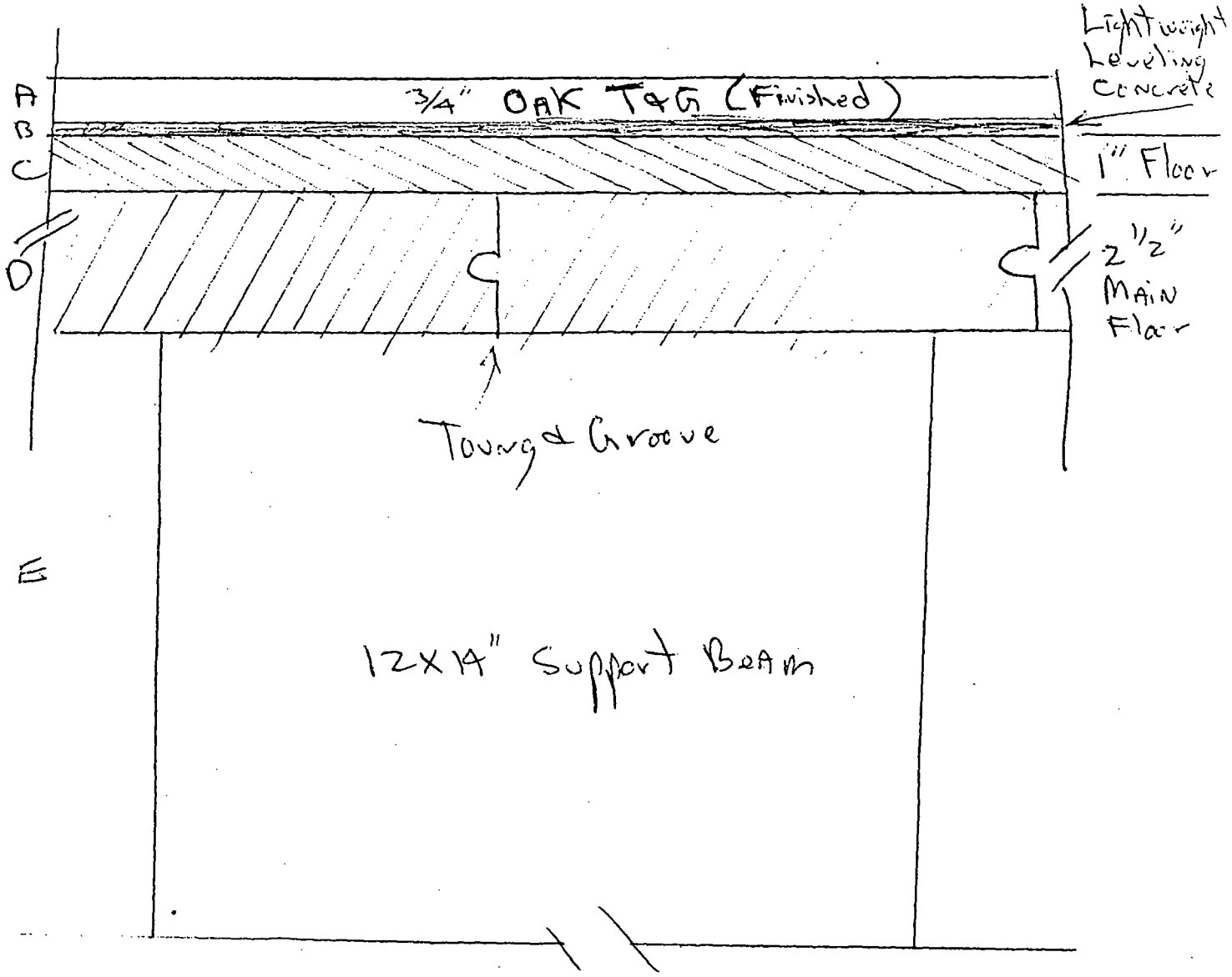
Bought By Kerr McGee Corporation

↑

Seem to be legally liable in other cases under the theory that they bought all assetts and liabilities.

- Nuclear Regulations created in 1954.
- Contamination found at 161 in 1980.

161 E. Grand
(2nd) Floor Detail



A - Oak T&G Floor
B - Lightweight Leveling Concrete or wood stripping.
C - 1" Finished Floor (Original - Probably Maple)
D - 2 1/2" T&G Pine? support Floor
E - 12x14 Support Coloums

RSSI

Eli Port (Owner)

Eric S. Pittman
6312 West Oakton Street
Morton Grove, IL 60[illegible]3-2723
847-965-1999
Fax 847-965-1991

DEM Services, Inc.

An Environmental Contractor

Paul Middleton

Environmental and Renovation Contractor
1018 S. Oakley Blvd
Lower Level
Chicago, IL 60612
Phone: 312-421-2352
Fax: 312-421-2369
DEMservice@aol.com

JMS

JMS Environmental Associates, Ltd.
Environmental Consulting Laboratory

JOSEPH M. STERNER
Environmental Director/President

816 Burr Oak Drive
Westmont, IL 60559

(630) 655-8500
Fax (630) 655-8724

Never used these guys.
They did work in the
Neighborhood

0 0006

United States
Environmental Protection
Agency

Region 5
77 West Jackson Blvd.
Chicago, Illinois 60604

Illinois, Indiana
Michigan, Minnesota
Ohio, Wisconsin

EPA

Lindsay Light Sites Update

Chicago, Illinois

DARIO Kimber –
LARRY ~~GENTA~~ Jonston
Josey DELION
Linda Knocwood

April 2000

INTRODUCTION

The purpose of this fact sheet is to provide community residents and other interested individuals with information about the Lindsay Light sites. In particular, this fact sheet will provide a brief overview of cleanup activities at each site with background information on the company and contacts for additional information.

LINDSAY LIGHT BACKGROUND

The Lindsay Light Chemical Company is the former maker of incandescent gas mantles for home and street lighting. Earlier reports show this company first imported and then manufactured mantles from around 1910 until 1933 at 161 East Grand Avenue. Sometime after 1933, Lindsay Light moved to West Chicago, Illinois.

The process of gas mantle manufacturing involves dipping gauze mantle bags into solutions containing thorium nitrate and small amounts of cerium, beryllium and magnesium nitrates. The principal ingredient in thorium nitrate is radioactive thorium, specifically, thorium-232.

LINDSAY LIGHT I SITE

The Lindsay Light I site is located at 161 East Grand Avenue, at the corner of Grand Avenue and St. Clair Street in downtown Chicago. Lindsay Light I is the former manufacturing location for the Lindsay Light Chemical Company. The U.S. Environmental Protection Agency took a series of surveys and recommended that decontamination of areas throughout the building be undertaken, where practicable (areas where employees and members of the general public work or frequent). In August 1981, the current building owners funded a limited project to decontaminate only occupied work areas on the second and fourth floors. During June 1983 and February 1984, U.S. EPA took dose measurements to determine what, if any, levels of radiation were present. On both occasions results were minimal.

1 Pico PER GRA

In June 1993, a site assessment was performed to measure gamma exposure rates. This assessment concluded that there were additional areas that should be removed.

5 PK PER GR

7.1

LINDSAY LIGHT II SITE

The Lindsay Light II Site, which is a public parking lot, is located at 316 East Illinois Street. The three acre lot is bounded by Grand Avenue, Illinois Street, McClurg Court and Columbus Drive. Records show that the Lindsay Lite II Site originally housed a stable, which was later used as a laboratory/ processing facility by the former Chemical company. A site assessment was done in June 1993, which determine the extent of cleanup activities.

Eli PORT
Environmental Specialist in

RSSI in Skokie

LUDLUM MEASUREMENTS, INC.
501 OAK ST P.O. BOX 810
SWEETWATER, TEXAS 79556
Phone 915-235-5494 800-622-0828 (USA)
Fax 915-235-4672 E-Mail: dstevens@ludlums.com
Website: http://www.ludlums.com

DESIGNER AND MANUFACTURER OF
Scientific and Industrial Instruments

FAX COVER SHEET

Date: Wednesday, April 19, 2000

To: Ron Steele
Fax 708-366-1880

From: Dwaine Stevens
Ludlum Measurements, Inc.
Fax 915-235-4672

Number of Pages Including Cover Sheet 3

This document was sent from Ludlum Measurements, Inc. The information in this transmittal is CONFIDENTIAL and is intended only for the use of the addressee. If you are not the intended recipient or an employee or an agent authorized to deliver it to the intended recipient, you are hereby notified that any dissemination or copying is strictly prohibited. If you have received this transmission in error, or if you have any trouble receiving the document(s), please contact us.

COMMENTS:

I am most pleased to offer the following.

Ludlum will supply :

Model 3 Survey Meter w/202-666 meter face	P/N 48-1605	$395.00ea
Model 44-2 1"x1" NaI Gamma Scintillator	P/N 47-1532	$405.00ea
	Total	$800.00ea

FOB: Sweetwater, Texas (Freight is prepaid and added to the invoice)
Delivery: From the factory approximately 2-3 days after receipt of order
Terms: Credit Card or Net 30 Days with approved credit

If I may assist in any manner, please call or e-mail at your convenience.

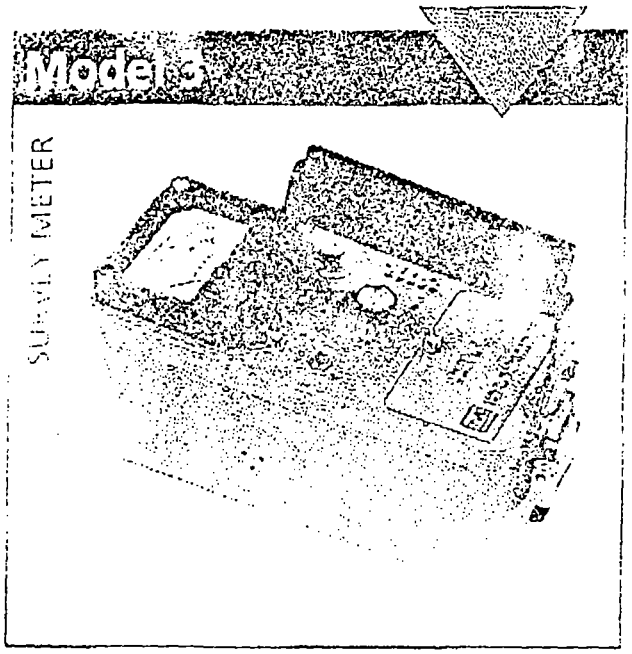
Best Regards,

Dwaine Stevens
Sales Manager

It might be good to own this to save on consulting fees.
R.S

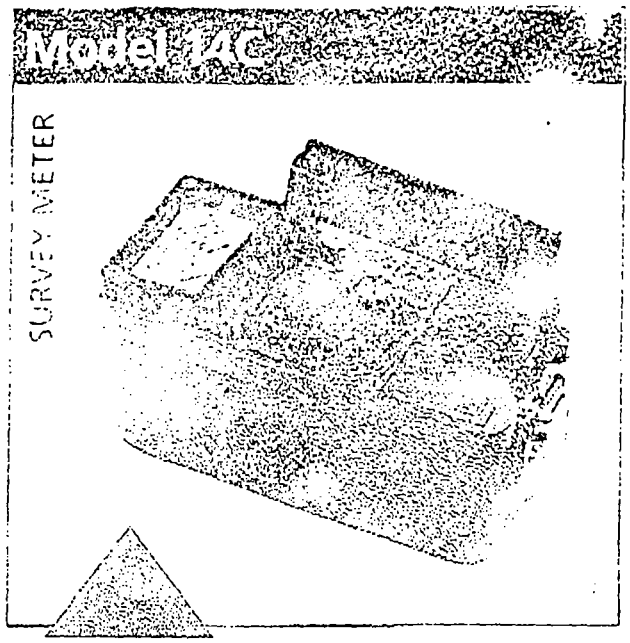
General Purpose Survey Meters

Model 3



Note: The Model 3 is also available with an alarm circuit. (Model 3A)

Model 14C



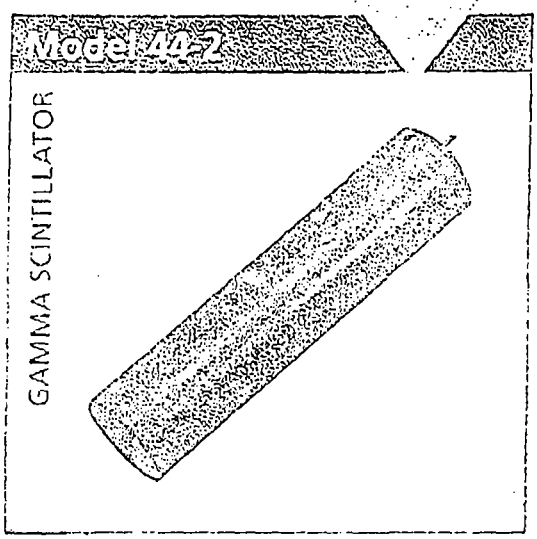
0-2,000 mR/hr total range

Common Specifications

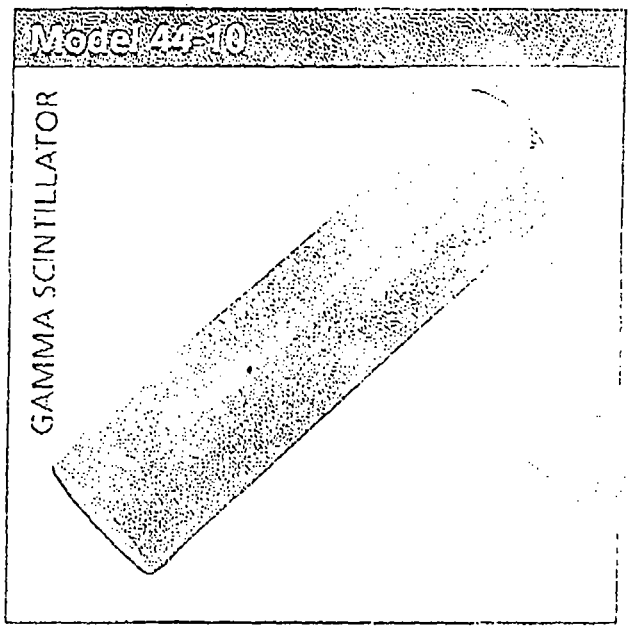
COMPATIBLE DETECTORS: G-M, scintillation
THRESHOLD: 30 mV ± 10 mV
SIZE: 6.5" (16.5 cm)H X 3.5" (8.9 cm)W X 8.5" (21.6 cm)L
WEIGHT: 3.5 lbs (1.6 kg) including batteries

	MODEL 3	MODEL 14C
METER DIAL (others available)	0 - 2 mR/hr, or 0 - 5k cpm, BAT TEST	0 - 2 mR/hr and cpm, BAT TEST
MULTIPLIERS	X0.1, X1, X10, X100	X0.1, X1, X10, X100, X1000
INTERNAL DETECTOR	N/A	Energy compensated G-M *(used with X1000 range only)*
ENERGY RESPONSE	Dependant on detector used	Within ± 15% of true value between 60 keV - 3 MeV *(internal detector only)*
HIGH VOLTAGE	Adjustable from 200-1500 volts	900 V

Model 44-2



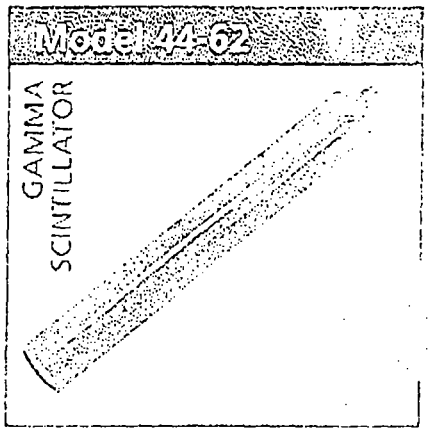
Model 44-10



Common Specifications

INDICATED USE: High energy gamma detection
ENERGY RESPONSE: Energy dependant
COMPATIBLE INSTRUMENTS: General purpose survey meters, ratemeters, and scalers
OPERATING VOLTAGE: 500 - 1200 volts

Model 44-62



	44-2	44-10	44-62
SCINTILLATOR	1"(2.5cm) diameter 1"(2.5cm) thick NaI	2"(5.1cm) diameter 2"(5.1cm) thick NaI	0.5"(1.3 [illegible] diameter 1"(2.5cm) thick NaI
SENSITIVITY	Typically 175 cpm/uR/hr ([illegible]Cs gamma)	Typically 900 cpm/uR/hr ([illegible]Cs gamma)	Typically 49 cpm [illegible] ([illegible] Cs gamma)
TUBE	1.5"(3.8cm) diameter magnetically shielded photomultiplier	2"(5.1cm) diameter magnetically shielded photomultiplier	0.5"(1.3cm) diameter magnetically shielded photomultiplier
DYNODE STRING RESISTANCE	100 megohm	60 megohm	100 megohm
SIZE	2"(5.1cm) diameter 7.3"(18.5cm)L	2.6"(6.6cm) diameter 11"(27.9cm)L	0.9"(2.3cm) diameter 7.8"(19.7cm)L
WEIGHT	1 lbs (0.5kg)	2.3 lb (1.1kg)	0.3 lbs (0.1kg)

161 E. GRAND ASSOCIATES
161 E. Grand
Chicago, Il. 60611

12/30/00

Mr. Tom Duff
Optimus Inc.
161 E. Grand
Chicago, Il. 60611

I hereby acknowledge the receipt of the Environmental File concerning the Property known as 161 E. Grand , Chicago, Il.

_____

Tom Duff

Ron Steele 0.0011

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

REPLY TO ATTENTION OF:

Preliminary Report at 161 East Grand Avenue

Chicago, Illinois

November 17 and 24, 1980

By

Larry Jensen

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Radiation Program

There have been recurring reports that the building at 161 East Grand Avenue, Chicago, Illinois, is radioactively contaminated with residual materials from the thorium oxide lantern mantle operations of the former Lindsay Light Company. These reports began to surface as the historical origins of the Kerr-McGee Chemical Corporation's rare earths operation in West Chicago, Illinois, were traced. The West Chicago site has considerable thorium and uranium contamination associated with its factory and waste disposal operations. The first occupant of that site to use radioactive materials was Lindsay Light Company which moved its operations from downtown Chicago to West Chicago in 1931-32. The downtown Lindsay site was determined to be at 161 East Grand Avenue by the stone nameplate afixed to the building. The immediate impetus for a survey of the building was a report by Radiation Safety Services, Inc., that they had measured elevated radiation levels there while visiting their messenger service. Ironically, with all the attention the building has received, no thorough survey has ever been performed on the premises until U.S. Environmental Protection Agency (EPA) took the initiative.

Overview of Survey Procedure

Two separate data collections were made - the first as a general building survey on November 17, 1980, and the second for further specific measurements on November 24, 1980. Survey personnel from the U.S. Environmental Protection Agency and the Illinois Department of Nuclear Safety (IDNS) are given in the attachments to this report as are instruments used in the survey. (Tables A,B)

In the November 17, survey a sodium iodide scintillation crystal was used to locate points of elevated gamma exposure rate. Dose rate readings were then taken on contact with the surface using a microroentgen (uR) meter by the EPA and with a tissue equivalent multiplying ion chamber by the IDNS. EPA readings are shown on the attached floor plans (Figures A-D). Two dry smears were taken in the basement and were read with an alpha scintillation probe.

In the November 24, survey EPA returned to Room 202 where numerous elevated readings were obtained earlier. A portable multi-channel analyzer with a 3"x4" sodium iodide scintillation crystal was used to obtain a gamma spectrum from one of the most elevated exposure points on the floor. Air samples were taken in Room 202 and above in Room 302 (background) and the filters were read with an alpha scintillation counter. Further and more extensive exposure rate readings were taken in Room 202 and the adjacent hallway.

Radiation Reference Levels

Judgements on the measured values can be made by reference to:

(1) an ambient background in the building of about 20-30 uR/hr,

(2) a contact value with the uR meter of 25 uR/hr on two Coleman brand lantern mantles,

(3) the limits for the general population in unrestricted areas as given in Title 10 Part 20.105 of the Code of Federal Regulations (10 CFR 20.105).

Whole Body Doses

500 mrem/year

100 mrem/week (7 consecutive days)

2 mrem/hour

These would be equivalent to hourly gamma exposure rates of :

500 mrem/year ⇒ 250 uR/hour	(2000 hour work year)
100 mrem/week ⇒ 600 uR/hour	(168 hours work week)
2 mrem/hour ⇒ 2000 uR/hour	(1 hour work exposure)

(4) the limits for the general population in unrestricted areas as given in Part D Section D1.05 of the Illinois Rules and Regulations for Protection Against Radiation

100 mrem/week (7 consecutive days)

2 mrem/hour

It is the intent of this section to limit whole body exposures to less than 500 mrem/year as in the Federal Regulations.

General Comments

On these bases there are numerous spots of contamination on the first and second floors and in the basement. These should be viewed in the context that a spot may not be able to expose the whole body, that a collecton of spots may expose the whole body at some average value, and that a person may not remain at a given spot for the entire time required to obtain the exposure limit. The contamination appears to be thorium and possibly uranium. Again, see the attached floor plans (Figure A-D). The most extensive region of contamination is in Room 202 and the adjacent hallway. This is measurable in the first floor office space below. Also, there are several other localized spots of contamination on the first floor and in the basement. Only one localized spot of contamination was found on the third floor and none were found on the fourth floor. Swipes in the basement showed that any alpha contamination was not removable. Alpha contamination in the air of Room 202 was evident when compared to readings in the room above.

Specific Comments

Room 202 and Vicinity

Room 202 and adjacent hallway showed numerous localized spots of contamination. These rise to 800 uR/hr on contact in the receptionist's area and to 1100 uR/hr on contact in the conference room. The contamination may extend into the office across the hall but we could not access that room at the time of our survey. Hallway exposure rates reached 825 uR/hr on contact. Movement of a survey meter several inches can significantly alter the exposure rate readings. This indicates spottiness where material may have been spilled, tracked by shoes or lodged in floor cracks. A spectrum obtained with the multi-channel analyzer showed definite peaks for Tl-208 near 583 KeV, 2614 KeV and 3198 KeV. Peaks near 1120 KeV and 1764 KeV are possibly Bi-214. The former would indicate thorium as would be expected with lantern mantles, the latter uranium. Spectrums are included in the appendix as is the Cs-137 peak at 661 KeV used for calibration (Figures E). No background spectrum was available because of time constraints on being in the building but to insure as little background impact as possible the spectrum was obtained over one of the highest exposure rate readings in the receptionist's area. A dose rate reading was also made directly on the seat used by the receptionist because this general area showed elevated readings and because a person might spend significant portions of a work day at this location. We measured 130 uR/hr including background at the seat level, roughly 40% of the dose rate necessary to give the 10 CFR 20.105 limit for annual exposure (500 mrem) to the general population in unrestricted areas when a background of 20-30 uR/hr is subtracted.

An air sample was also obtained with a Gelman glass fiber filter. The alpha level in Room 202 was about 3.5 times as high as the alpha level measured in Room 302, the background area (Table C). Because the surveys took place at night we were not able to wait the normal four hours after collection to take a reading and determine a concentration. Elevated alpha levels would be consistent with the emission of daughter products from thorium and uranium.

Our recommendation for this area is that remedial action is necessary to remove the contamination present. There are unnecessary exposures being taken by people in this work area both by whole body gamma exposure and by inhalation of alpha particles in the air. This situation is inconsistent with the prudent health physics philosophy of keeping exposures As Low As Reasonably Achievable (ALARA) and may also be inconsistent with the legal 10 CFR 20.105 limit and with the intent of the Illinois Rules and Regulations for Protection Against Radiation.

First Floor

The first floor receptionist's area showed elevated gamma exposure levels but these increased with height, indicating that the second floor above was the source. However, there are two spots in the office nearest the building entrance on Grand Avenue that are attributable to the first floor. These are the pipe in the office corner and the wall behind the Norfolk Pine, about 10 feet to the east of the pipe. A desk straddled these two points indicating occupancy may be high in this area. The high level of 380 uR/hr on contact indicates cleanup should definitely be instituted.

Basement

The basement area shows localized spots of contamination as on the other floors. This is most extensive in Room 12. The highest readings are near the sink in the back of Room 1. The piping near the restrooms in the front portion of this room also shows somewhat elevated readings and could be associated with contamination in the piping. While occupancy may be low in the basement there is no way of knowing to what use these areas might be put in the future. The piping should be checked further and cleanup of higher exposure rate spots in the basement should be instituted.

Recommendation for a Comprehensive Survey

The surveys performed on November 17 and 24, were aimed at investigation the numerous allegations of radioactive contamination in this building. It was our intent to identify if a real problem existed and, if so, to identify the general extent and to possibly identify the contaminating radionuclides present. Based upon the data collected at this point there is sufficient reason to recommend a comprehensive survey of the entire building. Such a survey would have two primary goals.

(1) A background radiation level for the building environment must be set. This would be the basis for identifying deviations from the norm in other parts of the building and for defining where this required remedial action.

(2) The points of elevated radiation readings must be specified completely. This should include such information, but not be limited to, the dose rate levels at contact and at one meter off the surface, the type of radiation being emitted (alpha, beta, gamma), the radionuclide source of such emissions, and whether the emissions are removable and are capable of inhalation.

Such a comprehensive survey could be performed at times when the building is not normally occupied so as not to disturb normal operations.

The results of a comprenensive survey will determine whether further actions are required. If so, critical areas can be targeted and applicable standards for remedial action specified. The primary goal for any remedial action would be to restore affected areas of the building to unrestricted levels so as to ensure the health and safety of the occupants and to ensure that usage of the building in the future would not require any restrictions.

TABLE A

Survey Personnel

November 17, 1980

U.S. Environmental Protection Agency

Larry Jensen
Pete Tedeschi
Mike Madigan

Illinois Department of Nuclear Safety

Dave Derenzo

November 24, 1980

U.S. Environmental Protection Agency

Larry Jensen
Mike Madigan

TABLE B

Survey Instrumentation

November 17, 1980

U.S. Environmental Protection Agency

Eberline PRM-5-3	EPA #127371
- 1"x1 NaI Scinillation Crystal	
- AC-3 Alpha Scintillation Probe	
Ludlum Model 19 Micro R Meter	EPA #164325

Illinois Department of Nuclear Safety

Health Physics Instruments Tissue Equivalent Multiplying Ion Chamber

November 24, 1980

U.S. Environmental Protection Agency

D.S. Davidson Model 4106 Multi-channel Analyzer	EPA #164321
- Harshaw 12A12/3A 3"x4" NaI Scintillation Crystal	EPA #101063
Ludlum Model 2200 Sealer	EPA #164320
- Model 43-10 Alpha Scintillation Counter	EPA #164355
Eberline Model RAS-1 Air Sampler	EPA #164349
- Gelman 47mm Glass Fiber Filters	
Ludlum Model 19 Micro R Meter	EPA #164325

TABLE C
Air Sampling in Rooms 202, 302

161 East Grand Avenue, Chicago, Illinois
November 24, 1980

Building was formerly utilized by the Lindsay Light Company

Survey of November 17, 1980, showed portions of the building to have elevated levels of gamma radiation.

Air samples were taken in Room 202 where elevated gamma levels were found and in Room 302 where elevated levels were not present.

Air sampler - Eberline RAS-1 (EPA# 164349)
- Gelman 47 mm glass fiber filters
- 50 liters/minute
Alpha scintillation detector - Ludlum Model 43-10 (EPA# 164355)
Scaler - Ludlum Model 2200 (EPA# 164320)

Room 202			
Time	Counts/minute*	Time	Counts/minute*
6:52 PM	1710	7:09 PM	1819
6:53	1664	7:10	1829
6:54	1659	7:11	1811
6:56	1685	7:13	1834
6:57	1703	7:14	1752
6:58	1683	7:15	1777
7:02	1777	7:16	1883
7:03	1798	7:17	1824
7:04	1802	7:18	1899
7:05	1735	7:19	1857
7:07	1773	7:21	1841
7:08	1847	Average	1781
		Sampling Time 64 minutes	

Blank Filter	
Time	Counts/minute*
7:24 PM	4
7:25	0
7:27	3
Average	2

Room 302	
Time	Counts/minute*
7:35 PM	310
7:38	309
7:39	331
7:40	316
7:41	315
7:42	316
Average	316
Sampling Time 39 minutes	

* Counting time 1 minute

Samples

I. Room 202, Average 1781 counts/minute
Background 2 cpm
Net, Room 202 1779 cpm

Air Sampling Rate 50 liters/minute
Air Sampling Time 64 minutes
Air Sampling Volume 3200 liters = 3.2×10^6 ml

Concentration

$$\frac{1779 \text{ cpm}}{3.2 \times 10^6 \text{ ml}} = 5.56 \times 10^{-4} \text{ cpm/ml}$$

II. Room 302, Average 316 cpm
Background 2 cpm
Net, Room 302 314 cpm

Air Sampling Rate 50 liters/minute
Air Sampling Time 39 minutes
Air Sampling Volume 1950 liters = 1.95×10^6 ml

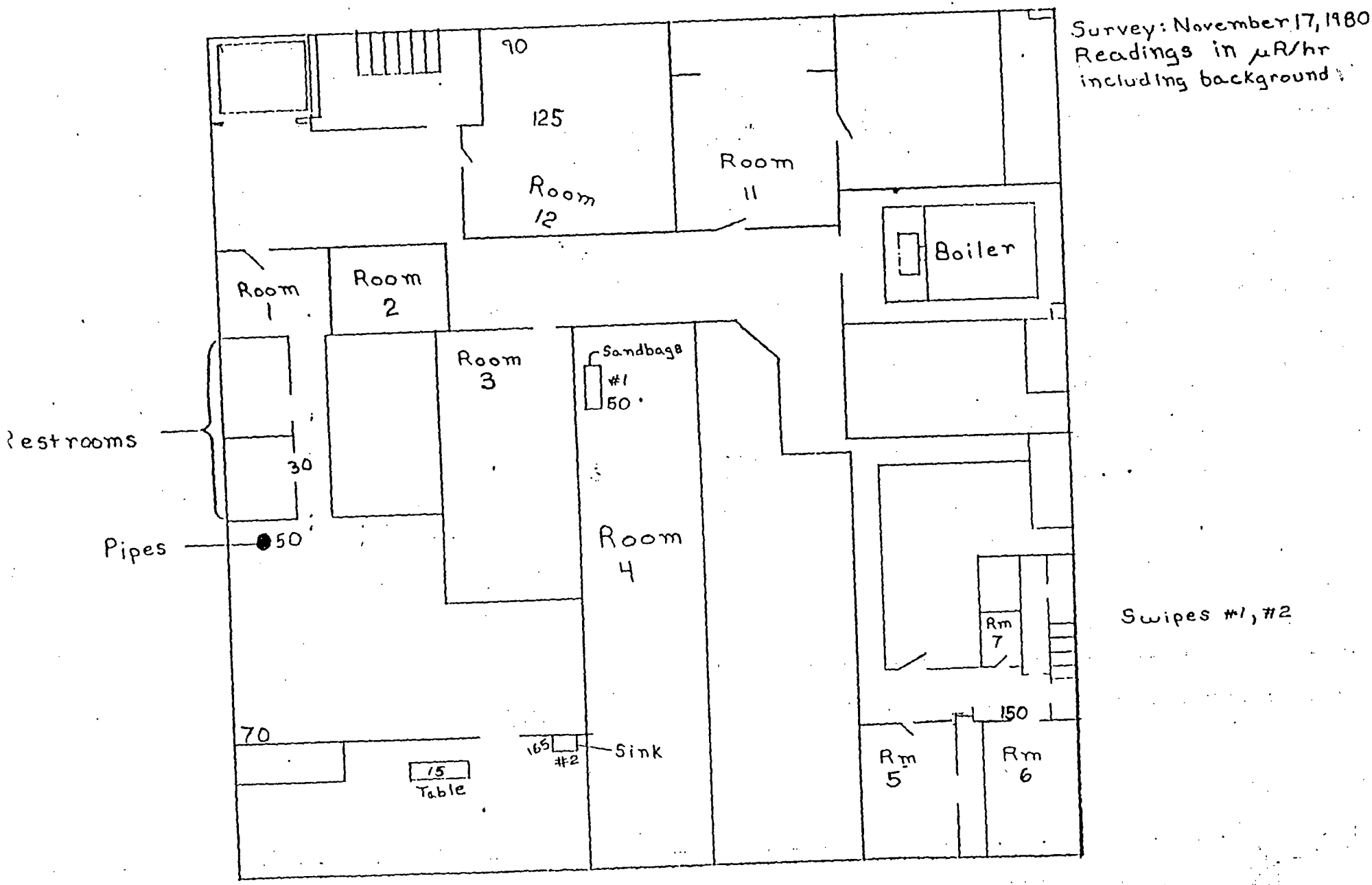
Concentration

$$\frac{314 \text{ cpm}}{1.95 \times 10^6 \text{ ml}} = 1.61 \times 10^{-4} \text{ cpm/ml}$$

III. Relative Concentration

$$\frac{\text{Room 202}}{\text{Room 302}} = \frac{5.56 \times 10^{-4} \text{ cpm/ml}}{1.61 \times 10^{-4} \text{ cpm/ml}} = 3.45$$

Figure A

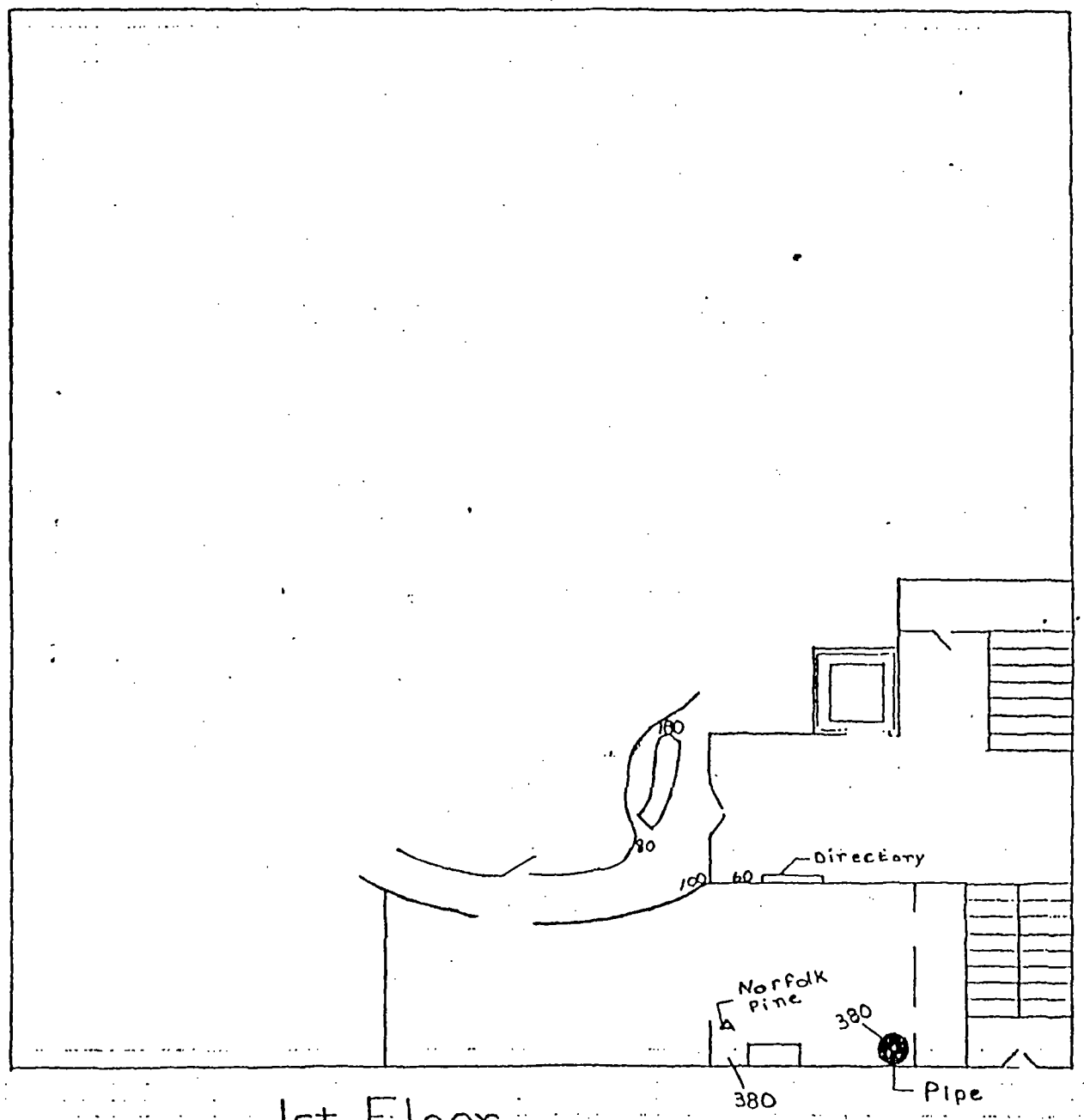


Basement
Grand Avenue

0 0021

Figure B

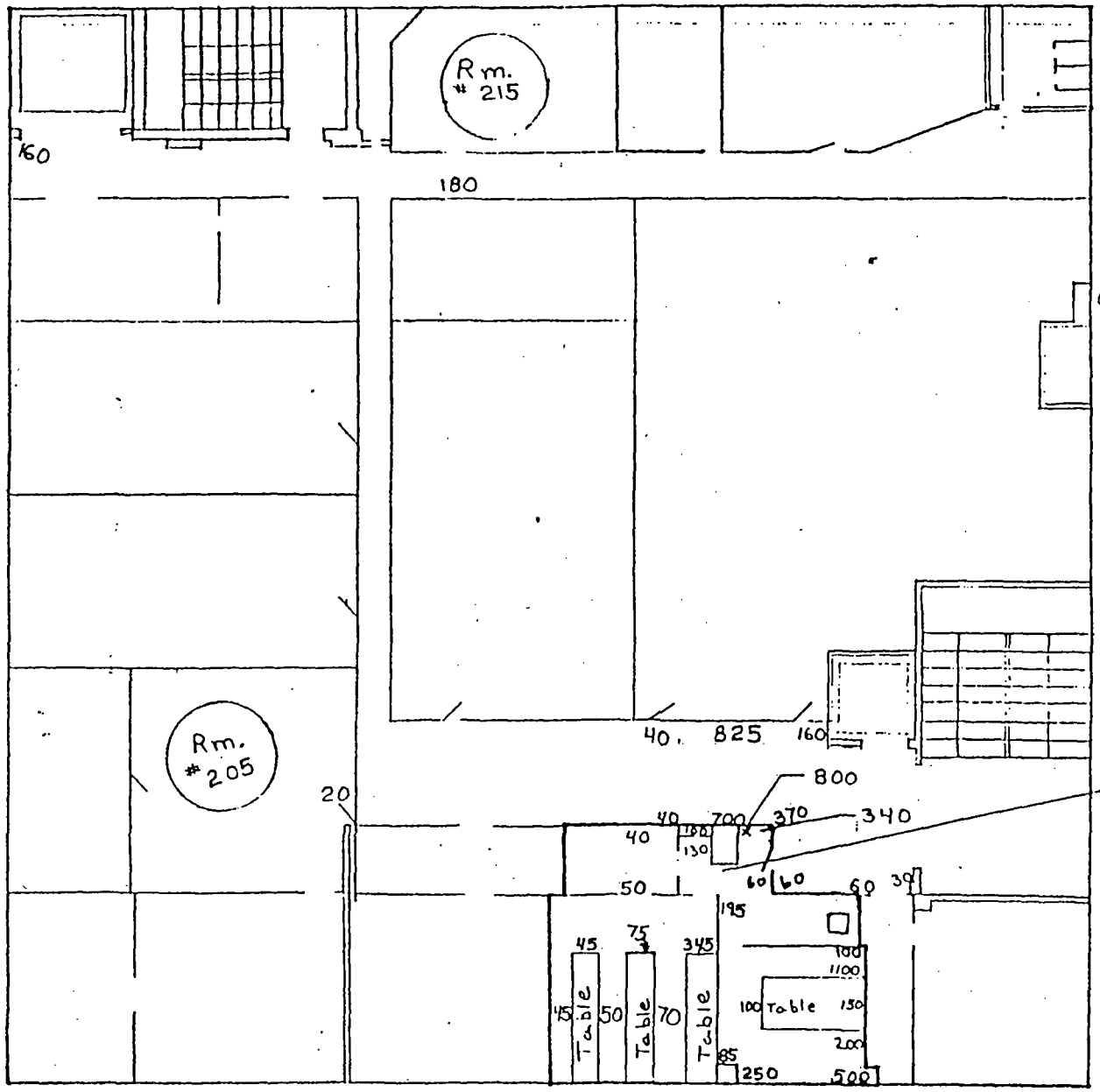
Survey: November 17, 198
Readings in μR/hr
Including background



1st Floor

Grand Avenue

Figure



Surveys: November 17, 1980
November 24, 1980
Readings in μR/hr
including background

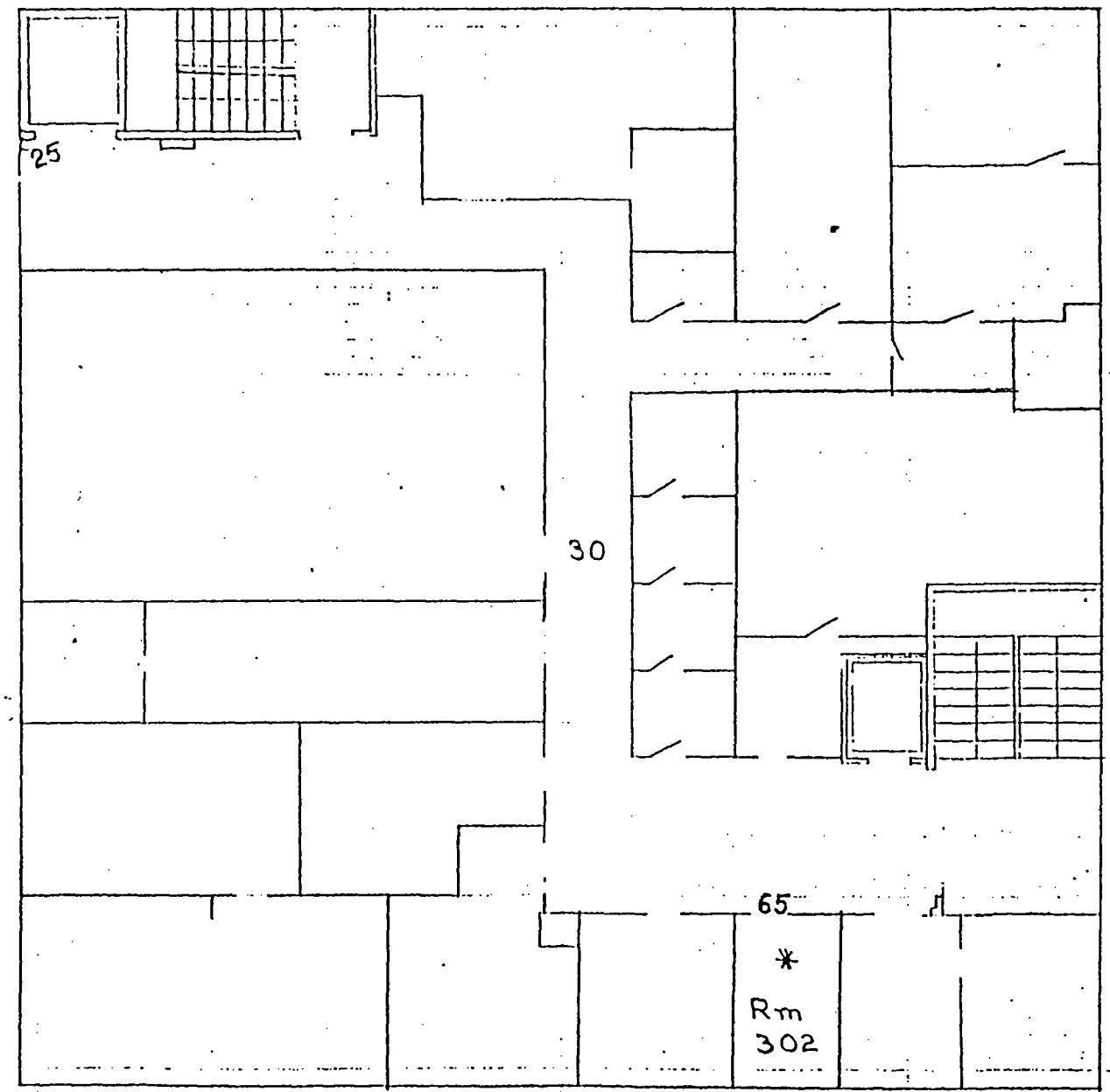
Room 202 and Hallway
readings taken
November, 24, 1980
Others taken November 17, 198

readings in MRH

2nd Floor
Grand Avenue

0 0023

Figure D



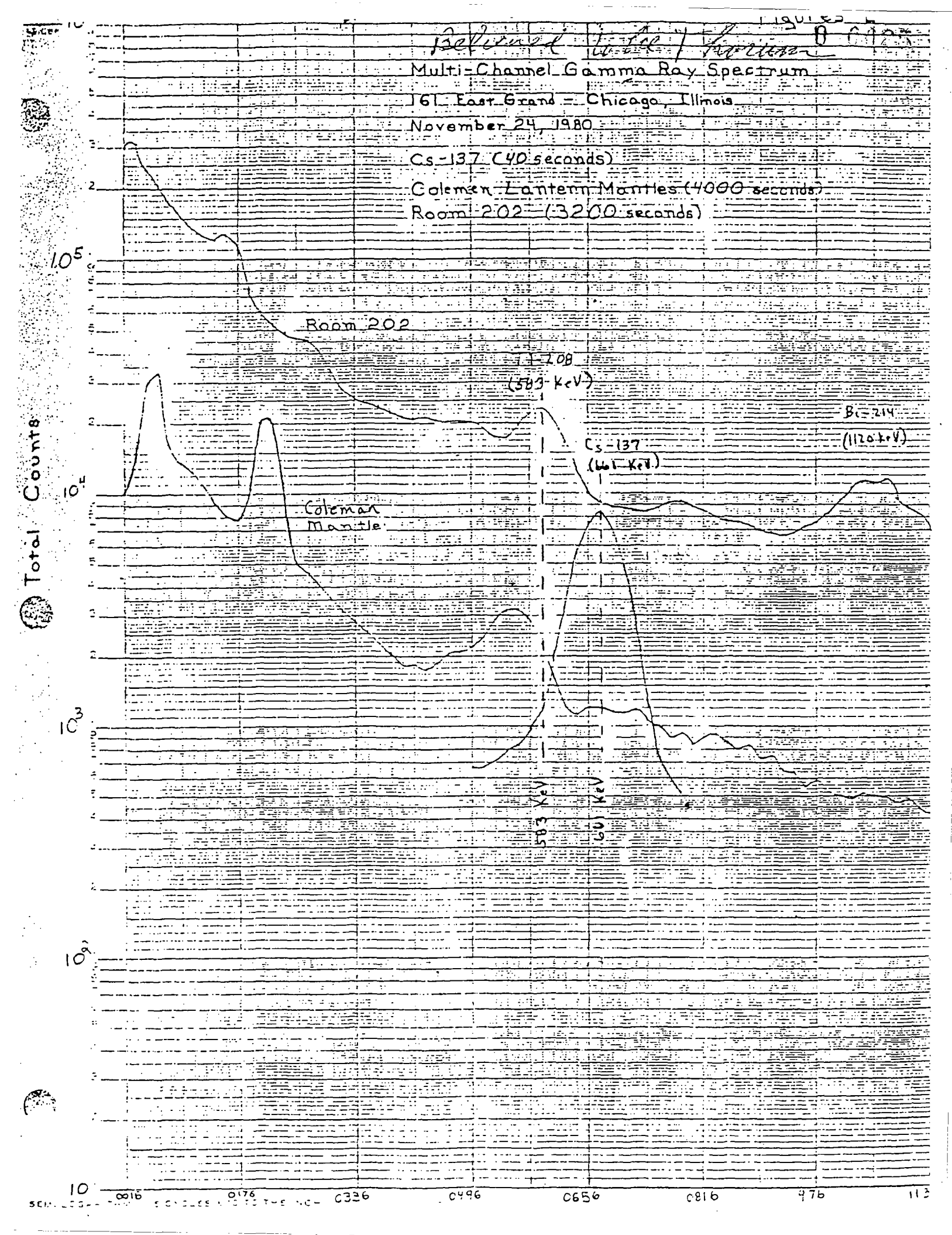
Survey: November 1

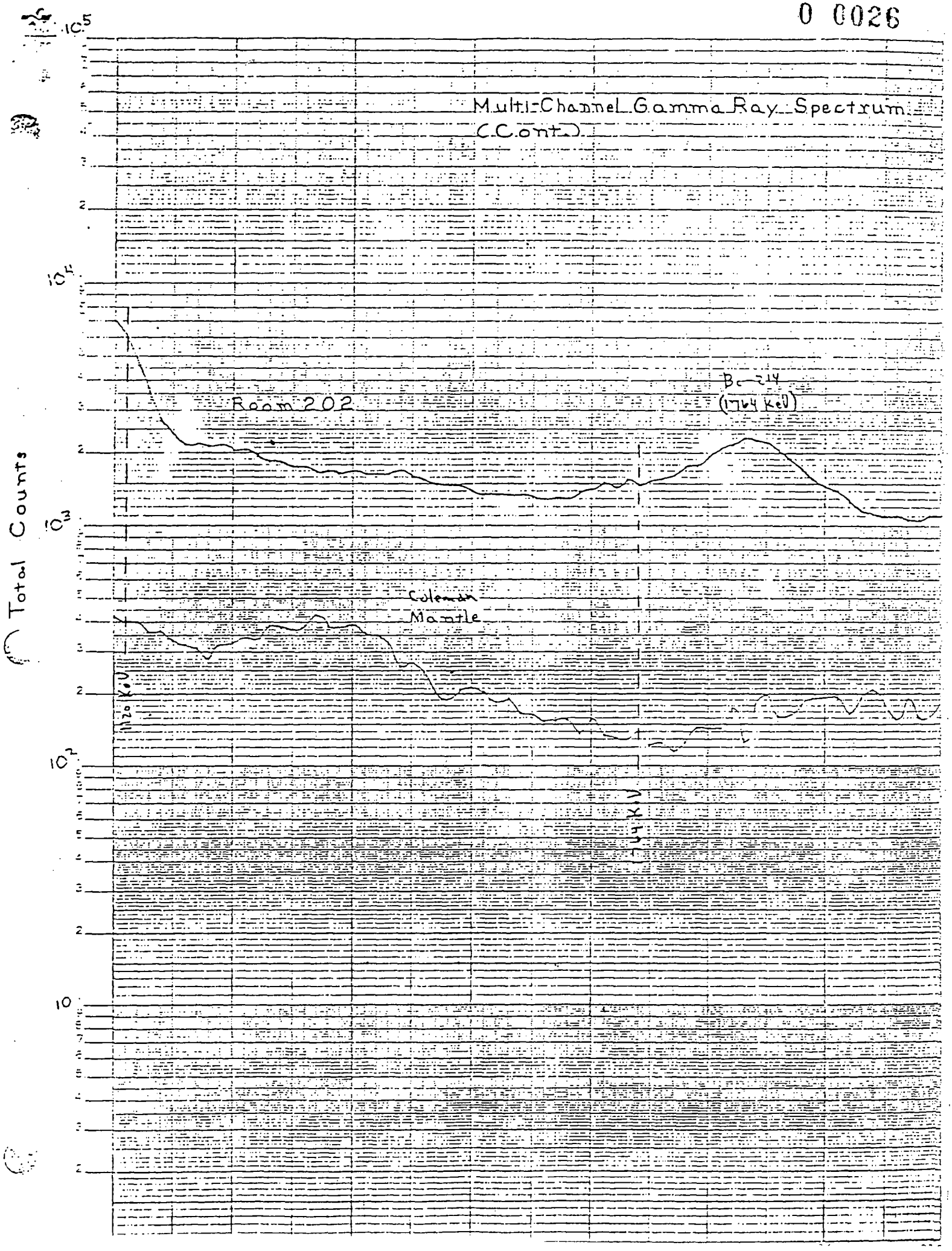
Readings in μR/hr
Including backgro

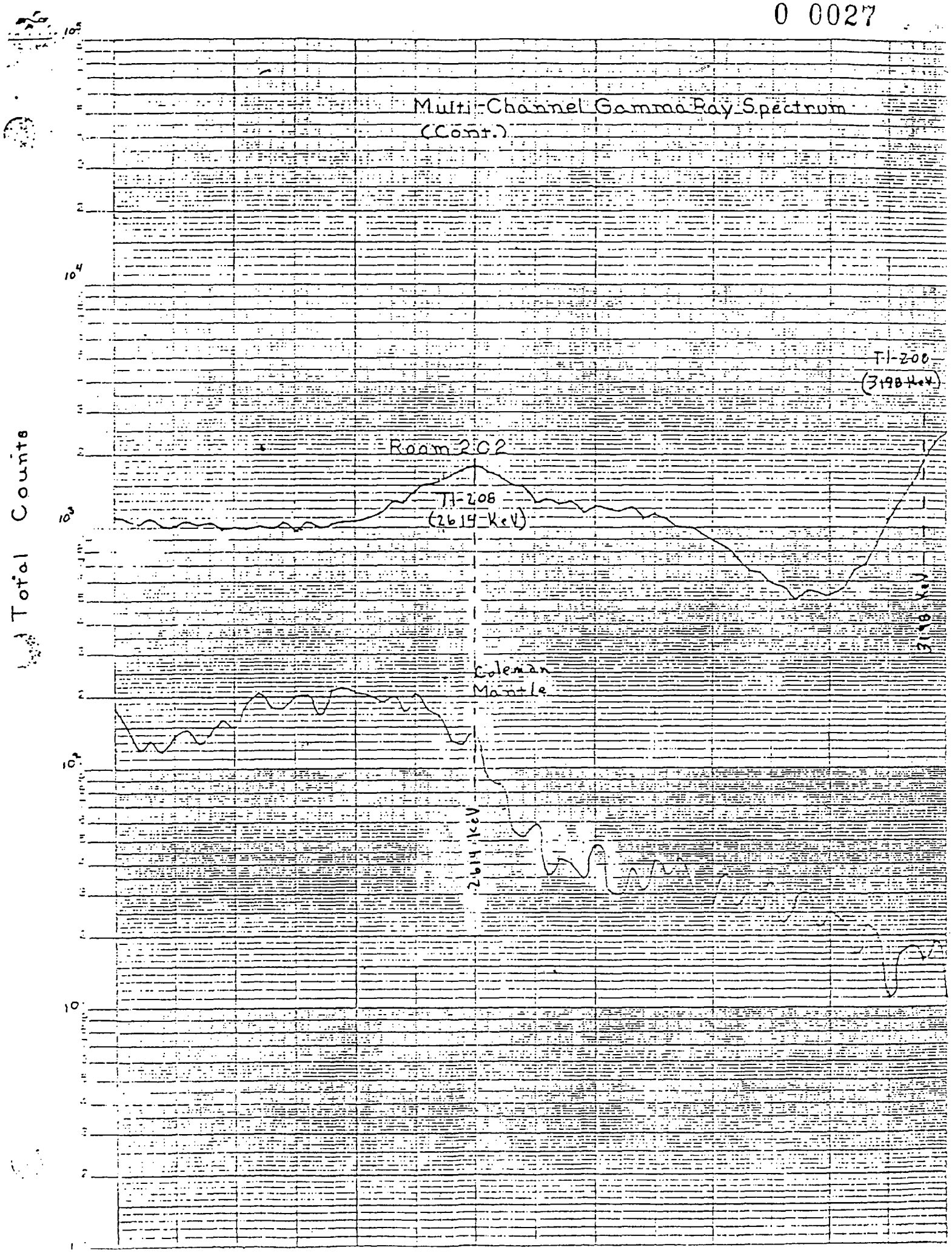
* Air Sampler loc
November 24, 19

3rd Floor

0 0024


Multi-Channel Gamma Ray Spectrum
161 East Grand - Chicago, Illinois
November 24, 1980
Cs-137 (40 seconds)
Coleman Lantern Mantles (4000 seconds)
Room 202 (3200 seconds)
Room 202
Tl-208
(583 KeV)
Bi-214
(1120 KeV)
Cs-137
(661 KeV)
Coleman
Mantle
583 KeV
661 KeV
Total Counts
10^5
10^4
10^3
10^2
10
0016
0176
0336
0496
0656
0816
976


Multi-Channel Gamma Ray Spectrum
(Cont.)
Room 202
Bi-214
(1764 KeV)
Coleman
Mantle
1120 KeV
1764 KeV
Total Counts
10^5
10^4
10^3
10^2
10


Multi-Channel Gamma Ray Spectrum
(Cont.)
Total Counts
Room 202
Tl-208
(2614 KeV)
Tl-200
(3198 KeV)
Coleman
Mantle
2614 KeV
3198 KeV

Multi-Channel Gamma Ray Spectrum
(Cont.)

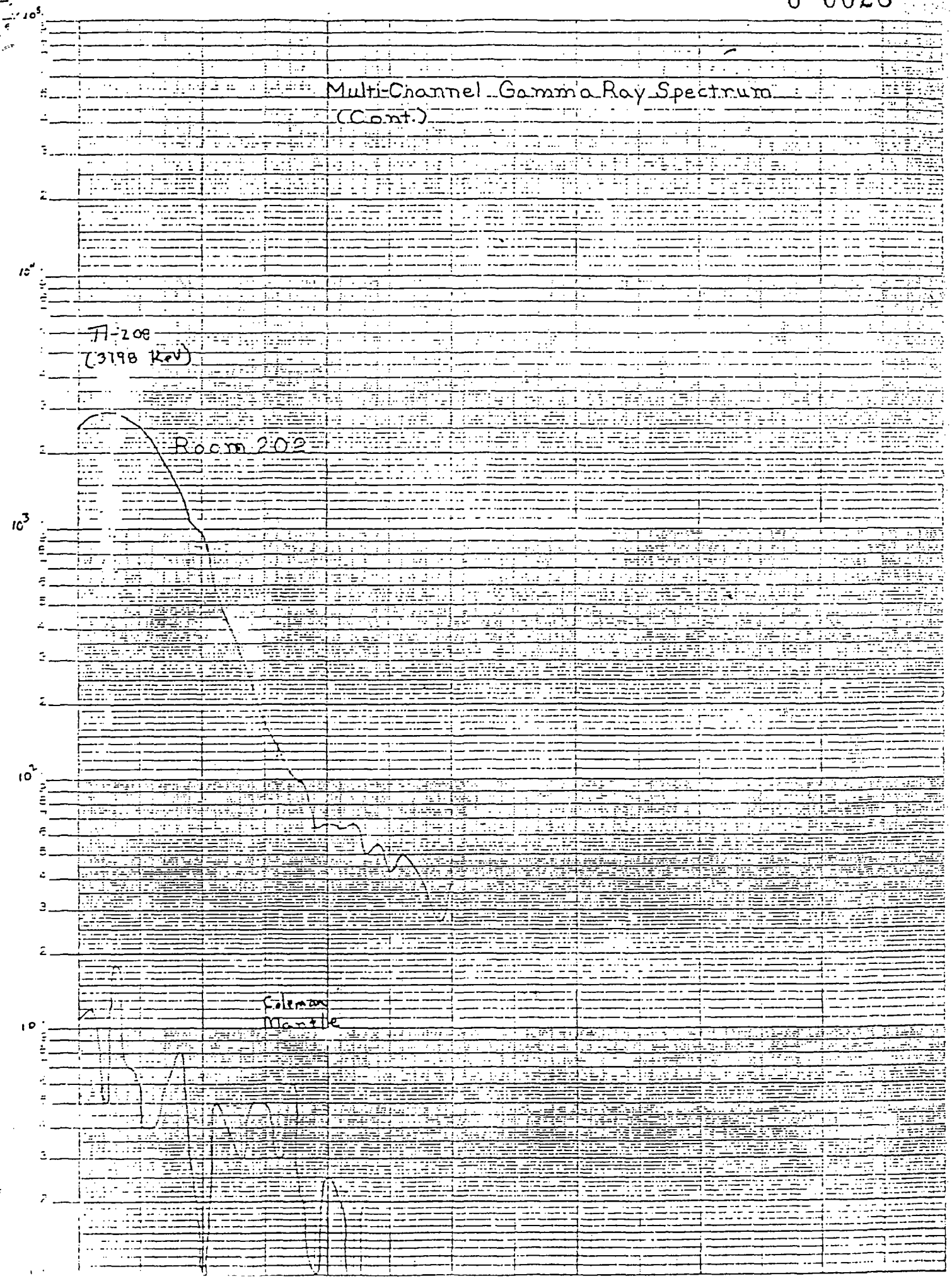


Figure E (Cont.)

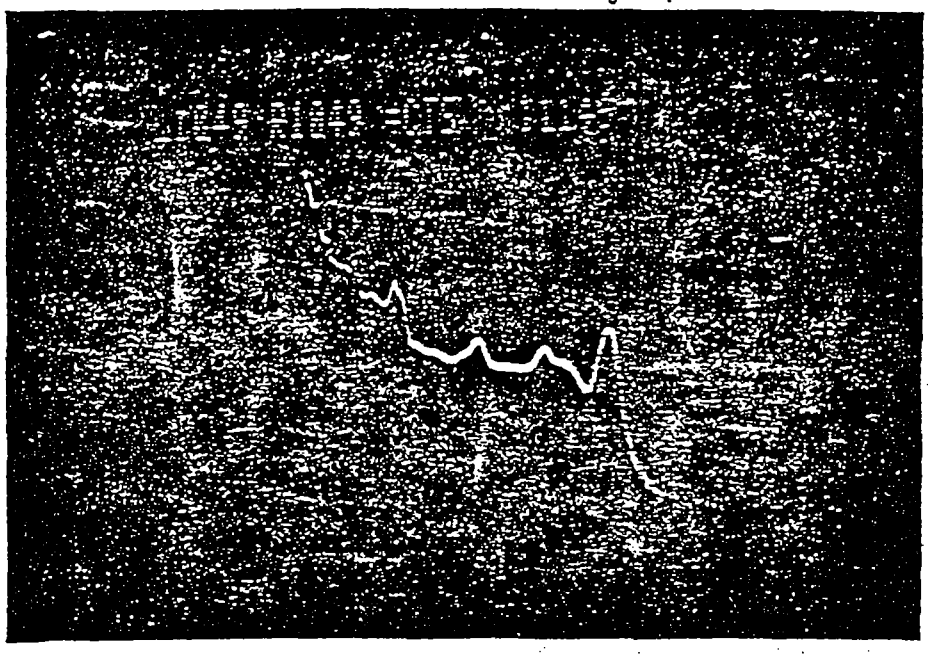
DATE: 11/24/80

TIME: ~7:00 PM

LOCATION: 161 East Grand Ave, Chicago, IL Room 207

CAMERA AIMED:

PHOTOGRAPHER: Larry Jensen



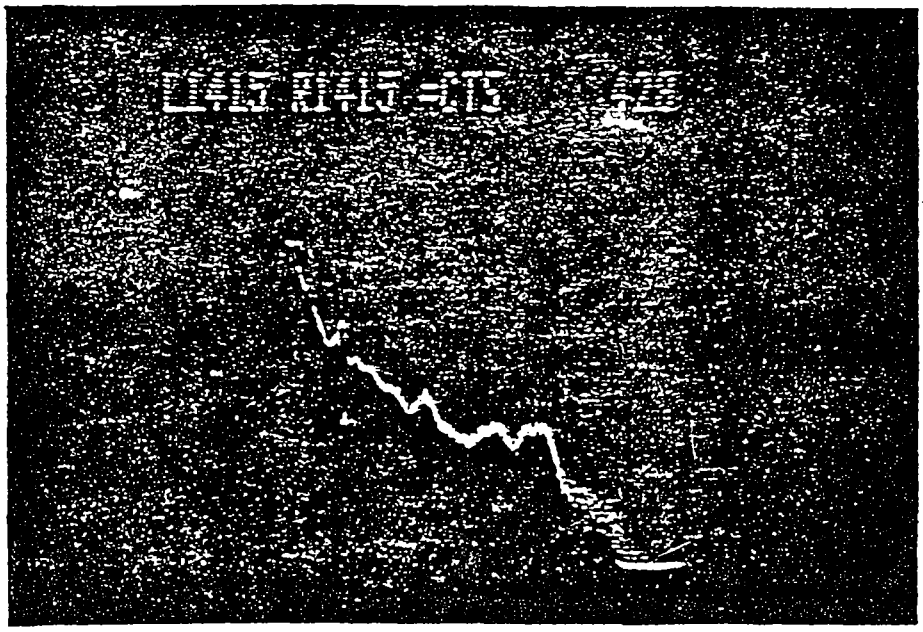
DATE: 11/24/80

TIME: ~9:00 PM

LOCATION: 2 Coleman Lantern Mantles

CAMERA AIMED:

PHOTOGRAPHER: Larry Jensen



Final Report On a Survey of the

Former Lindsay Light Company Building

at

161 East Grand Avenue, Chicago, Illinois

May, 1981

INTRODUCTION

The building at 161 East Grand Avenue, Chicago, Illinois, was formerly utilized by the Lindsay Light Company between 1910 and 1936 to manufacture incandescent gas light mantles with radioactive thorium compounds. No regulations governed the possession and usage of radioactive source and byproduct materials at that time nor were radiation health effects well understood. Consequently, it was suspected the building might still contain residual radioactive contamination.

A series of data collections were performed by the U.S. Environmental Protection Agency, the Occupational Safety and Health Administration and the Illinois Department of Nuclear Safety between November 1980, and March 1981. Residual thorium contamination was found on every floor and in the basement, principally in the northwest and west-central portions of the floors. The contamination manifests itself by elevated gamma ray emissions and by elevated thoron gas working levels in the air. Limited sampling on exposed areas did not show removable alpha particle contamination. Dose measurements made in selected occupied areas were clearly elevated and unwarranted, but fortunately, not in excess of Title 10, Part 20.105 of the Code of Federal Regulations. Prompt cleanup of specific areas is strongly recommended to reduce personnel exposures to levels as low as reasonably achievable.

NOTE

In the interest of clarity, this report has been subdivided into a Main Report and a Technical Appendix. The Main Report is intended for the general public while the The Technical Appendix is, as the name implies, additional supportive technical material intended for persons acquainted with radiation health physics.

SURVEY PARTICIPANTS

Preliminary Survey

U.S. Environmental Protection Agency

Larry Jensen
Pete Tedeschi
Mike Madigan

Illinois Department of Nuclear Safety

Dave Derenzo

Comprehensive Survey

U.S. Environmental Protection Agency

Larry Jensen
Carl Onesti

Occupational Health and Safety Administration

Craig Henderson

MAIN REPORT

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I. SPECIFICATION OF THE SITE

Lindsay Light Company once manufactured incandescent gas mantles for home and street lighting in a building on the southwest corner of Indiana and St. Clair Streets from at least 1910 until 1936. During that time span (on April 14, 1913, to be exact) Indiana Street became Grand Avenue. Grand Avenue is half a mile north of the central Chicago "Loop" area and St. Clair Street is a quarter of a mile west of Lake Michigan. Today, at 161 East Grand Avenue, a greystone nameplate four stories up still reads Lindsay Light Company although the company moved to West Chicago, Illinois over the period 1931-36. The building is jointly owned by the 161 East Grand Co-op and managed by Browne and Storch, a real estate firm. Representative of the tenants in the building are film, video tape and sound production firms, an architect, an insurance investigator, and a locksmith.

II. RECOGNITION OF A POSSIBLE RADIATION PROBLEM

Interest in the Lindsay Light Company did not arise directly but grew through events 30 miles west of the "Loop" in suburban West Chicago, Illinois. A rare earths *extraction operation run by Kerr-McGee Chemical Corporation had terminated operations in 1973 and the company had asked to be released from its Nuclear Regulatory Commission (NRC) license. Subsequent surveys showed the factory buildings were extensively contaminated and several million pounds of radioactive materials, principally thorium with some uranium, were exposed in an open waste dump.

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*The rare earths are elements 58-71 in the Periodic Table of the Elements, from cerium to lutetium, and are used, to give two examples, for grinding compounds and high strength magnets. Ironically, they are quite abundant.

In writing a decommissioning plan for the NRC to deal with this situation, Kerr-McGee noted that they had purchased the facility from American Potash and Chemical Corporation in 1967, which, in turn, had purchased their operation from Lindsay Light and Chemical Company in 1958. Lindsay first occupied the West Chicago site in 1931 when they expanded their operations from downtown Chicago and changed their name to Lindsay Light and Chemical Company. Between 1931 and 1936, they fully translocated from Grand Avenue to West Chicago. Interest aroused by the West Chicago problem led to curiosity about the earlier Lindsay site. "Was it also radioactively contaminated?" The building was found to be located at Grand and St. Clair (By whom and how has not been determined). No records, however, have been identified showing any building surveys were made then. The Chicago Tribune newspaper apparently found out about the building through the West Chicago situation and referred to it in a series on radioactive waste in October 1978. The first indication that there might actually be residual materials left in the building came from Radiation Safety Services, Inc., a health physics consulting firm, that reported in the fall of 1980 that they had measured radioactivity in the halls while visiting their messenger service. At this point EPA arranged for a survey of the building. This was the subject of the "Preliminary Report on 161 East Grand Avenue Chicago, Illinois, November 17, and 24, 1980."

III. BACKGROUND INFORMATION ON GAS LIGHT MANTLE MANUFACTURE

The problems with Lindsay arose because thorium compounds used in the manufacture of gas mantles contain some atoms of the Thorium Decay Series, a naturally occurring sequence of radioactive elements starting with thorium-232 and radioactively decaying to lead-208 (see Fig. 1).

Figure 1

Thorium Series (4n)*

0 0037

Nuclide	Historical name	Half-life	Major radiation energies (MeV) and intensities† α	β	γ
$^{232}_{90}Th$	Thorium	1.41×10^{10} y	3.95 (24%) 4.01 (76%)	---	---
$^{228}_{88}Ra$	Mesothorium I	6.7y	---	0.055 (100%)	---
$^{228}_{89}Ac$	Mesothorium II	6.13h	---	1.18 (35%) 1.75 (12%) 2.09 (12%)	0.34c‡ (15%) 0.908 (25%) 0.96c (20%)
$^{228}_{90}Th$	Radiothorium	1.910y	5.34 (28%) 5.43 (71%)	---	0.084 (1.6%) 0.214 (0.3%)
$^{224}_{88}Ra$	Thorium X	3.64d	5.45 (6%) 5.68 (94%)	---	0.241 (3.7%)
$^{220}_{86}Rn$	Emanation Thoron (Tn)	55s	6.29 (100%)	---	0.55 (0.07%)
$^{216}_{84}Po$	Thorium A	0.15s	6.78 (100%)	---	---
$^{212}_{82}Pb$	Thorium B	10.64h	---	0.346 (81%) 0.586 (14%)	0.239 (47%) 0.300 (3.2%)
$^{212}_{83}Bi$	Thorium C	60.6m	6.05 (25%) 6.09 (10%)	1.55 (5%) 2.26 (55%)	0.040 (2%) 0.727 (7%) 1.620 (1.8%)
64.0% / 36.0%					
$^{212}_{84}Po$	Thorium C' ^{212}Po	304ns	8.78 (100%)	---	---
$^{208}_{81}Tl$	Thorium C'' ^{208}Tl	3.10m	---	1.28 (25%) 1.52 (21%) 1.80 (50%)	0.511 (23%) 0.583 (86%) 0.860 (12%) 2.614 (100%)
$^{208}_{82}Pb$	Thorium D	Stable	---	---	---

*This expression describes the mass number of any member in this series, where n is an integer.
Example: $^{232}_{90}Th$ (4n).....4(58) = 232

†Intensities refer to percentage of disintegrations of the nuclide itself, not to original parent of series.

‡Complex energy peak which would be incompletely resolved by instruments of moderately low resolving power such as scintillators.

Data taken from: Lederer, C. M., Hollander, J. M., and Perlman, I., Table of Isotopes (6th ed.; New York: John Wiley & Sons, Inc., 1967) and Hogan, O. H., Zigman, P. E., and Mackin, J. L., Beta Spectra (USNRDL-TR-802 [Washington, D.C.: U.S. Atomic Energy Commission, 1964]).

Some uranium, more specifically the Uranium Decay Series, might have been present as a contaminant (see Fig. 2). It is probably safe to say that the thorium was not given special handling. Little was known of the health effects associated with radiation exposure at the time nor was there a regulatory system to provide an oversight function. As a result solutions and powders of thorium compounds were probably not treated with tidiness and caution. At this point a short diversion to explain the mantle making process may be helpful.

Mantles were generally woven from cotton, ramie, or artificial silk fibers in the form of a long tube. The tubes were treated with a solution containing 25-50% thorium and cerium nitrates (Cerium is one of the rare earths). In treating the tubes the solution was about 98-99 parts thorium to 1-2 parts cerium nitrate. Small quantities of beryllium and magnesium nitrates were also added for strength. Treated tubes were cut to the desired length and one end was closed with asbestos thread. The mantles were fixed with a thorium solution containing considerable alumina and alkaline earths. Once the fixed mantle was dried and shaped it was "burned off" whereby nitrates were converted to oxides by an intense flame. Mantles which survived the flame treatment were dipped in collodion for strength and then sold.*

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*From "Monazite, Thorium, and Cerium", Information Circular 6321, August 1930, Department of Commerce - Bureau of Mines.

Figure 2

Uranium Series (4n + 2)*

Nuclide	Historical name	Half-life	Major radiation energies (MeV) and intensities† α	β	γ
$^{238}_{92}U$	Uranium I	4.51×10^{9}y	4.15 (25%) 4.20 (75%)	---	---
$^{234}_{90}Th$	Uranium X_1	24.1d	---	0.103 (21%) 0.193 (79%)	0.063c‡ (3.5%) 0.093c (4%)
$^{234}_{91}Pa^{m}$	Uranium X_2	1.17m	---	2.29 (98%)	0.765 (0.30%) 1.001 (0.60%)
99.87% | 0.13%					
$^{234}_{91}Pa$	Uranium Z	6.75h	---	0.53 (66%) 1.13 (13%)	0.100 (50%) 0.70 (24%) 0.90 (70%)
$^{234}_{92}U$	Uranium II	2.47×10^{5}y	4.72 (28%) 4.77 (72%)	---	0.053 (0.2%)
$^{230}_{90}Th$	Ionium	8.0×10^{4}y	4.62 (24%) 4.68 (76%)	---	0.068 (0.6%) 0.142 (0.07%)
$^{226}_{88}Ra$	Radium	1602y	4.60 (6%) 4.78 (95%)	---	0.186 (4%)
$^{222}_{86}Rn$	Emanation Radon (Rn)	3.823d	5.49 (100%)	---	0.510 (0.07%)
$^{218}_{84}Po$	Radium A	3.05m	6.00 (~100%)	0.33 (~0.019%)	---
99.98% | 0.02%					
$^{214}_{82}Pb$	Radium B	26.8m	---	0.65 (50%) 0.71 (40%) 0.98 (6%)	0.295 (19%) 0.352 (36%)
$^{218}_{85}At$	Astatine	~2s	6.65 (6%) 6.70 (94%)	? (~0.1%)	---
$^{214}_{83}Bi$	Radium C	19.7m	5.45 (0.012%) 5.51 (0.008%)	1.0 (23%) 1.51 (40%) 3.26 (19%)	0.609 (47%) 1.120 (17%) 1.764 (17%)
99.98% | 0.02%					
$^{214}_{84}Po$	Radium C'	164μs	7.69 (100%)	---	0.799 (0.014%)
$^{210}_{81}Tl$	Radium C"	1.3m	---	1.3 (25%) 1.9 (56%) 2.3 (19%)	0.296 (80%) 0.795 (100%) 1.31 (21%)
$^{210}_{82}Pb$	Radium D	21y	3.72 (.000002%)	0.016 (85%) 0.061 (15%)	0.047 (4%)
$^{210}_{83}Bi$	Radium E	5.01d	4.65 (.00007%) 4.69 (.00005%)	1.161 (~100%)	---
~100% | .00013%					
$^{210}_{84}Po$	Radium F	138.4d	5.305 (100%)	---	0.803 (0.0011%)
$^{206}_{81}Tl$	Radium E"	4.19m	---	1.571 (100%)	---
$^{206}_{82}Pb$	Radium G	Stable	---	---	---

*This expression describes the mass number of any member in this series, where n is an integer.
Example: $^{206}_{82}Pb$ (4n + 2).....4(51) + 2 = 206
†Intensities refer to percentage of disintegrations of the nuclide itself, not to original parent of series.
‡Complex energy peak which would be incompletely resolved by instruments of moderately low resolving power such as scintillators.

Data taken from: Table of Isotopes and USNRDL-TR-802.

IV. SURVEYS

A. Preliminary Survey

The Preliminary Survey was conducted in tandem with the Illinois Department of Nuclear Safety (IDNS) in November, 1980. The report filed on this "Preliminary Report on 161 East Grand Avenue, Chicago, Illinois, November 17 and 24, 1980," concluded that some portions of the building were indeed contaminated with radioactive materials, that the material was thorium, that it did not appear to be removable and that excess alpha radiation appeared in the air in a room with elevated gamma radiation on the floors.

B. Comprehensive Survey

Subsequently, a thorough and more extensive survey was initiated between January and March 1981, this time in conjunction with the Occupational Health and Safety Administration. Each room in the building was surveyed for localized gamma radiation. Thermoluminescent dosimeters were placed in critical occupied locations. Air samples were collected in three rooms and determinations of radon-220 and radon-222* working levels were made.

V. GENERAL SURVEY RESULTS WITHOUT DISCUSSION

A. Building Surveys

a. Preliminary Survey

On November 17 an exploratory survey was performed in the Lindsay building to test the allegations of contamination. EPA requested the assistance of the Illinois Department of Nuclear Safety (IDNS) because of their possible jurisdiction in this matter.

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*Radon-220 and radon-222 are radioactive gases emitted from the Thorium and Uranium Decay Series, respectively (See Figs. 1,2).

EPA used a sodium iodide crystal to detect gamma rays emitted from any contaminated areas and a micro-roentgen (micro-R meter) to measure gamma ray exposure rates in micro-roentgen per hour (uR/hr)(Table TA1 in the Technical Appendix gives complete instrumentation data).

The surveys were performed on the evening of November 17 and 24, so as to minimize both the disruption to normal business operations of the tenants and to avoid generating unnecessary concerns before information was fully collected and analyzed. Surveying in the evening, however, had the drawback of not letting us gain access to each and every room. The basement, 1st floor, accessible portions of the 2nd and 3rd floors, and the 4th floor were surveyed. Resurvey data discussed later in this report should be considered to be better than preliminary survey data because specific information about the character, levels and distribution of contamination were known.

Roughly, the general background of the building was found to be 20-25 uR/hr as measured with the micro-R meter on contact with the surface. Scattered basement areas showed readings elevated over this running to 165 uR/hr on contact with the surface (including background). An area on the 1st floor restricted to the northwest corner of one office and an adjacent pipe showed a reading of 380 uR/hr on contact (including background). Over the 1st floor reception area exposure rate readings increased with height. The most extensive areas of contamination were located on the 2nd floor in Room 202 and the adjoining hallway. A contact reading of 1100 uR/hr (including background) was measured in a conference room. This room was over the 1st floor reception area and was thought to probably explain the increased readings with height measured there. Surveyed portions of the third and fourth floors did not show appreciably elevated readings.

It was concluded from the results of the Preliminary Survey that the allegations of contamination were valid. The material was localized and appeared to be spotty rather than spread over a large area. The latter conclusion was reached because of the rapid changes in surface readings with a small change in distance from the source. A comprehensive survey of the premises was deemed warranted.

b. Comprehensive Survey

On January 22, February 12, February 20 and March 2, 1981, the basement and all four floors were surveyed completely by EPA and the Occupational Health and Safety administration (OSHA). OSHA had, when informed of the preliminary survey results, elected to assist EPA in further surveys. IDNS felt they wished to review the final survey report but declined to spend additional personnel time on this matter. EPA collected air samples on February 24, 25, and 26, and took a gamma ray spectrum on February 24. TLDs were placed on January 22 and collected on March 2.

Each room was walked through with a sodium iodide crystal (See Table TA1 in the Technical Appendix for instrumentation details). Representative readings were taken in every room on contact with the surface and at one meter above the surface with a micro-R meter. Additional readings were taken at points identified by the sodium iodide survey meter to be appreciably elevated over background. Again, background was estimated from the lowest micro-R readings encountered. These ran about 20-25 uR/hr at both contact and one meter, although, 1st floor readings dropped below 20 uR/hr and in some cases were as low as 10 uR/hr.

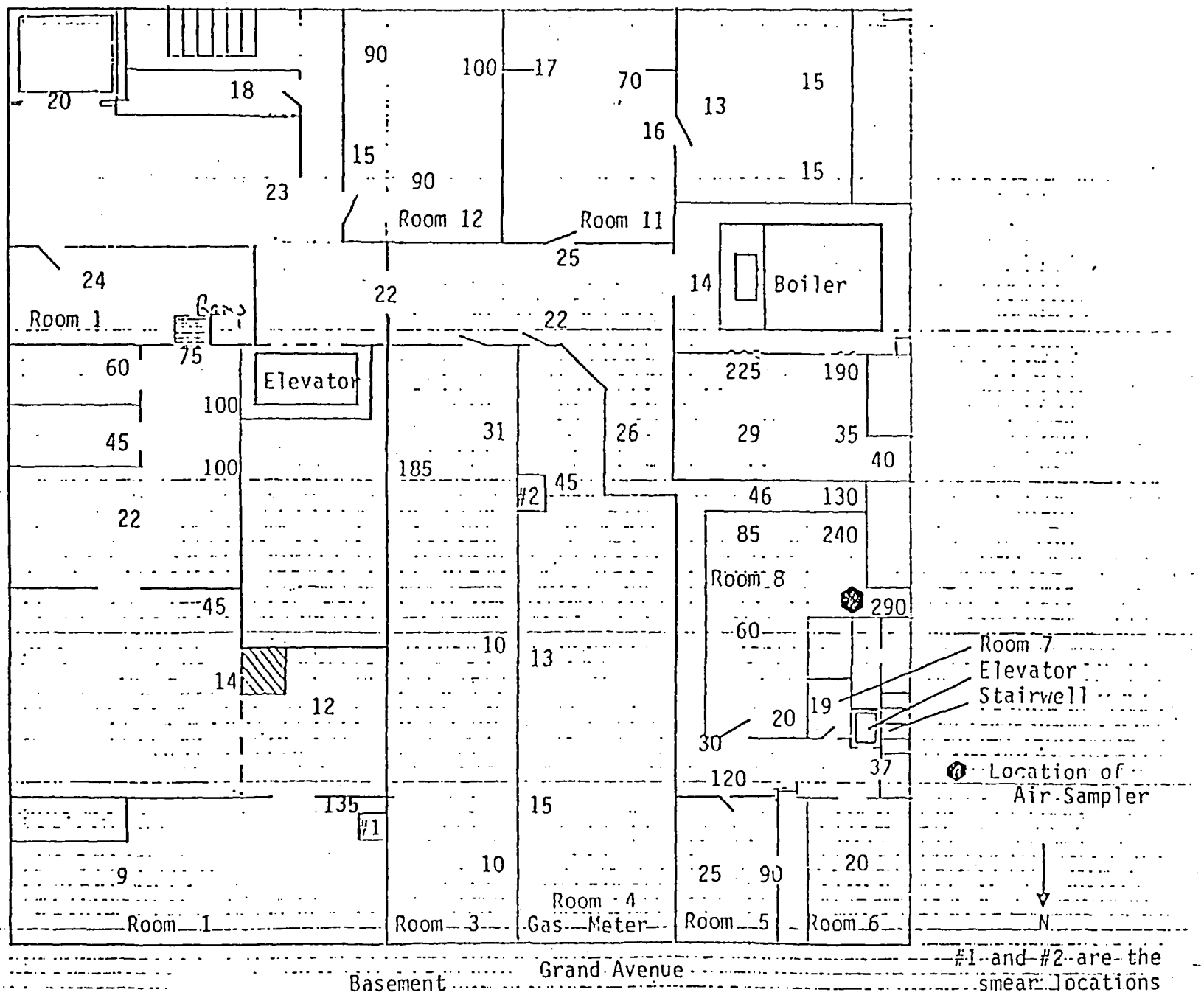
Basement readings are shown in Figs. 3 and 4. Contact readings are highest in Rooms 1,2,8 and 12, in the hallway near Room 5, and in the room adjacent to the boiler. The highest reading in the building was measured in Room 8 where what appeared to be a chimney had been partially plugged with concrete. The chimney reading was 3200 uR/hr on contact with the micro-R meter (including background). The room is used for storage of recording tapes and commercials and is generally not occupied.

First floor background levels (See Fig. 5,6) were in general, the lowest in the building. Elevated gamma ray readings were restricted to two areas, the front reception area and one section of the northwest office. In the reception area it was reaffirmed that exposure readings increased with height indicating an overhead source. In the office area the contamination appeared over 10-15 feet of the wall in the northwest corner and also appeared to be associated with a large vertically standing pipe.

Resurveys of the second floor (See Fig. 7-15) showed almost all contamination to be limited to the northwest corner of the floor comprising Rooms 200, 201, 202, a corner of Room 214, and the adjacent hallway. Roughly the highest readings are on a northwest - southeast line. Two very restricted spots of contamination were found at a pipe hole in the southeast corner of the floor and on a section of floor in the south central hallway.

Figure 3 :Micro - Roentgen Meter Readings , Con' -t With Floor , in Basement

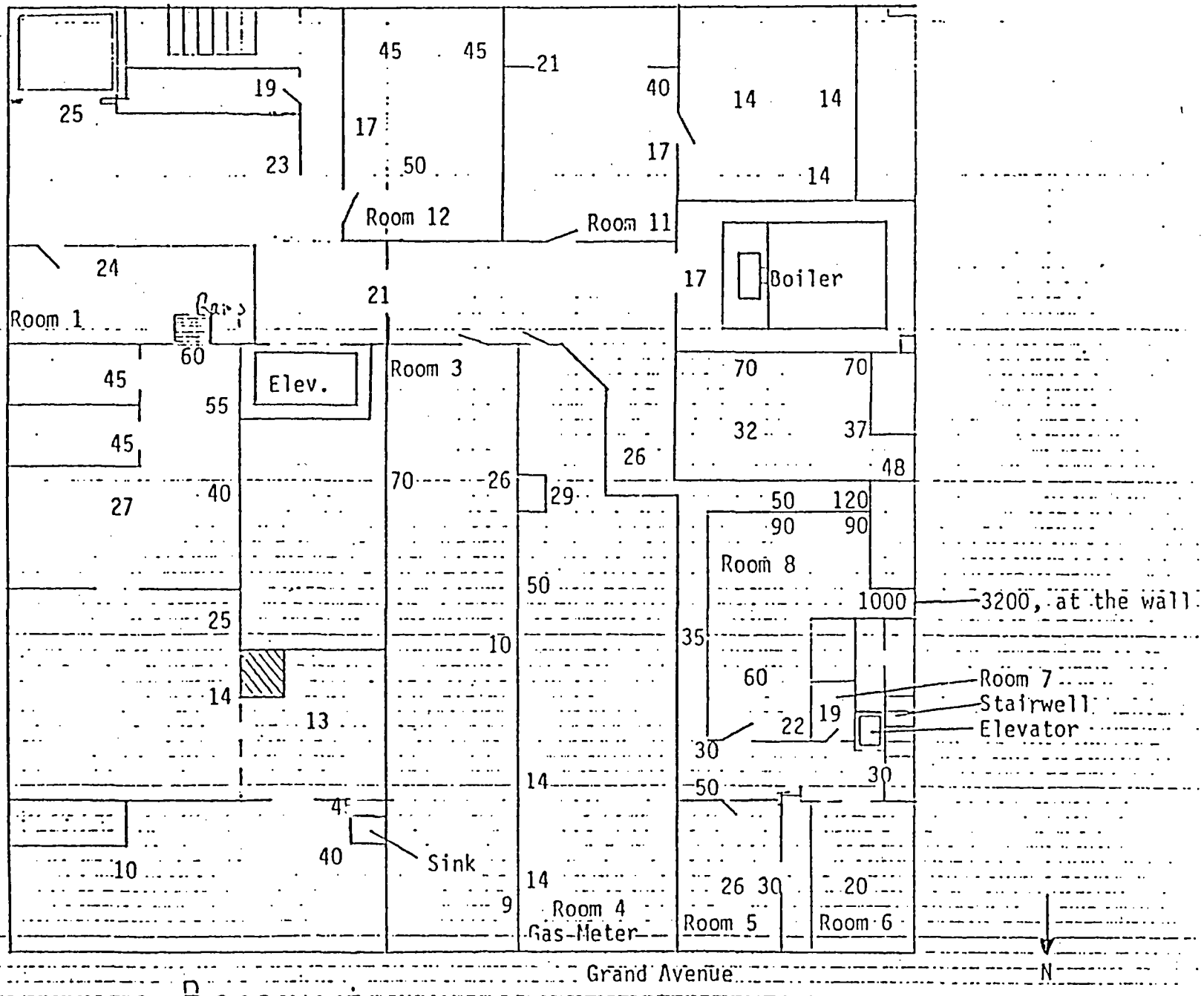
(All readings are in micro - roentgens per hour , uR/hr .)



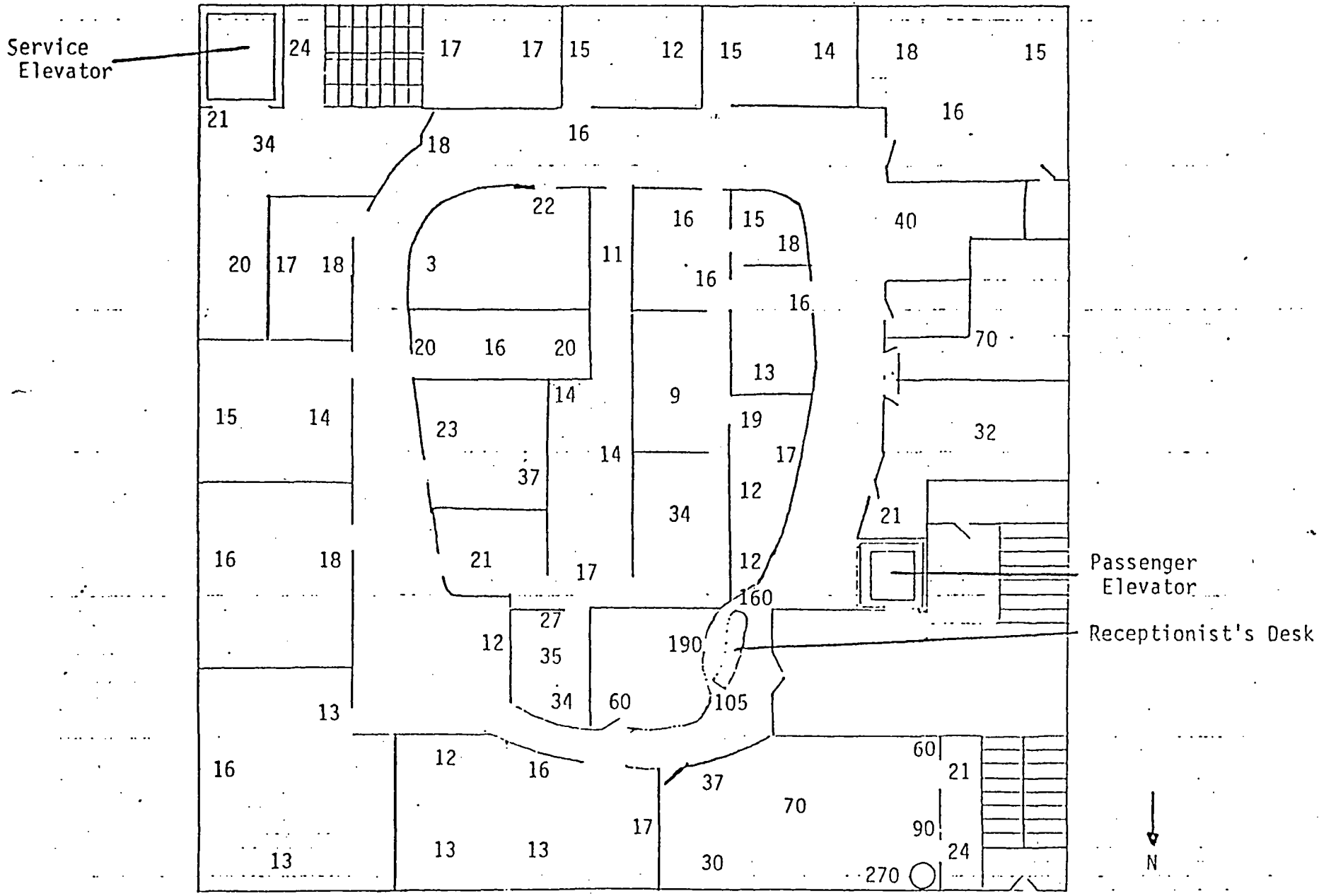
0 0044

Figure 4: Micro - Roentgen Meter Readings at One Meter Above Floor in the Basement

(All readings are in micro - roentgens per hour , uR/hr .)

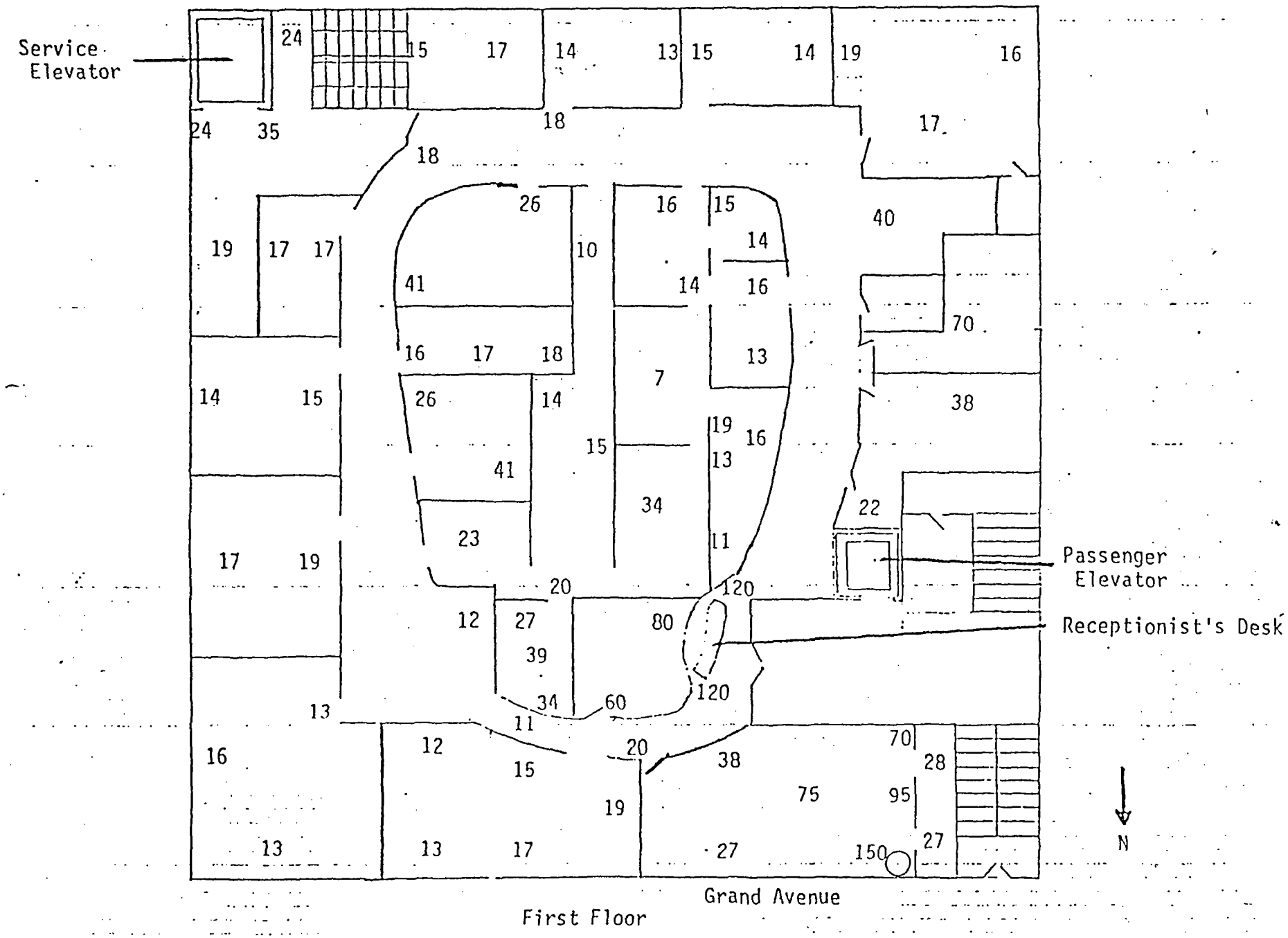


(All readings are in micro - roentgens per hour , uR/hr.)



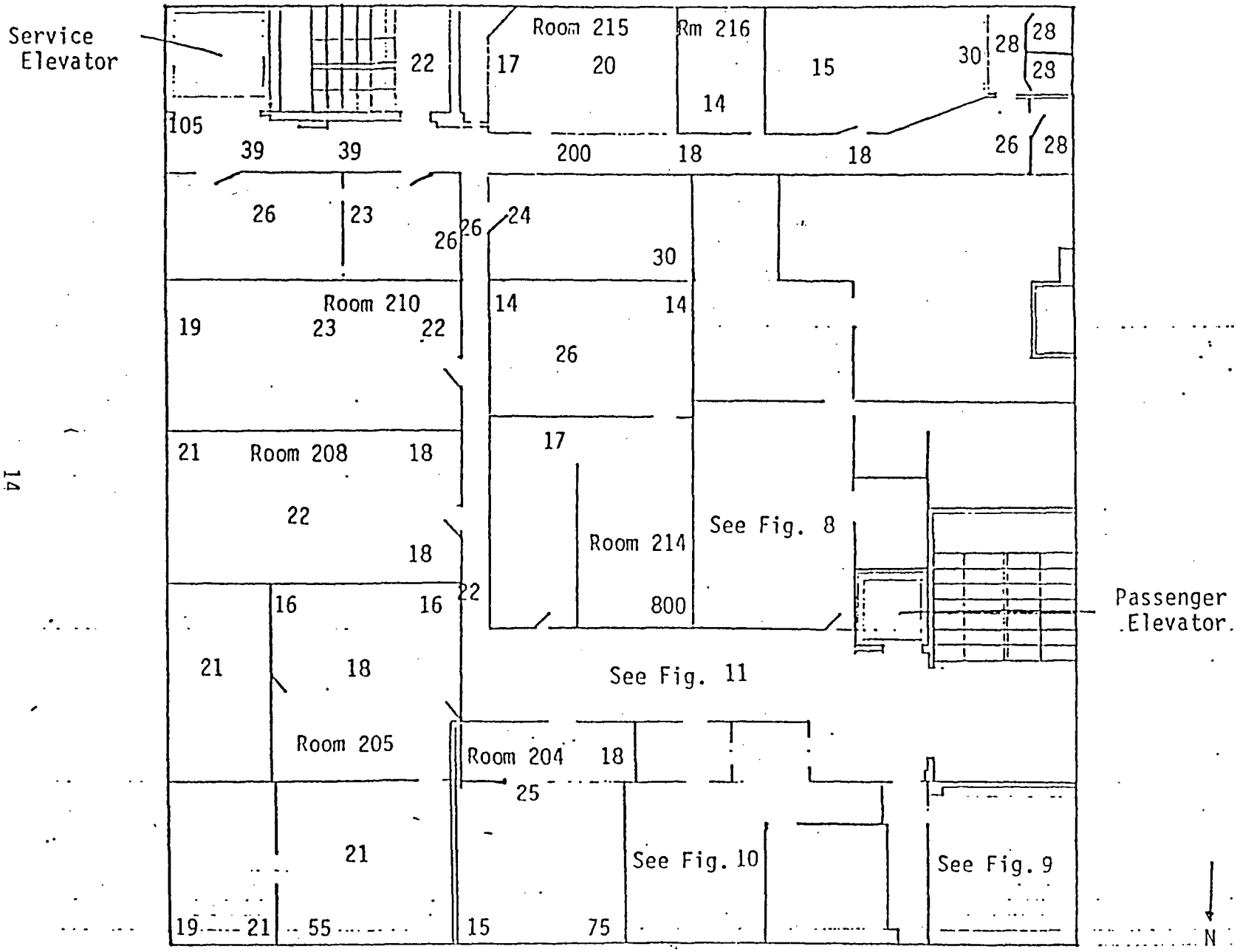
First Floor

Figure 6 : Micro-Roentgen Meter Readings at One meter Distance
(All readings are in micro-roentgens per hour , uR/hr .)



0 0047

(All readings are in micro-roentgens per hour, uR/hr.)

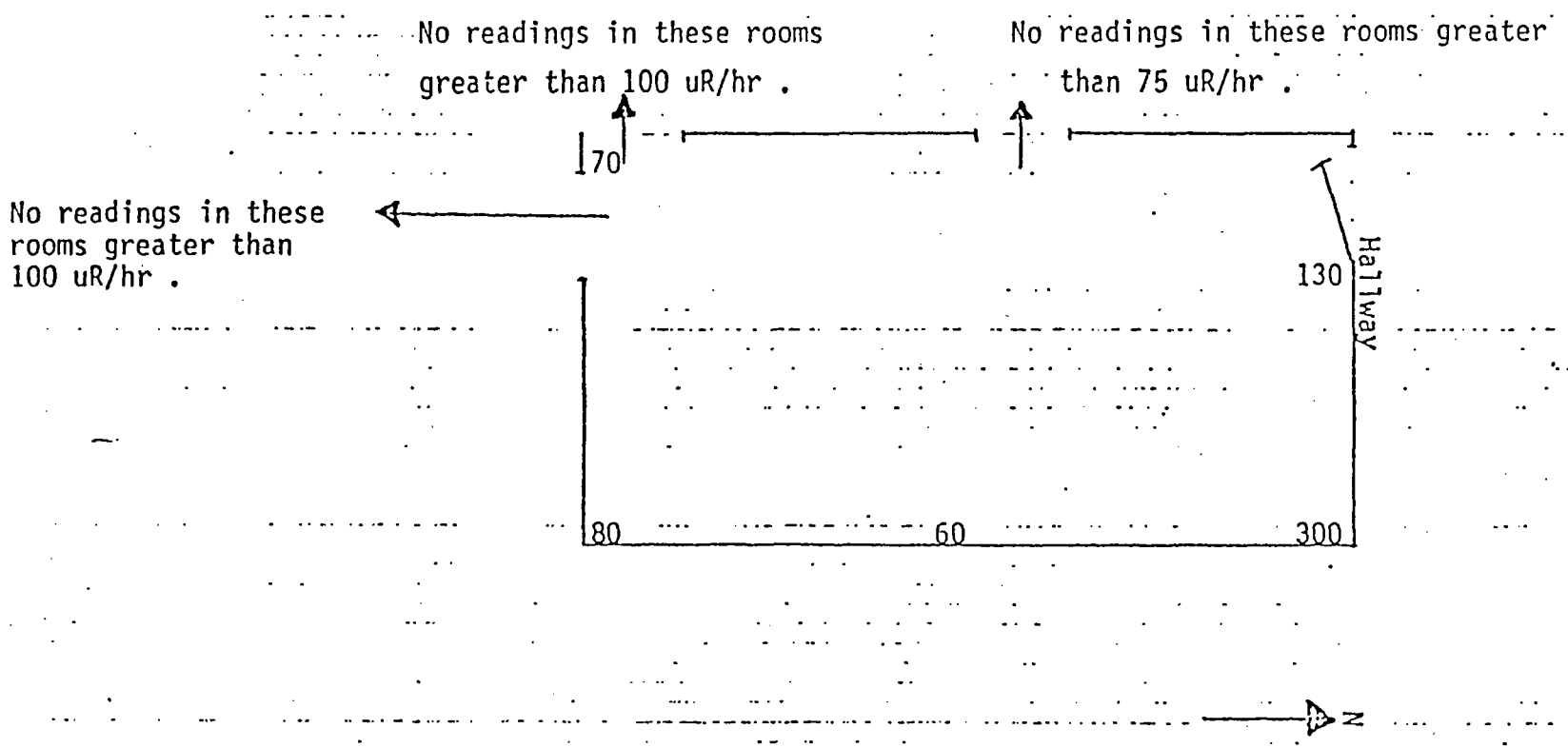


Second Floor

0 0048

Figure 8 : Micro - Roentgen Meter Readings , Contact With Floor , in Room 200

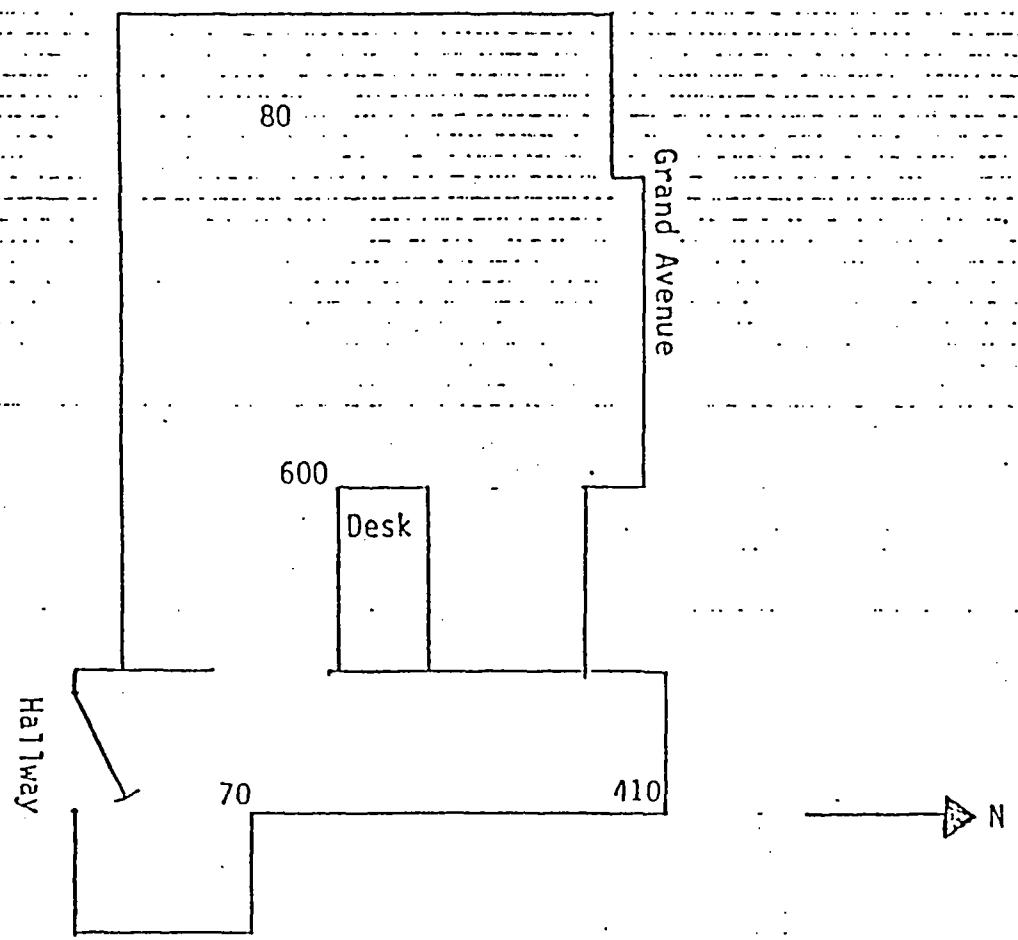
(All readings are in micro - roentgens per hour , uR/hr)



Second Floor - Room 200 (Glen McGowean and Son)

Figure 9:-Micro--Roentgen Meter Readings, Contact With Floor, in Room 201

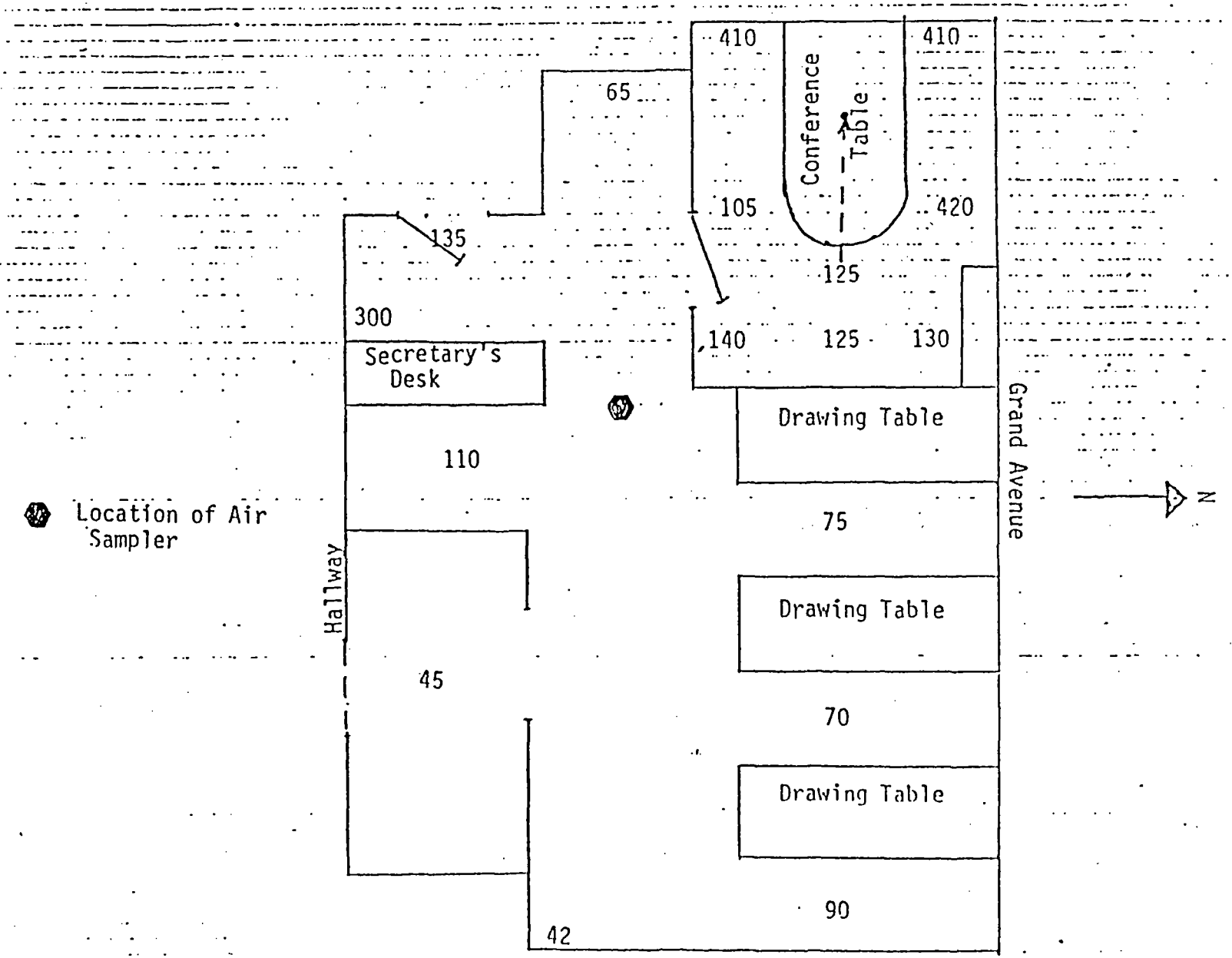
(All readings are in micro - roentgens per hour, uR/hr.)



Second Floor - Room 201 (Ascot Products)

Figure 10 : Micro - Roentgen Meter Readings , Contact With Floor , in Room 202

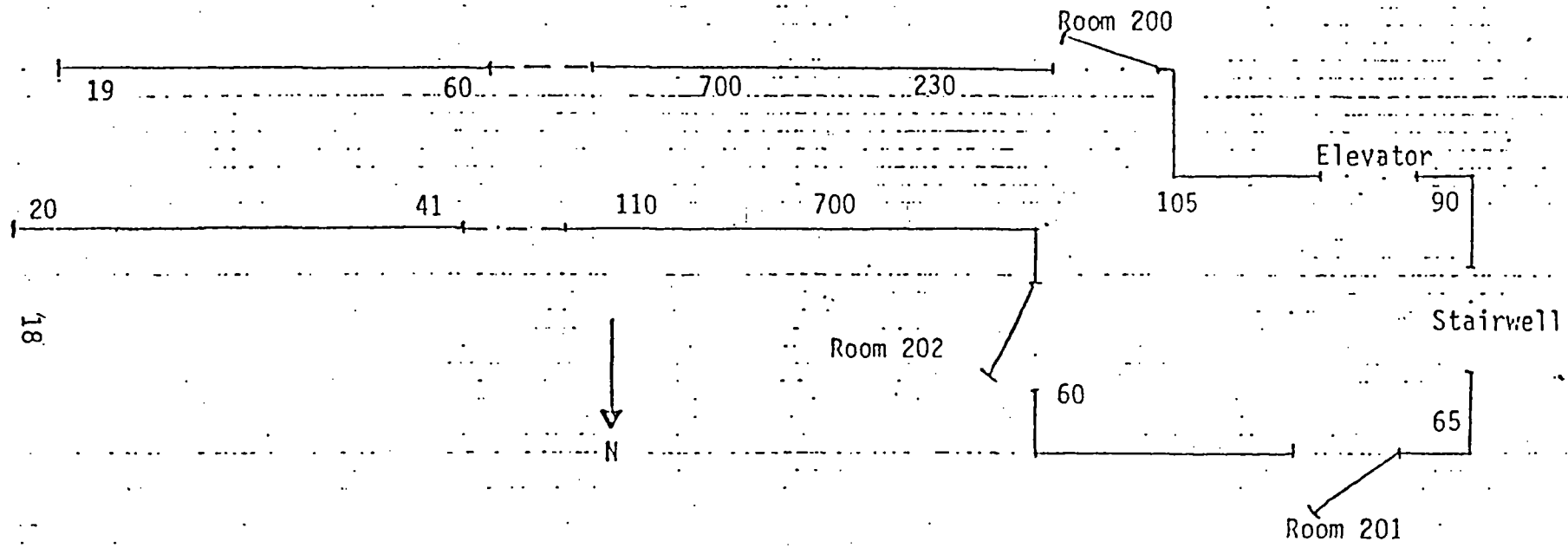
(All readings are in micro - roentgens per hour , uR/hr)



Second Floor - Room 202 (Meisel Hunson LTD)

0 0051

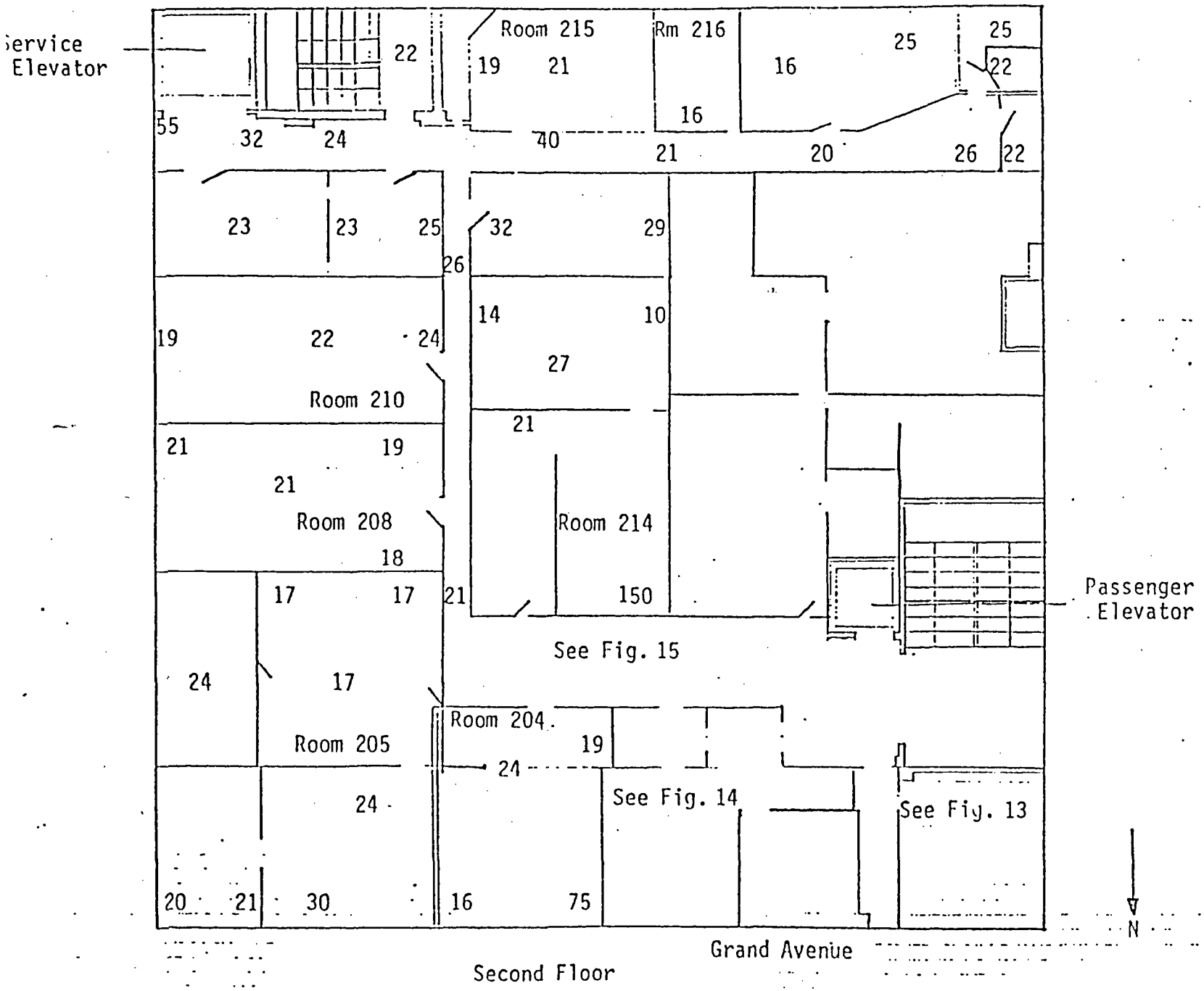
Figure 11: Micro - Roentgen Meter Readings ; Contact With Floor , in Hallway near Room 202
(All readings are in micro - roentgens per hour , uR/hr .)



Second Floor - Hallway

Figure 12 : Micro - Roentgen Meter Readings at One Meter From Floor

(All readings are in micro - roentg s per hour, uR/hr.)

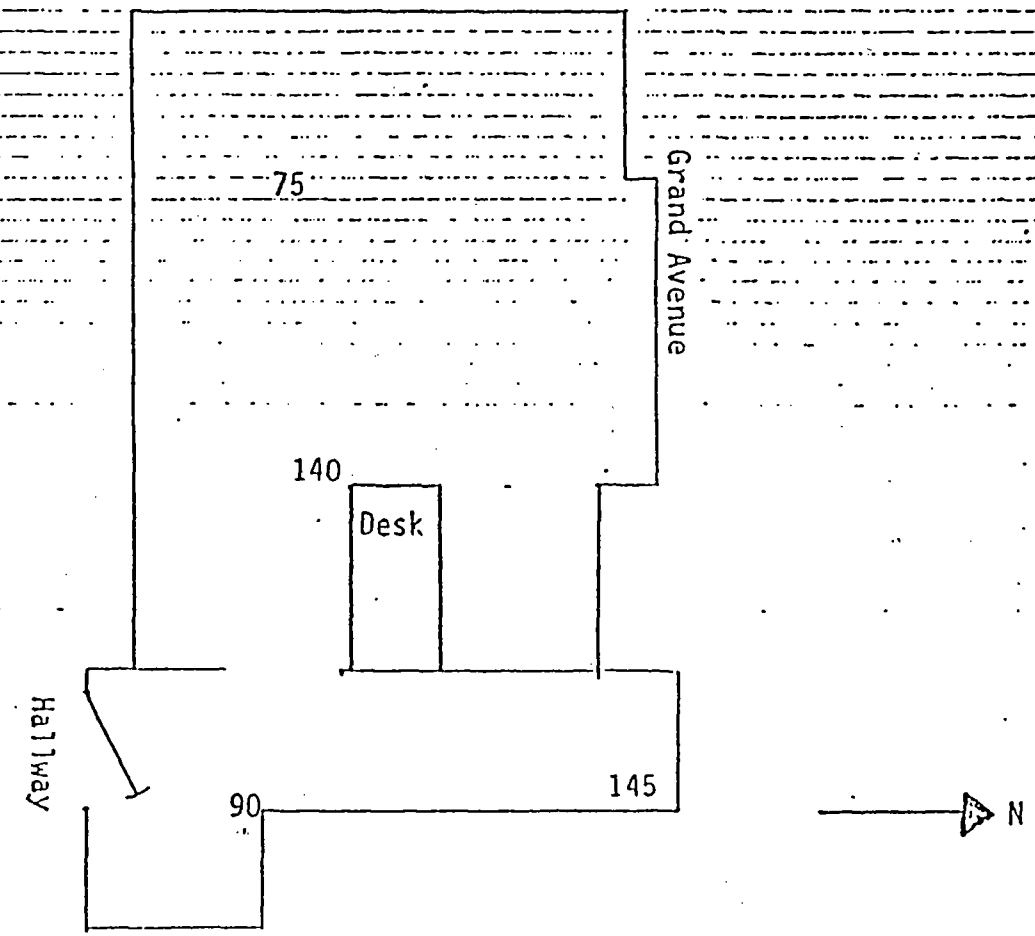


0 0053

Figure 13:

Micro - Roentgen Meter Readings at One Meter Above Floor in Room 201

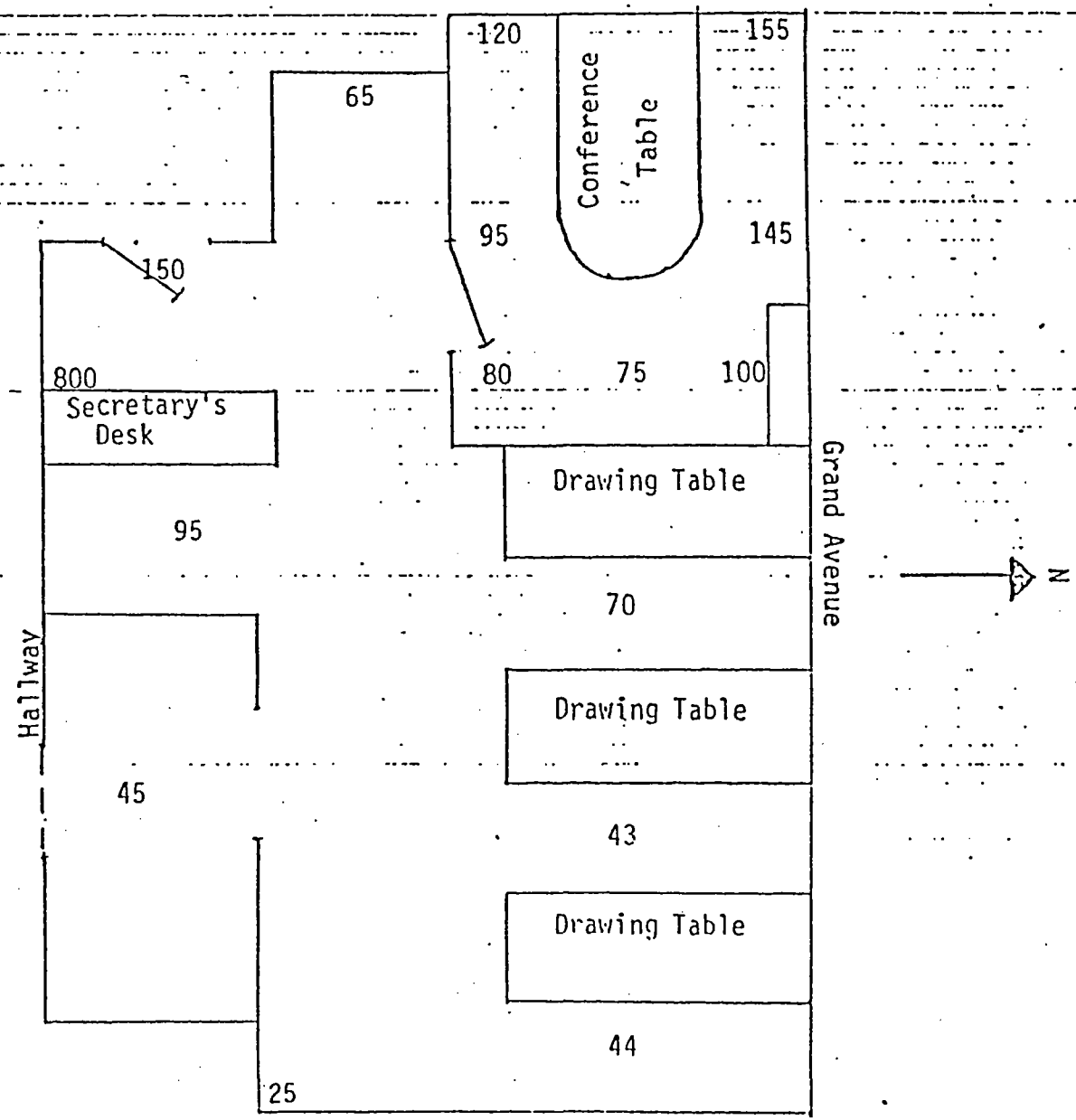
(All readings are in micro - roentgens per hour , uR/hr .)



Second Floor - Room 201 (Ascot Products)

Figure 14 - Micro - Roentgen Meter Rea ngs at One Meter Above Floor in Room 202

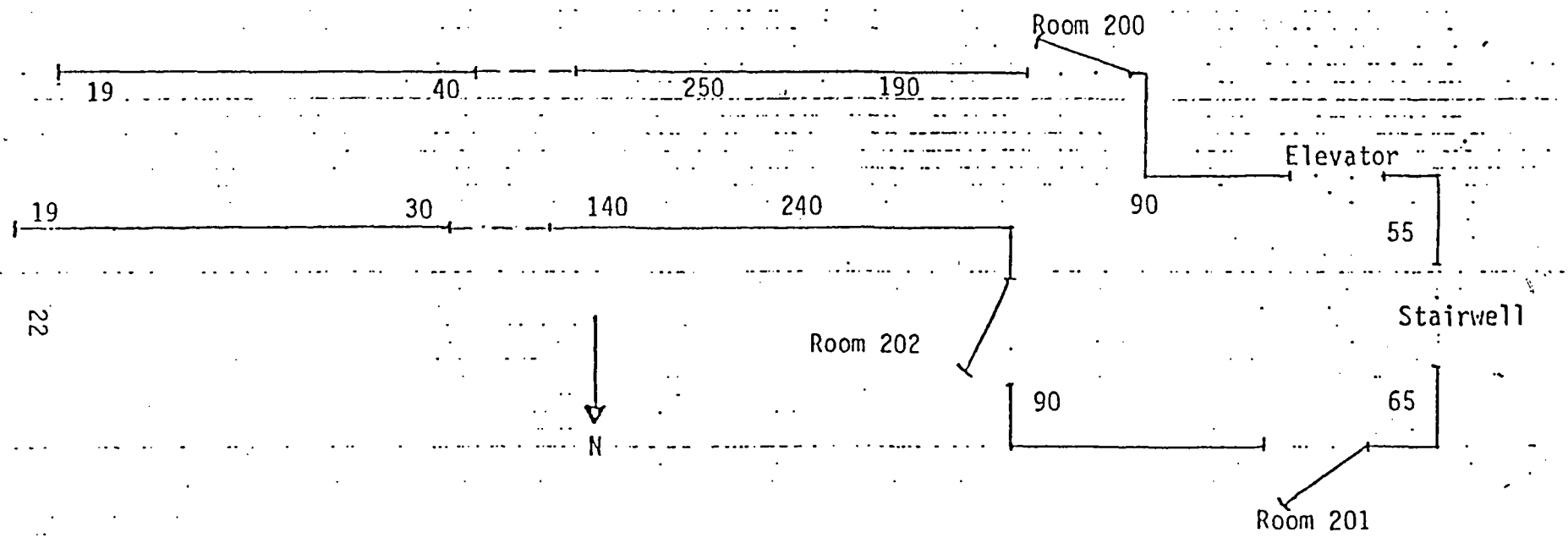
(All readings are in micro - roentgens per-hour , uR/hr.)



Second Floor - Room 202 (Meisel Munson LTD)

Figure 15 :- Micro - Roentgen Meter Readings at One Meter Above Floor in Hallway near Room 202

(All readings are in micro - roentgens per hour , uR/hr .)



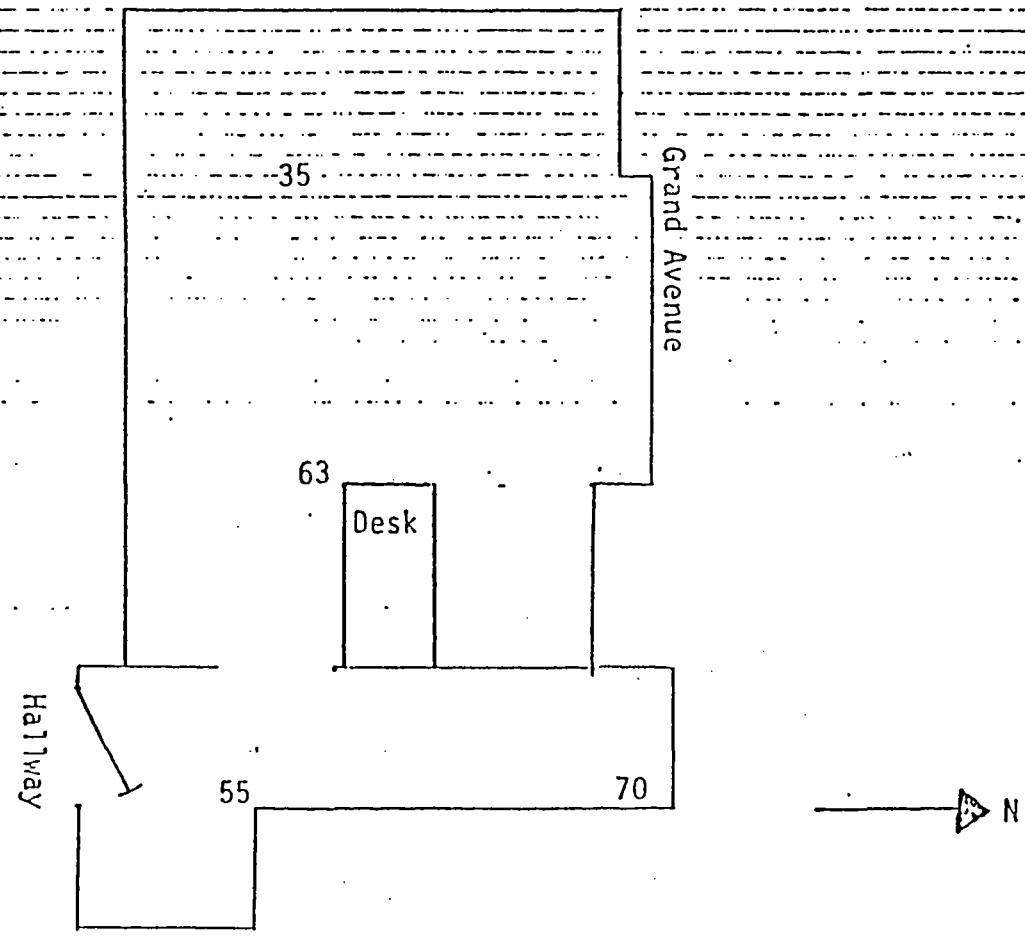
Second Floor - Hallway

In Rooms 200, 201, and 202 along with the adjoining hallway, dual readings with the micro-R meter and a pressurized ion chamber (PIC) were made (See Figs. 16-18). The micro-R meter is handy for surveys because it is small, light and sensitive, but it can give exaggerated readings where low energy gamma rays are present. The PIC comprises two heavy, bulky and expensive pieces that give very reliable readings without the problem of over response to low energy gamma rays. Both instruments were used to obtain readings at the same location and at the same height, one meter off the floor. To the limits of the PIC (500 uR/hr) this allowed a working conversion from micro-R meter readings to equivalent PIC readings. PIC readings should be considered much closer to true. Within the range 0-300 uR/hr the micro-R meter was found to read approximately twice the PIC readings (See Table TA2 and Fig. TAA in the Technical Appendix). Consequently, micro-R meter readings can be compared to "true" by reducing them by half.

The third floor (See Figs. 19-20) showed the greatest contamination in an area in the west central portion of the building. Limited areas of contamination were found in the northwest corner - Room 300 and the adjacent hallway - and in the southeast corner near the service elevator.

As with the third floor the primary area of contamination on the fourth floor (See Figs. 21,22) was in the west central portion of the floor. One somewhat isolated, but considerably elevated spot was also identified in the northwest corner.

Figure 16 : Pressurized Ion Chamber Readings at One Meter Above Floor in Room 201
(All readings are in micro - roentgens per hour , uR/hr .)

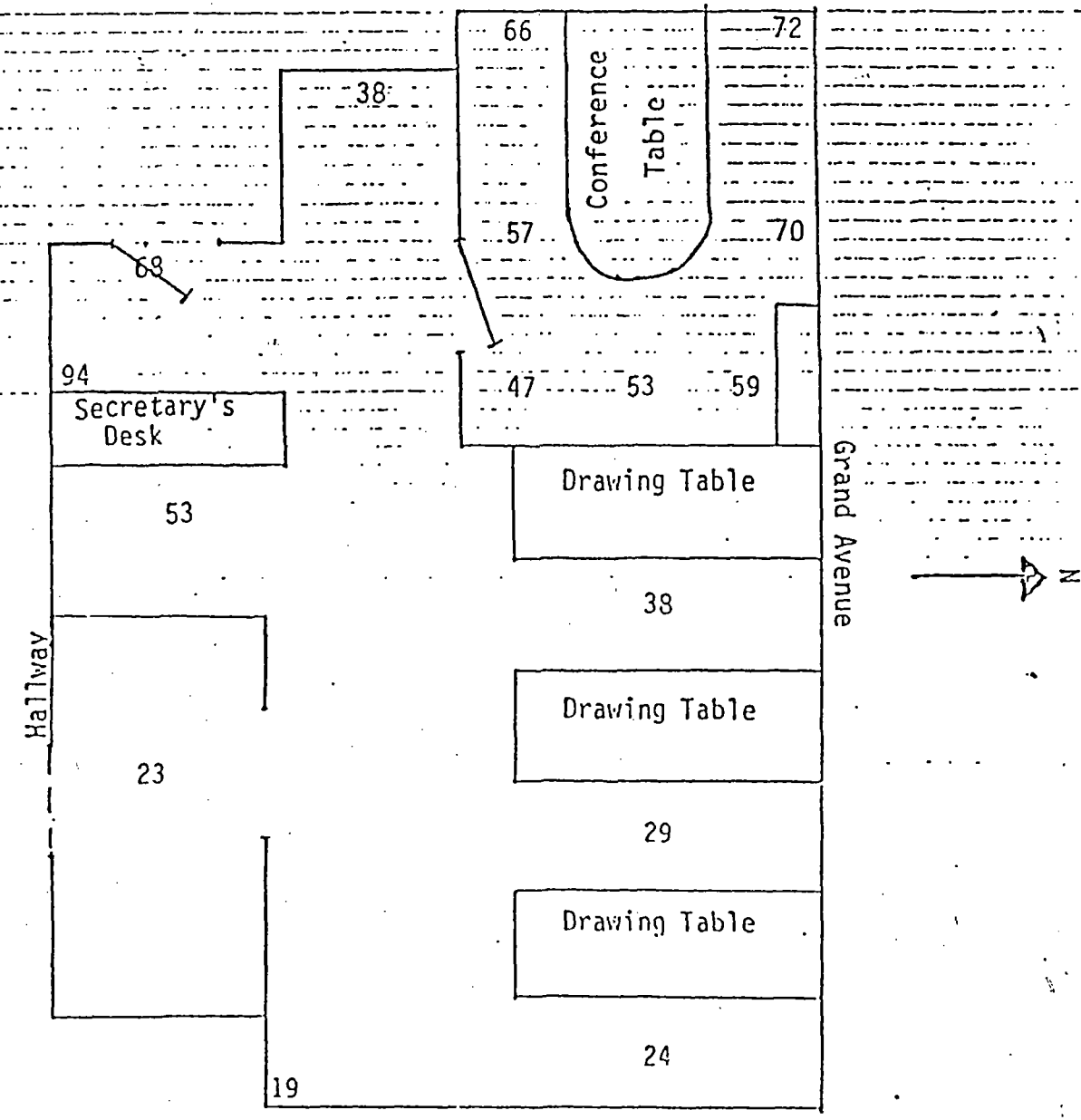


Second Floor - Room 201 (Ascot Products)

0 0058

Figure 17 : Pressurized Ion Chamber Readings at One Meter Above Floor in Room 202

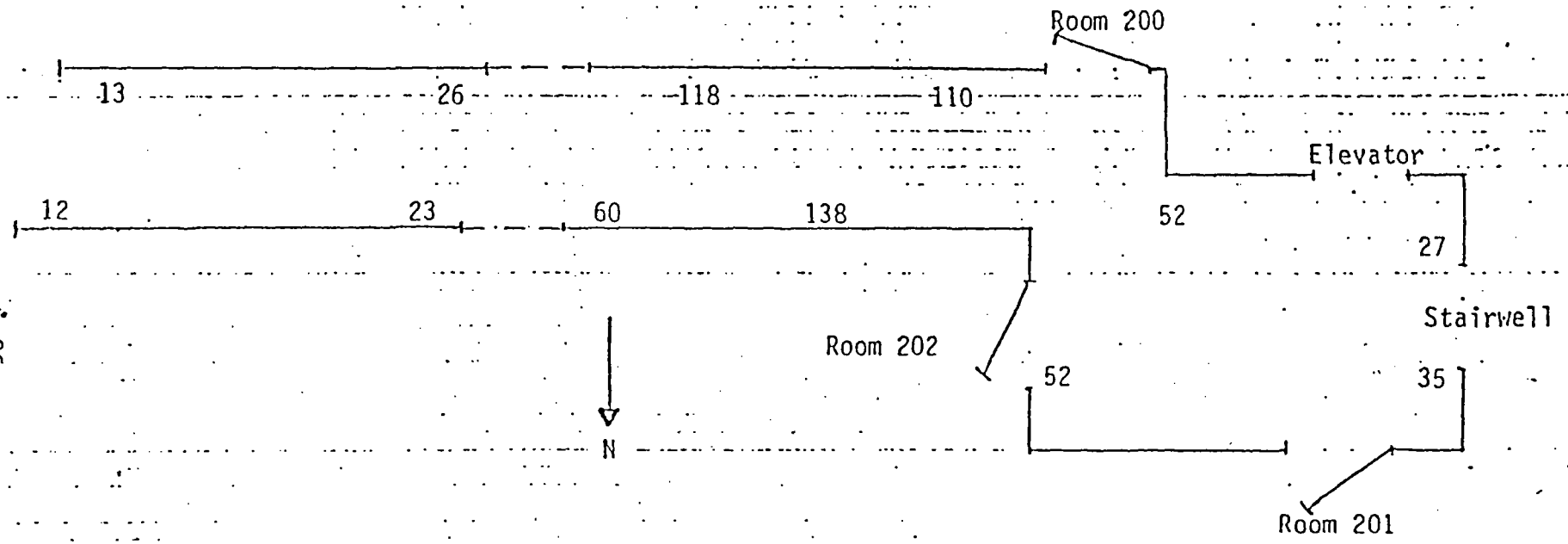
(-All readings are in micro - roentgens per hour , uR/hr-)



Second Floor - Room 202 (Meisel Hunson LTD)

Figure 18 - Pressurized Ion Chamber Readings at One Meter Above Floor in Hallway Near Room 202

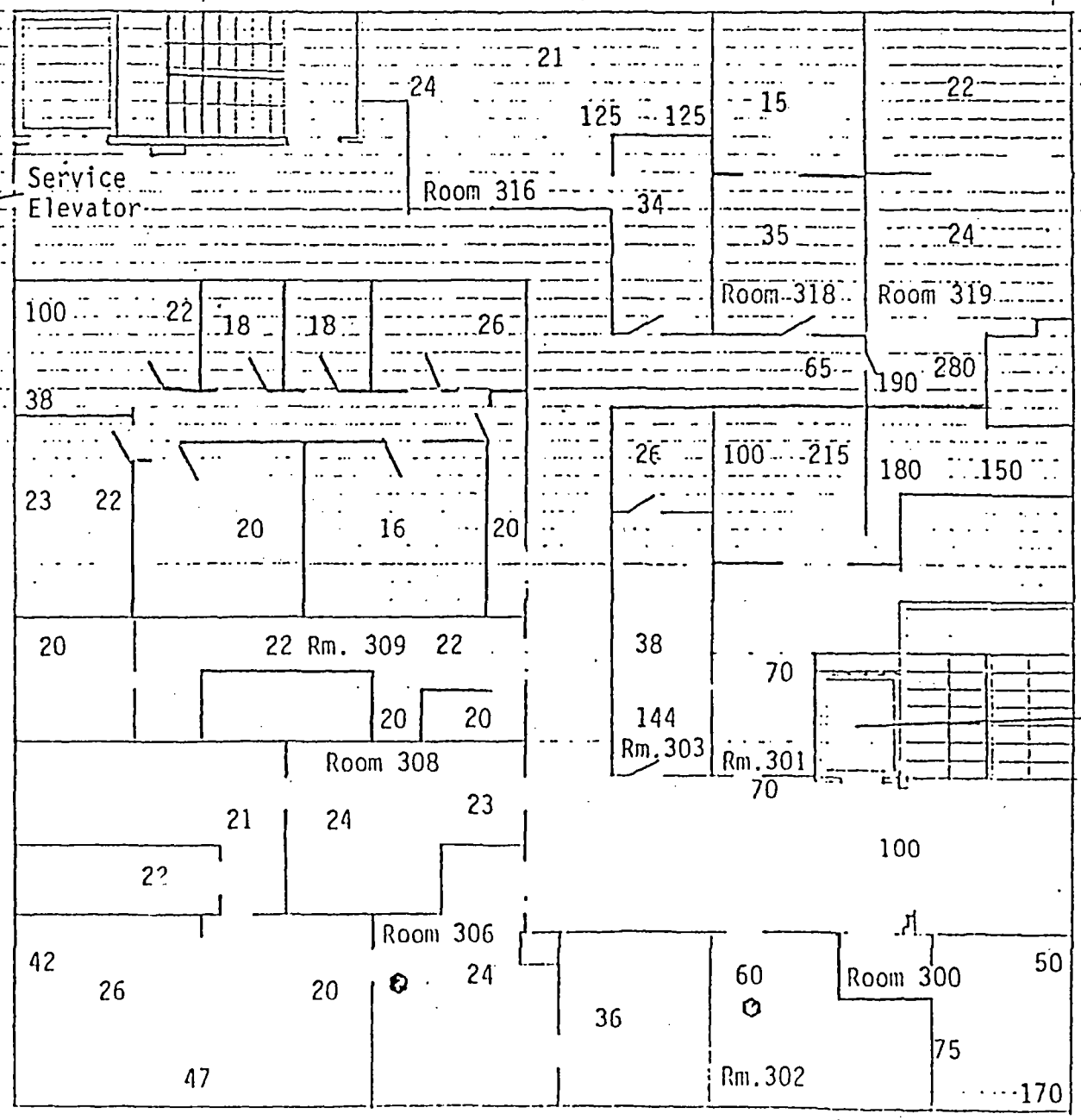
(All readings are in micro - roentgens per hour , uR/hr -)



Second Floor - Hallway

0 0060

Figure 19 : Micro - Roentgen Meter Readings , Contact With Floor , on the Third Floor
(All readings are in micro - roentgens per hour , uR/hr .)

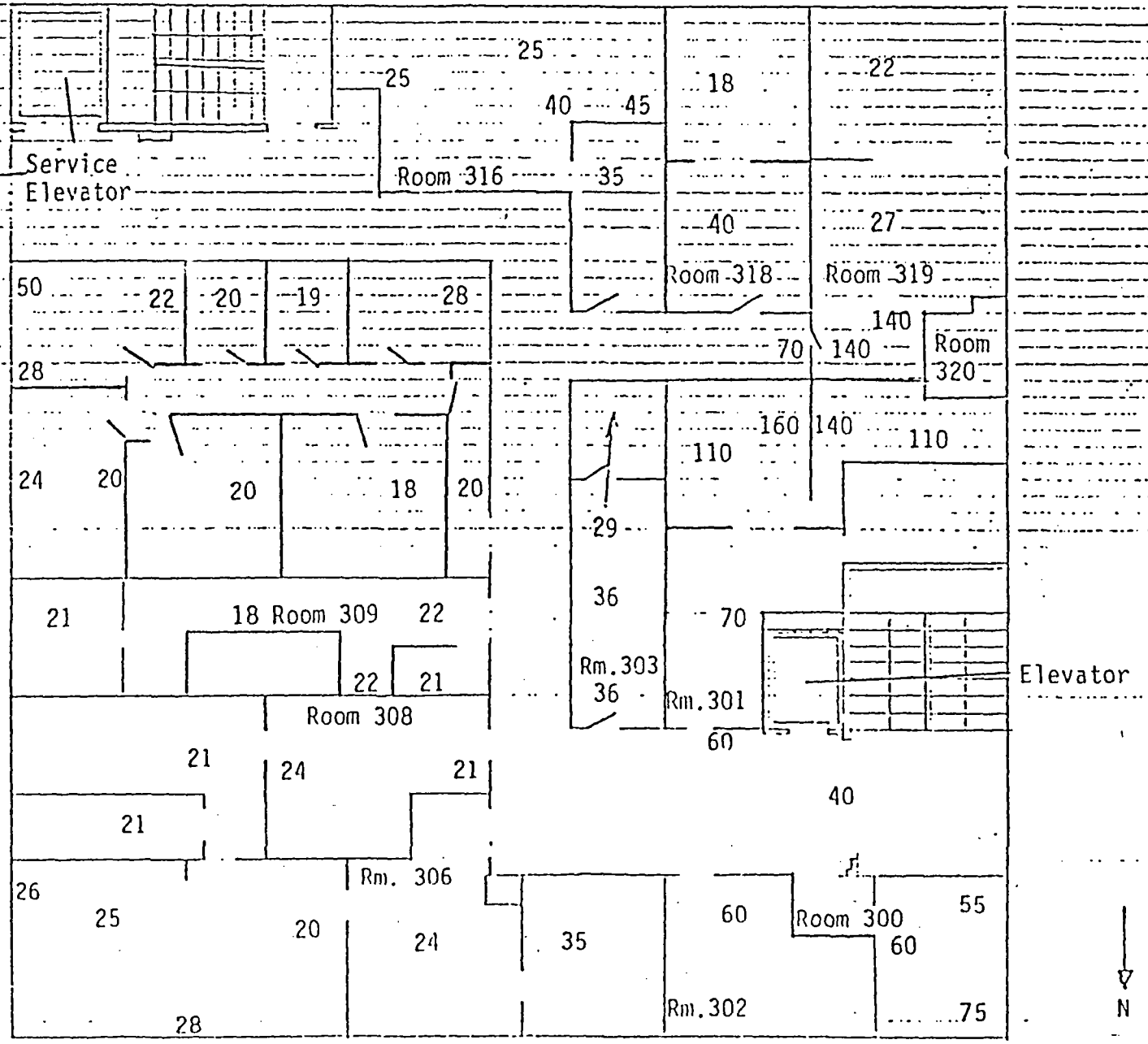


3rd Floor

0 0061

Figure 20 : Micro - Roentgen Meter Readin at One Meter Above Floor on Third Floor

(All readings are in micro - roentgens per hour , uR/hr .)

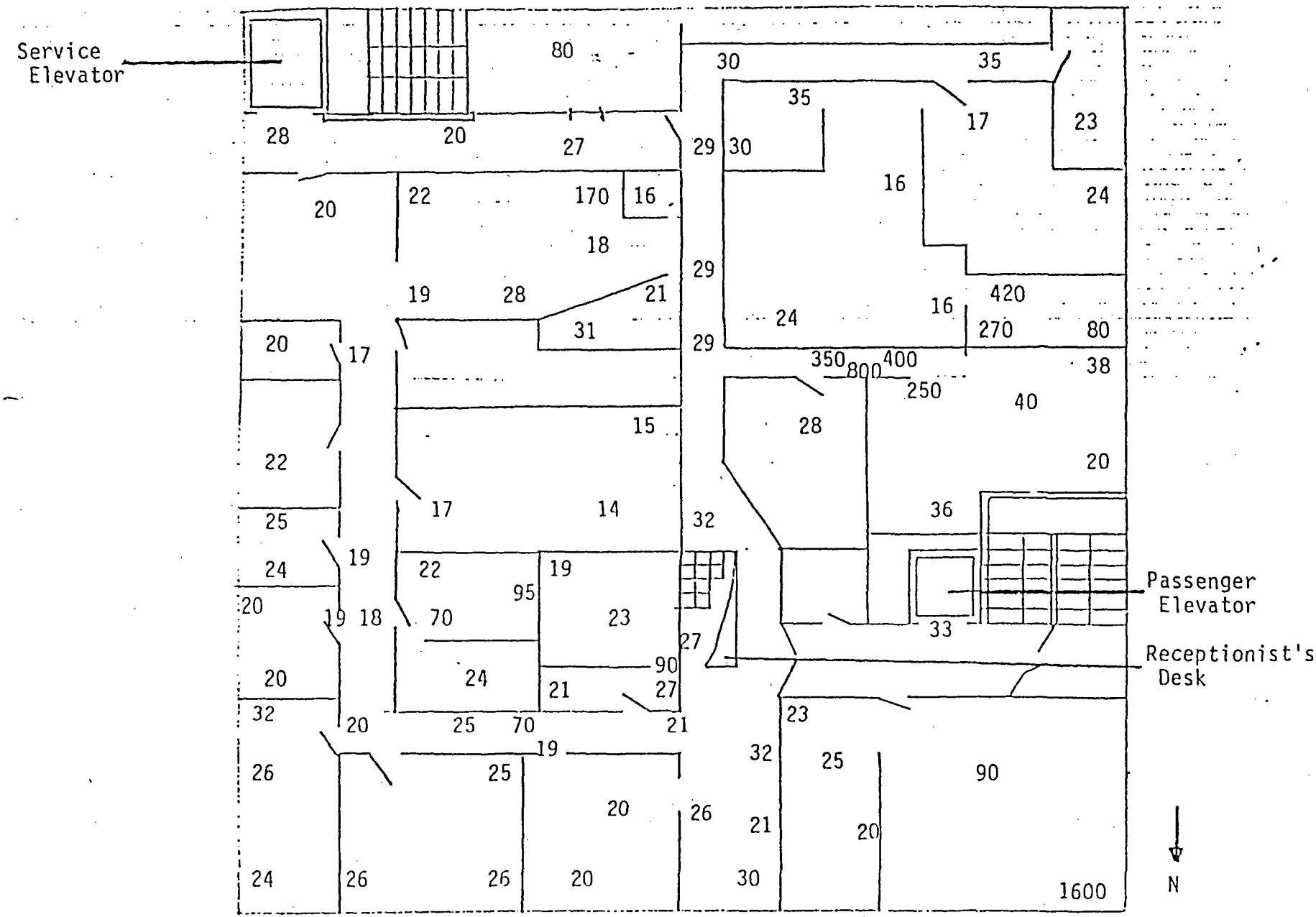


3rd Floor

0 0062

Figure 21 : Micro - Roentgen Meter Readi s , Contact With Floor

(All readings are in micro - roentgens per hour,uR/hr.)

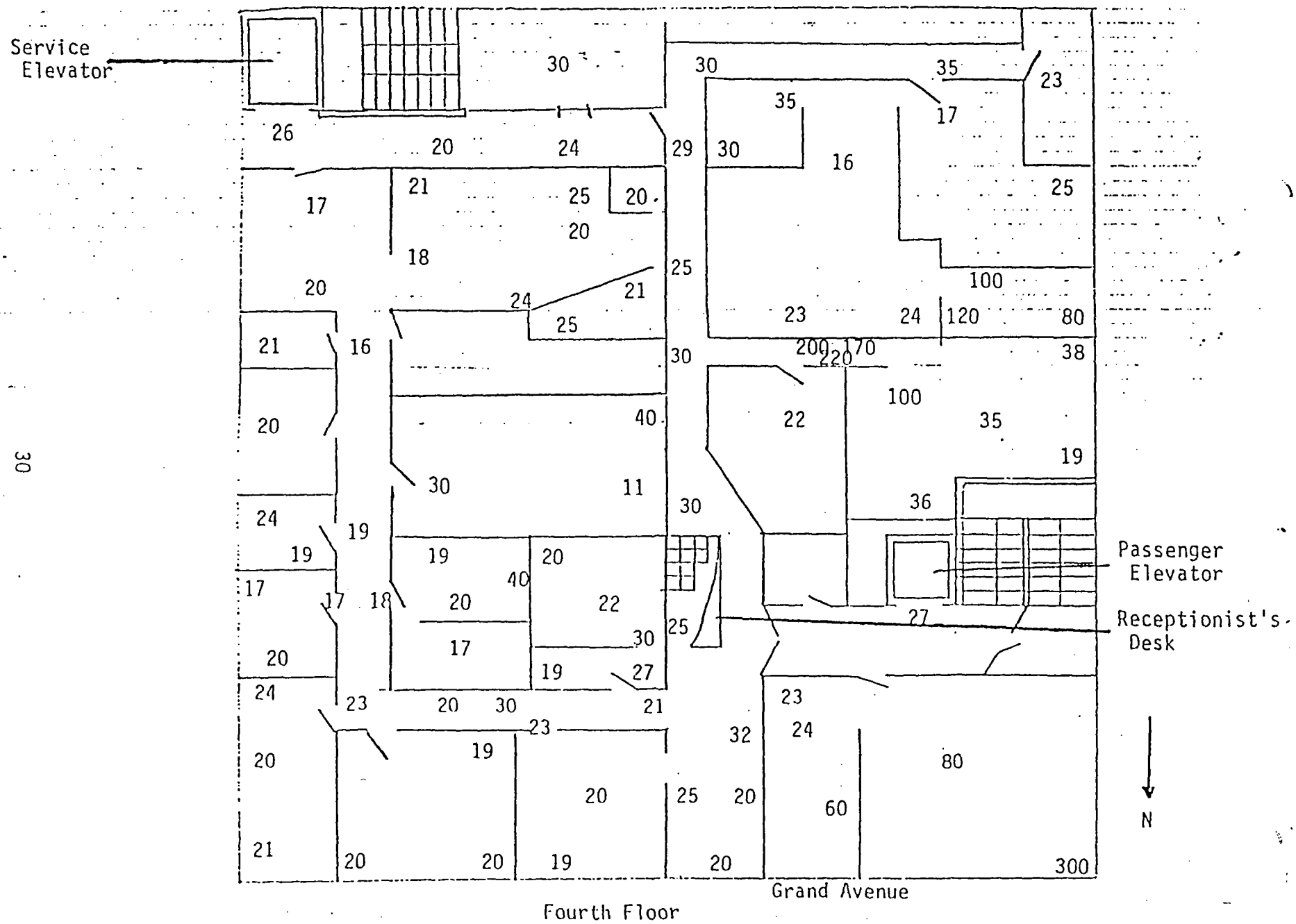


Fourth Floor

0 0063

Figure 22 : Micro - Roentgen Meter Readir - at One Meter Distance

(All readings are in micro - roentgens per hour , uR/hr.)



0 0064

B. Gamma Energy Spectrums

A portable multi-channel analyzer (MCA) was used to obtain the gamma energy spectrums of two contaminated spots within the buildings (See Figs. 23 and 24). Since the gamma rays emitted by various radionuclides have unique energies, the MCA can be used to identify these energies and thereby identify unknown radionuclides. One set of spectrum was obtained during the Preliminary Survey for the inside of the doorway in Room 202. The other was obtained during the Comprehensive Survey for the Basement in Room 8 where the highest gamma exposure rate reading in the building was measured. In the former spectrum a cesium-137 check source was used to calibrate the MCA and a modern Coleman brand gas light mantle was used for comparison. For the latter survey a small quantity of thorium dioxide was obtained and used for calibration and comparison. The cesium-137 peak was also used for an comparison. In both cases thorium was easily identified as the source of the contamination by matching the characteristic locations of the known peak positions with the unknown peak positions (See Figs. 23,24).

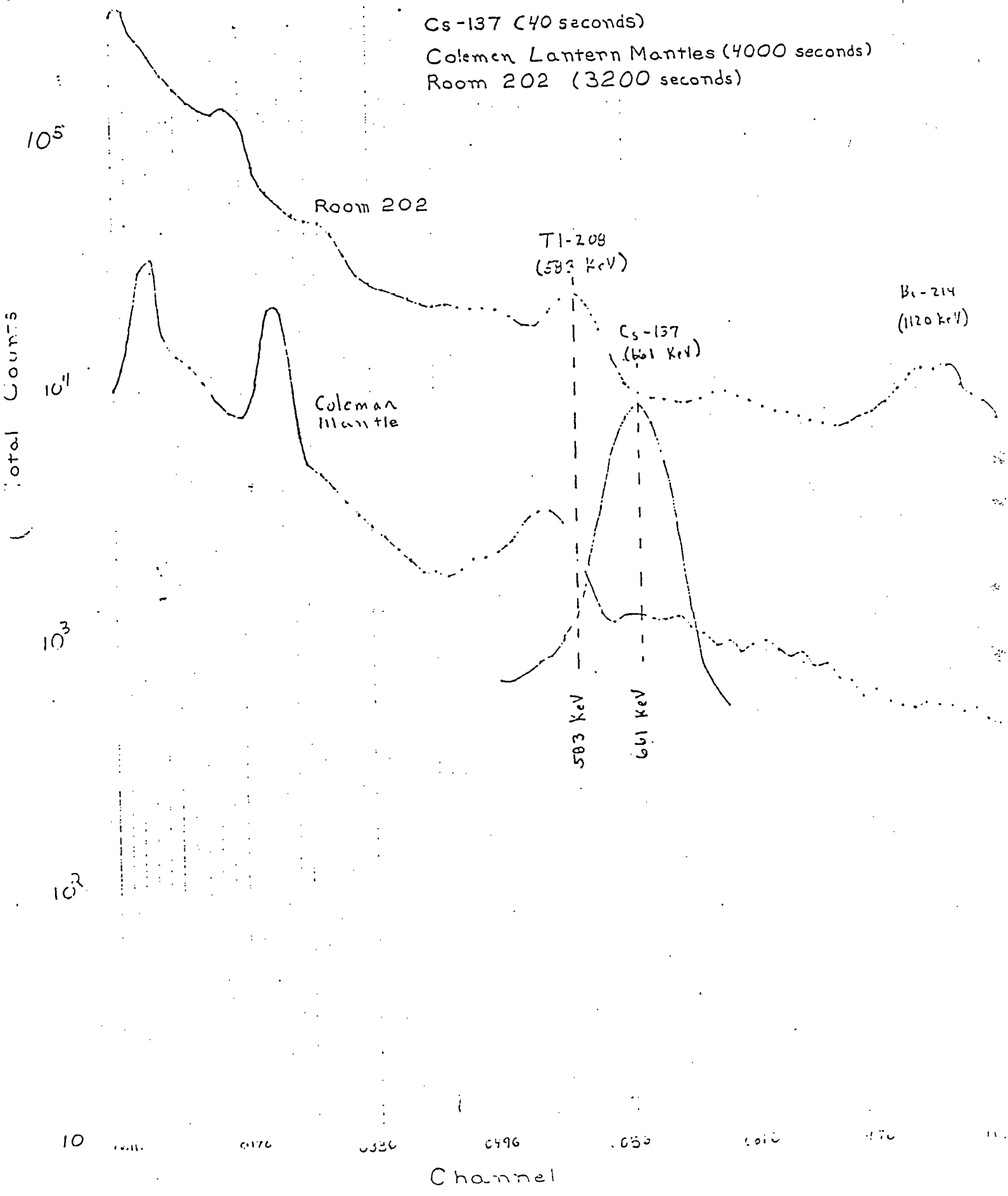
C. Thermoluminescent Dosimeter Data

Based upon the results of the Preliminary Survey thermoluminescent dosimeters* (TLDs) were placed in critical areas of major concern(See Fig. 25). Three TLDs were placed in a plastic amulet at each location to get an average exposure at that point.

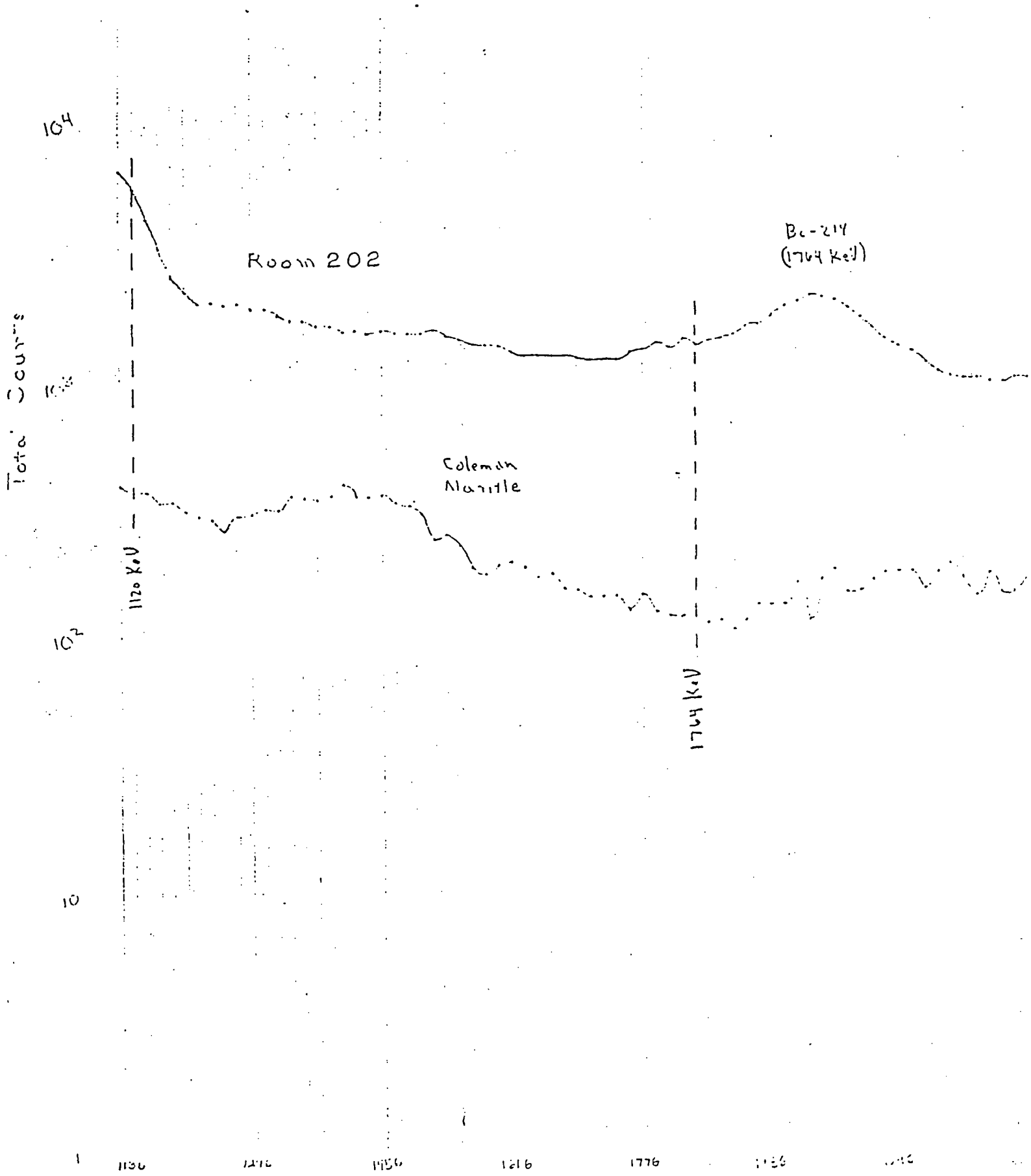
---

* TLDs are 1/8 inch square chips of lithium fluoride that are used like film badges to measure radiation exposure.

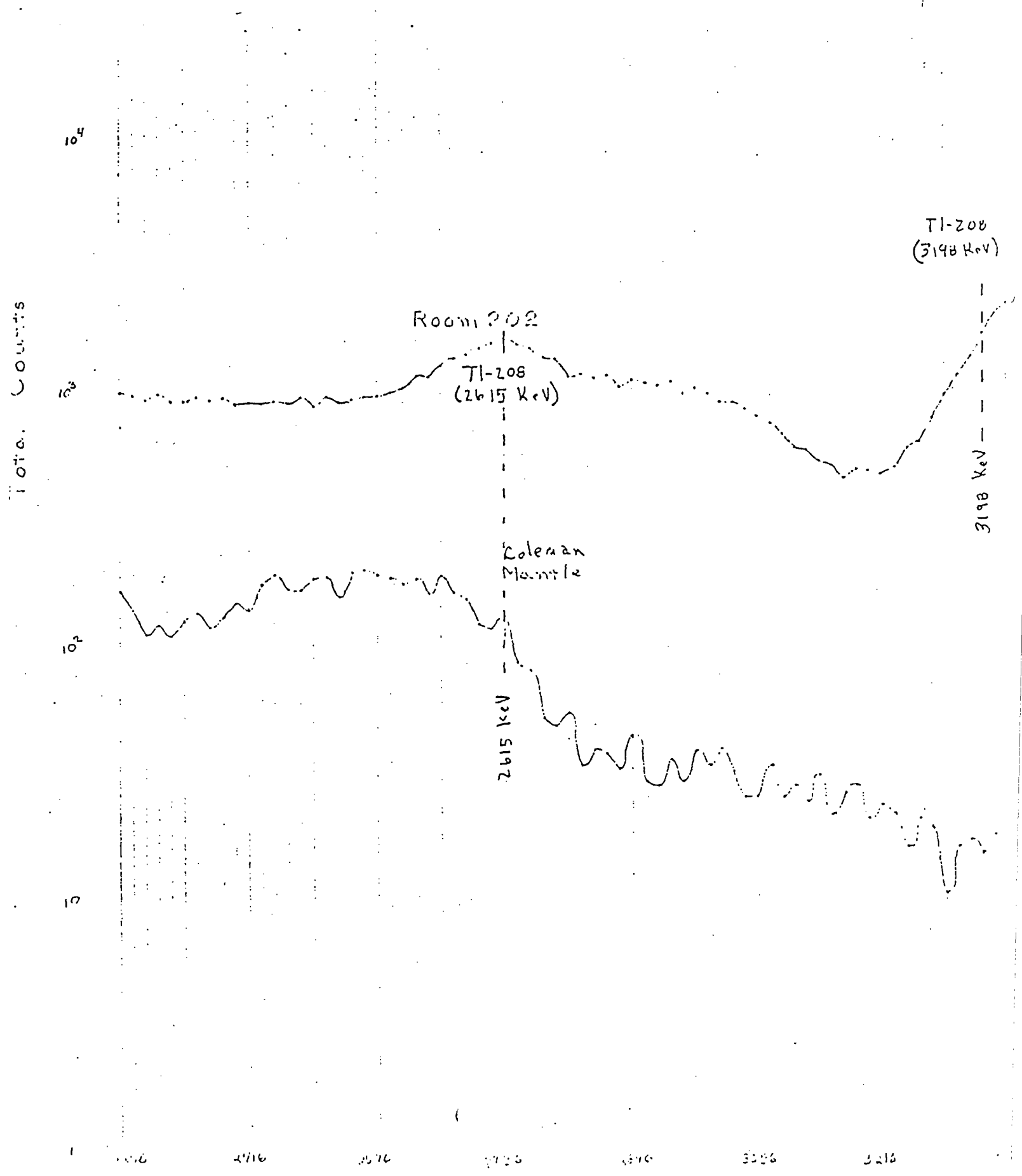
Figure 23 : Multi-Channel Gamma Ray Spectrum
161 East Grand - Chicago, Illinois
November 24, 1980
Cs-137 (40 seconds)
Coleman Lantern Mantles (4000 seconds)
Room 202 (3200 seconds)



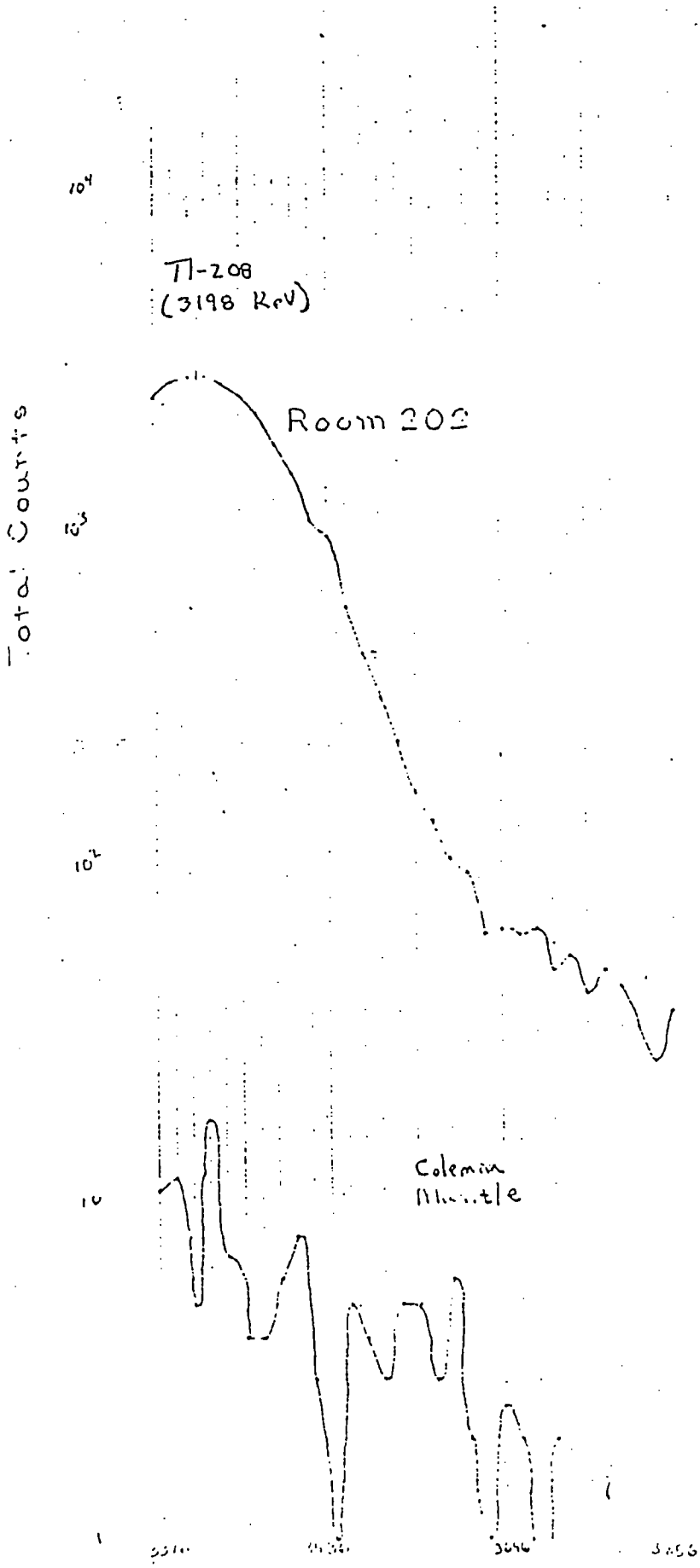
Multi-Channel Gamma Ray Spectrum
(Cont.)



Multi-Channel Gamma Ray Spectrum
(Cont.)



Multi-Channel Gamma Ray Spectrum
(Cont.)



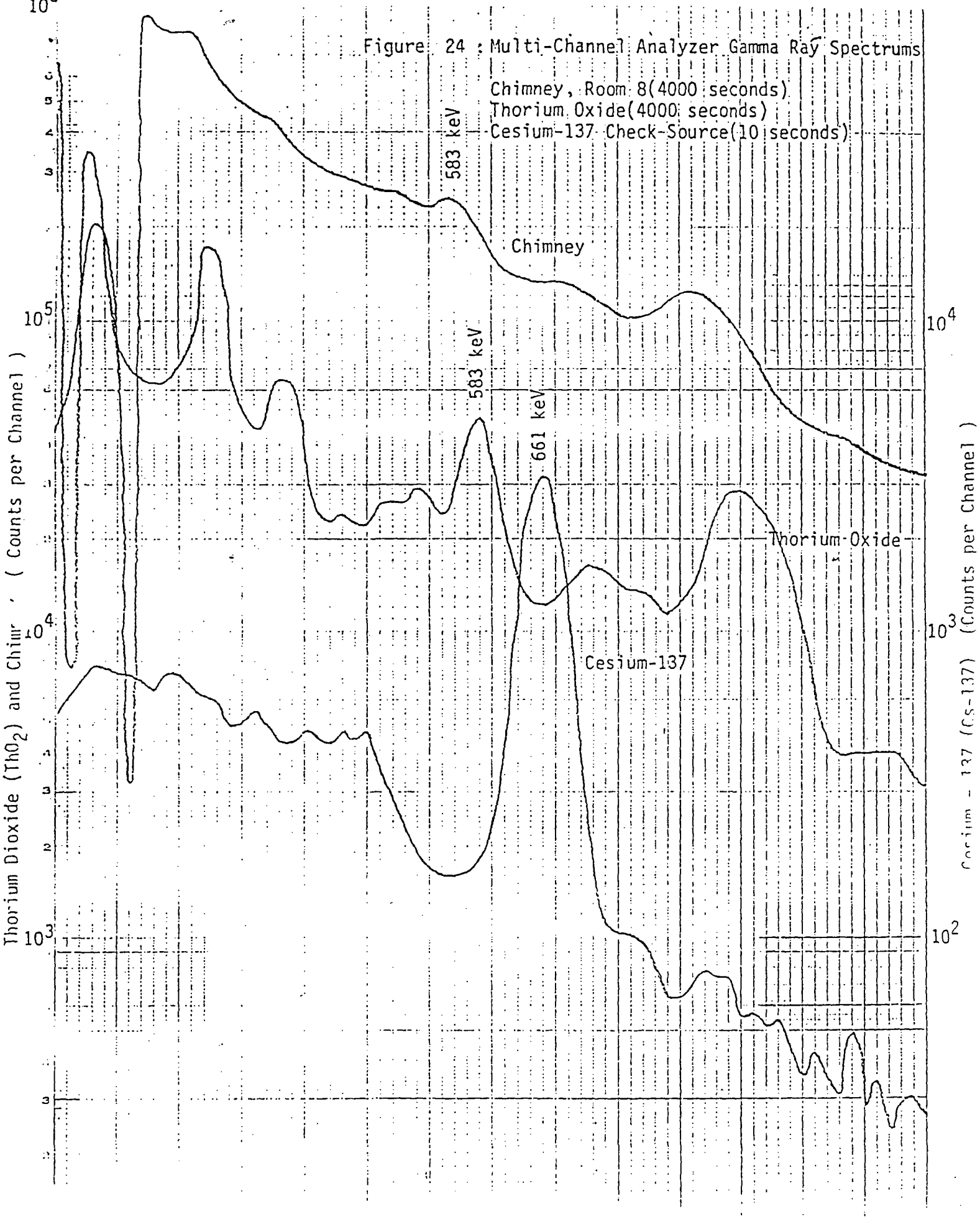
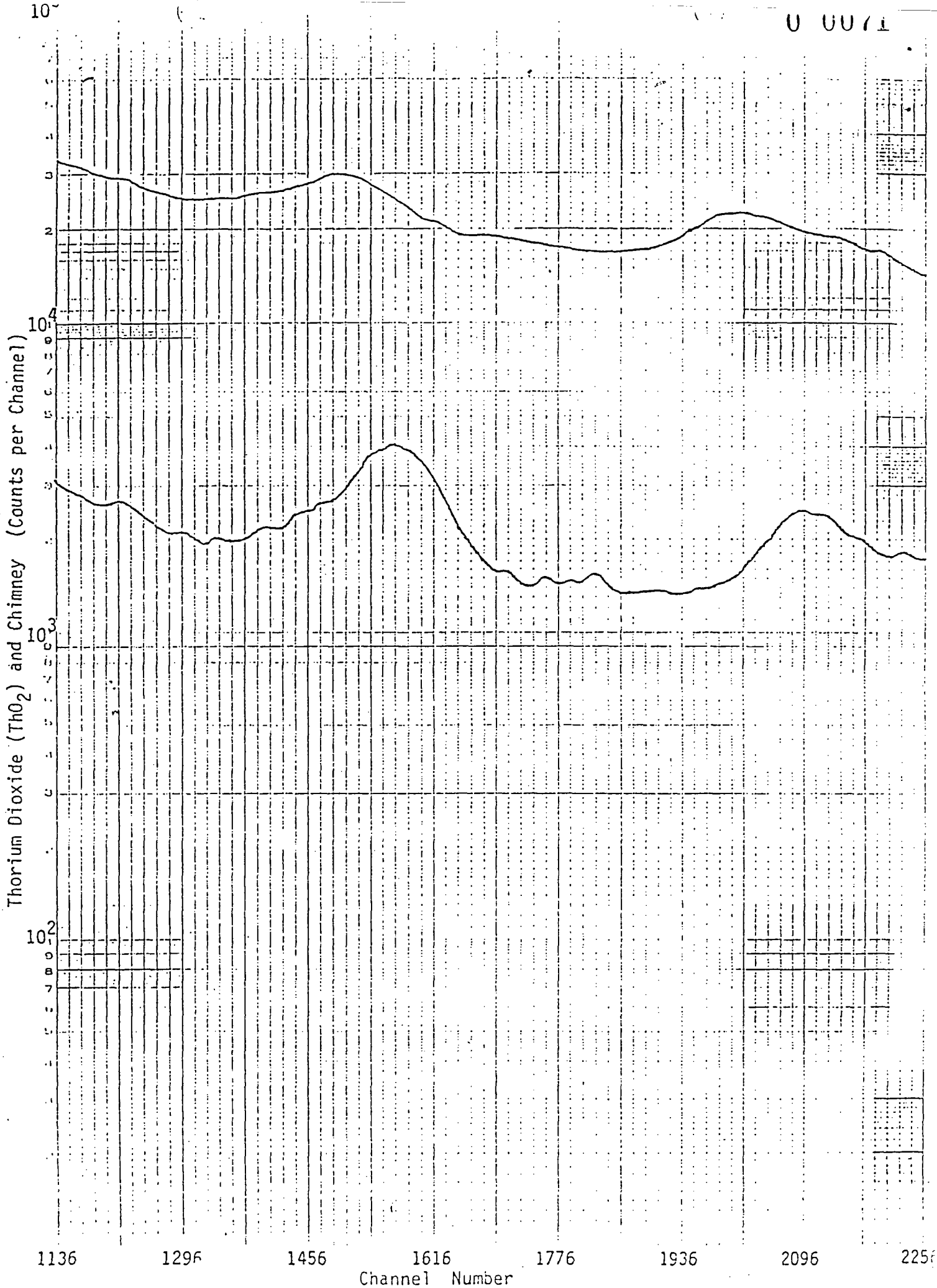


Figure 24 : Multi-Channel Analyzer Gamma Ray Spectrums


Thorium Dioxide (ThO_2) and Chimney (Counts per Channel)
10^4
10^3
10^2
1136
1296
1456
1616
1776
1936
2096
Channel Number

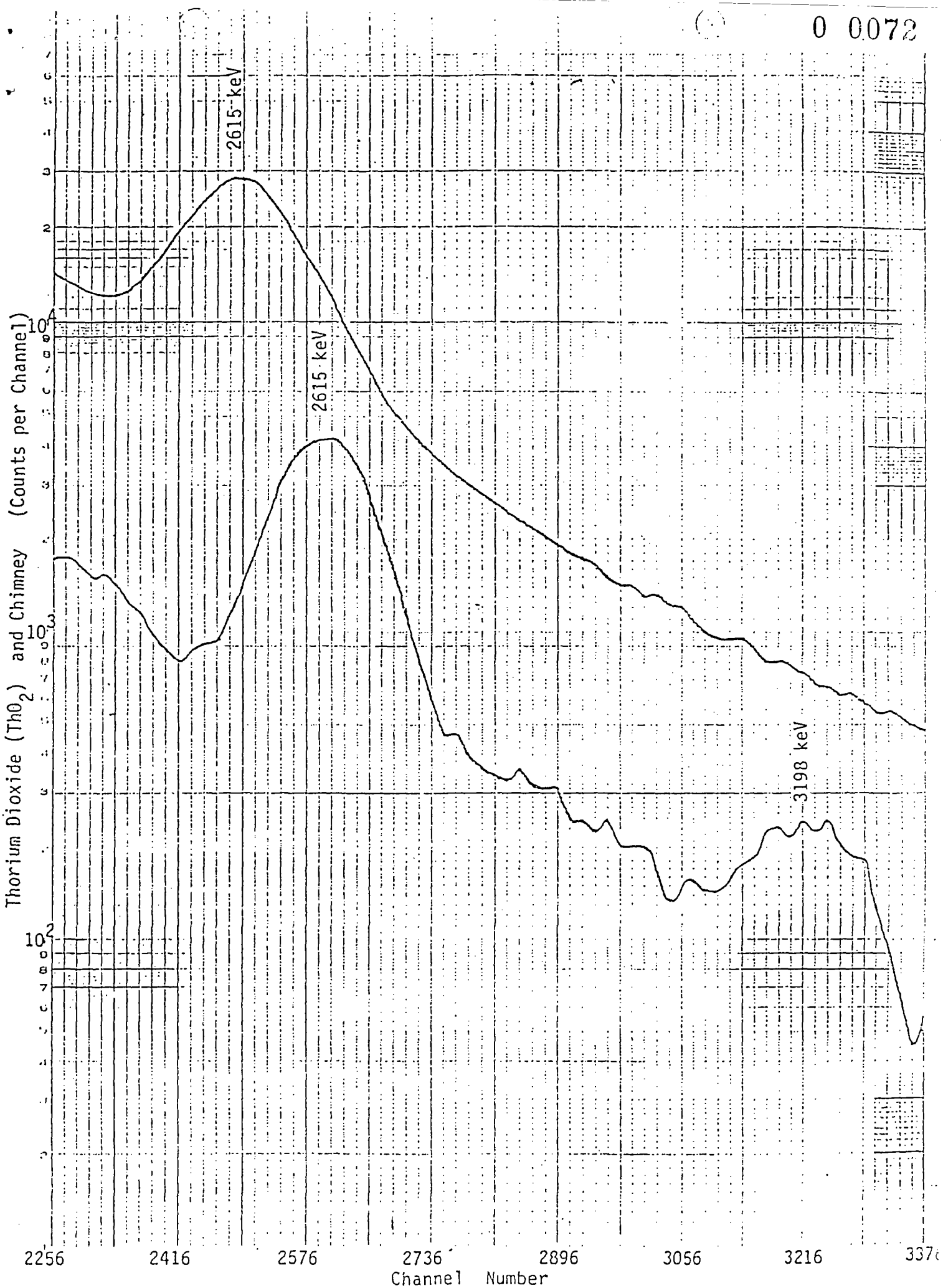
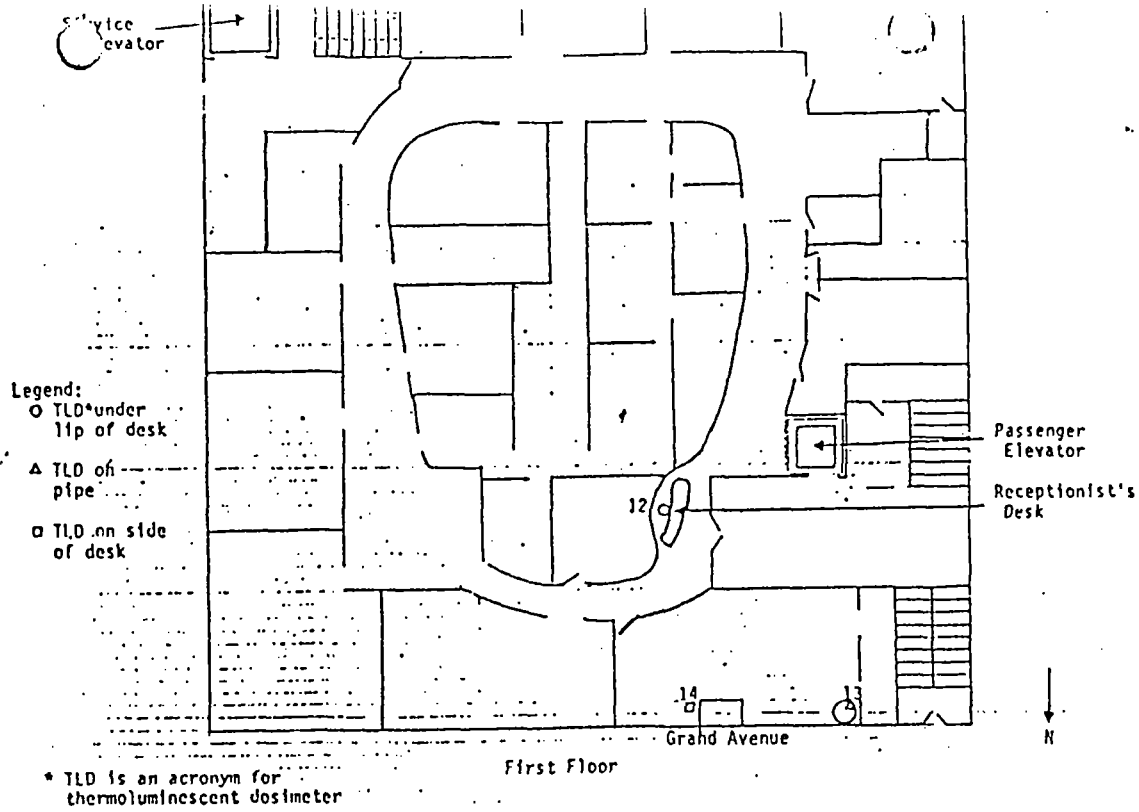
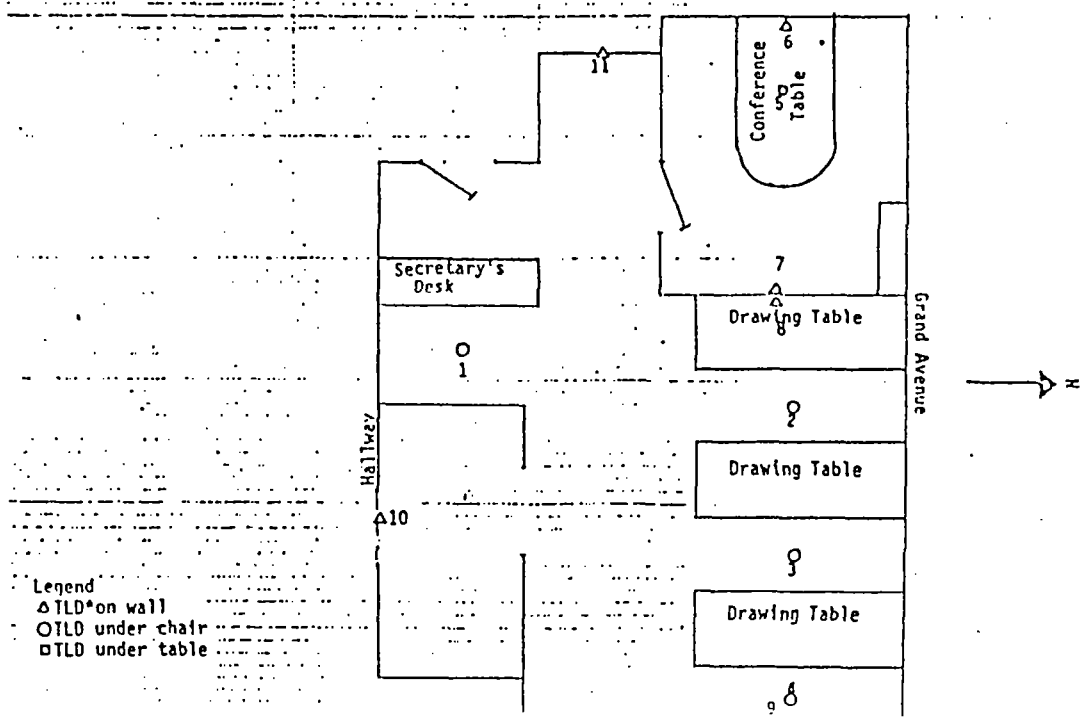

2615 keV
2615 keV
3198 keV
10^4
10^3
10^2
Thorium Dioxide (ThO_2) and Chimney (Counts per Channel)
2256
2416
2576
2736
2896
3056
3216
Channel Number

Figure 25



Location of Thermoluminescent Dosimeters in Room 202

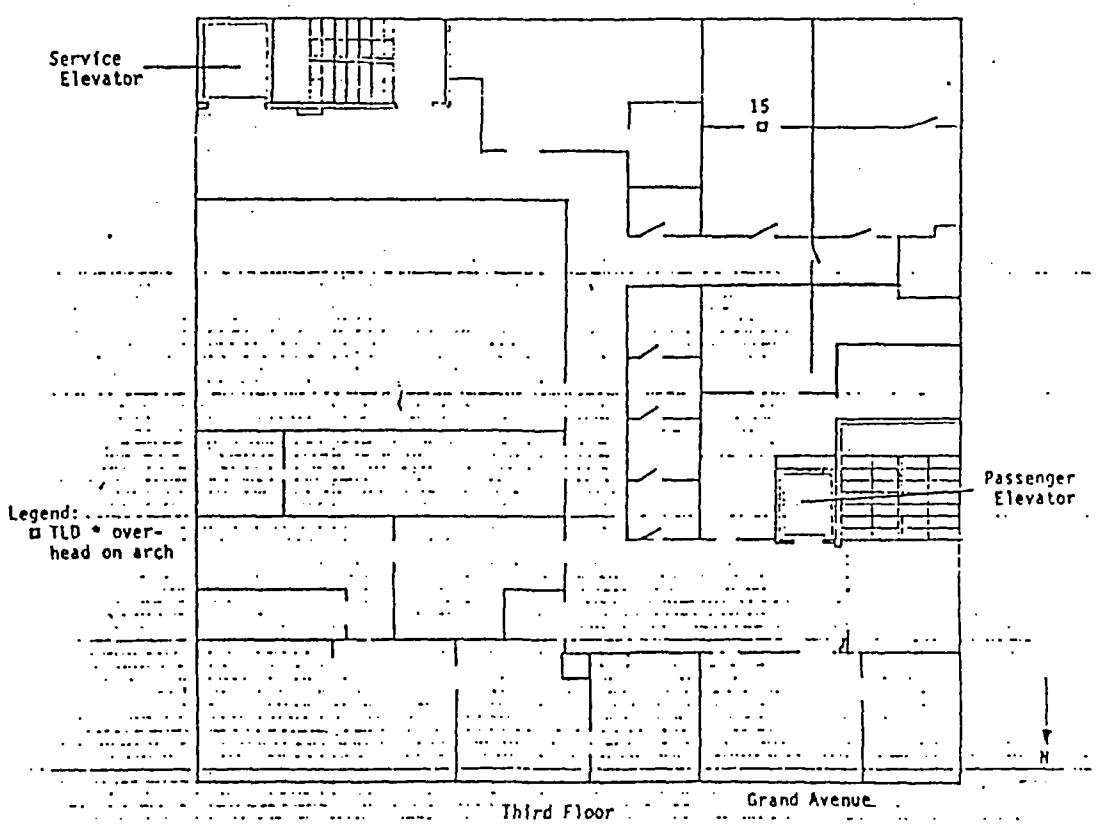


0 0073

Second Floor - Room 202 (Meisel Hunson LTD)

* TLD = Thermoluminescent Dosimeter

Location of Thermoluminescent Dosimeter on Third Floor



* TLD is an acronym for thermoluminescent dosimeter

Room 202 had shown predominantly higher gamma exposure readings and was fully occupied by an architectural firm. Eleven TLD amulets were placed there. On the first floor two TLD amulets were placed in the office area where higher exposure readings had been measured during the Preliminary Survey. One was placed on a pipe and the other was placed on the wall side of a desk. Part way through the exposure period the desk was shifted slightly, but probably not enough to alter the data substantially. A third TLD amulet was placed under the front edge of the receptionist desk because elevated readings from the floor above had been measured there and because it appeared to have a high occupancy. The fifteenth TLD amulet was placed over the arch in the middle of Room 318. This was for background to assess the normal radiation level of the building. Amulets were exposed from January 22 until March 2. Exposure results are shown in Table 1. Dose equivalent numbers in millirem (mrem) were divided by the hours in the exposure period to give hourly rates. The continuous exposure were taken to be 24x7 = 168 hours per week and 24x365 = 8760 hours per year. Workplace exposure was taken to be 40 hours per week and 40x50 = 2000 hours per year. Discussion of these results will be made later in this report.

D. Smears

During the preliminary survey, two smears* were taken at points in the basement that showed elevated micro-R meter readings. The basement floor, unlike most of the building, was readily accessible, not being covered with carpet or tile. Fig. 3 shows the points where smears were taken.

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*Smears are small disks of paper rubbed across a potentially contaminated spot to assess the degree of removable contamination in a given area, usually 100 cm^2.

Immediate survey of the smears with an alpha scintillation dectector were negative. Smears were sent to the IDNS laboratory for gross alpha and gross beta measurements. The results were so low that it appears the radioactive material is not readily removable. However, if contaminated areas are uncovered in the future this conclusion should be rechecked.

E. Air Samples

During the Preliminary Survey an air sample was taken in Room 202 where elevated gamma readings were obtained and in Room 302 which was believed to be uncontaminated. Subsequent surveying showed the room to have a slightly elevated exposure level.

Air samples were taken because in both the Thorium Decay Series and the Uranium Decay Series (See Figs. 1,2) radioactive gases are formed at one stage in the decay process. For the Thorium Decay Series the gas is called radon - 220 or thoron for short. For the Uranium Decay Series the gas is called radon - 222 or radon for short. Spots of thorium or uranium contamination on the floor will emit thoron and radon, respectively, and this gas can then diffuse through overlying materials like carpets into the air. The risk would be exposing the lungs to the decay products of the radioactive gas.

Air samples taken in Rooms 202 and 302 showed that the gross airborne alpha radiation levels measured immediately after collection ceased were 3.5 times as great in Room 202 as in Room 302. This indicates only that one room has more alpha emitting materials in the air not that the air is hazardous. No absolute airborne alpha concentrations were calculated at that time because:

(1) filters had to be read immediatlely rather than waiting the necessary five hours for decay. This was due to time constraints on being in the building after normal working hours.

(2) glass fiber filters were all that were available at the time and these tend to trap particulates among the fibers where they are less likely to be detected by alpha radiation counting devices.

(3) and calibrations for the air sampler and the alpha scintillation filter reader were inadequate.

Subsequently, during the Comprehensive Survey air samples were collected in Room 8 (basement), Room 202 and Room 306 (See Figs. 3,10,19). These rooms were chosen because Room 8 had the high exposure chimney, Room 202 showed extensive contamination and was fully occupied, and Room 306 showed low background levels. It was decided to measure the thoron and radon levels directly, rather than measuring gross alpha levels. A surface filter was used to obtain an air sample in each room and the method of Ogden was used to calculate thoron and radon working levels* (See Technical Appendix for Ogden's paper).

The results are:

	Thoron (WL)	Radon (WL)
Room 8	0.229	0.0139
Room 202	0.162	0.0105
Room 306	0.0255	0.00215

*Working levels are energy units related to air concentrations of alpha emitting decay products of thoron and radon.

VI. RESULTS

A. Background Levels

Specification of a background radiation level for the Lindsay building is a necessary first step. Trace amounts of radioactive materials in building materials can elevate the natural background of a structure. The Lindsay building is brick and therefore would be expected to have a slightly higher radiation background. A quantification of this level can be estimated by looking for the lowest measured levels in the survey results shown in Figs. 3-22. In general, the lowest levels are in the range 15-25 uR/hr as measured by the micro-R meter at one meter. First floor levels tend to group more about 15 uR/hr, with several falling near 10 uR/hr. It was reported the First floor had been sandblasted at one time. If so, this may have removed surface contamination and, thus, lowered the background.

Overall, it appears that about 20 uR/hr is a reasonable level for background as measured with the micro-R meter. Recall that, as stated previously the micro-R meter over responds to low energy gamma rays. The PIC is much less susceptible to this drawback and more nearly registers the actual gamma exposure rate. However, it is cumbersome to use. Consequently, surveys were done with the portable micro-R meter, comparing some readings to equivalent ones made with a PIC, and then deriving a correspondence relationship. It was found that the micro-R meter tends to read about twice the PIC for this material. Consequently, the best estimate of the true gamma exposure rate is half the micro-R meter reading. Thus the following will be used as a criteria.

Background Gamma Ray Exposure Levels	
As measured with a micro-R meter	20 uR/hr
As measured with a pressurized ion chamber	10 uR/hr

B. Contaminated Areas

To designate a contaminated area, reference was made to EPA's proposed Remedial Action Standards for Inactive Uranium Processing Sites. Specific reference was made to the standard for gamma radiation indoors of 20 uR/hr over background. While not strictly applicable because this is based on radon from uranium and the problem on Grand Avenue is thorium, it will be taken as the best available designator of contamination levels. Therefore, in looking at Figs. 3-22, areas that have levels above 60 uR/hr at contact with the surface as measured with a micro-R meter should be considered suspect. If the higher reading is anomalous for the general environs then it should not be considered contamination. The criteria for contamination will be set by several readings in a general area exceeding 60 uR/hr. This leads to the designation of the following areas shown in Figs. 26-30 as contaminated.

Basement - area near Room 8 and boiler
- front section of Room 1
- section of Room 5
- Room 12

1st Floor - northwest corner of northwest office
- *reception area not designated contaminated because source is believed to be on 2nd Floor

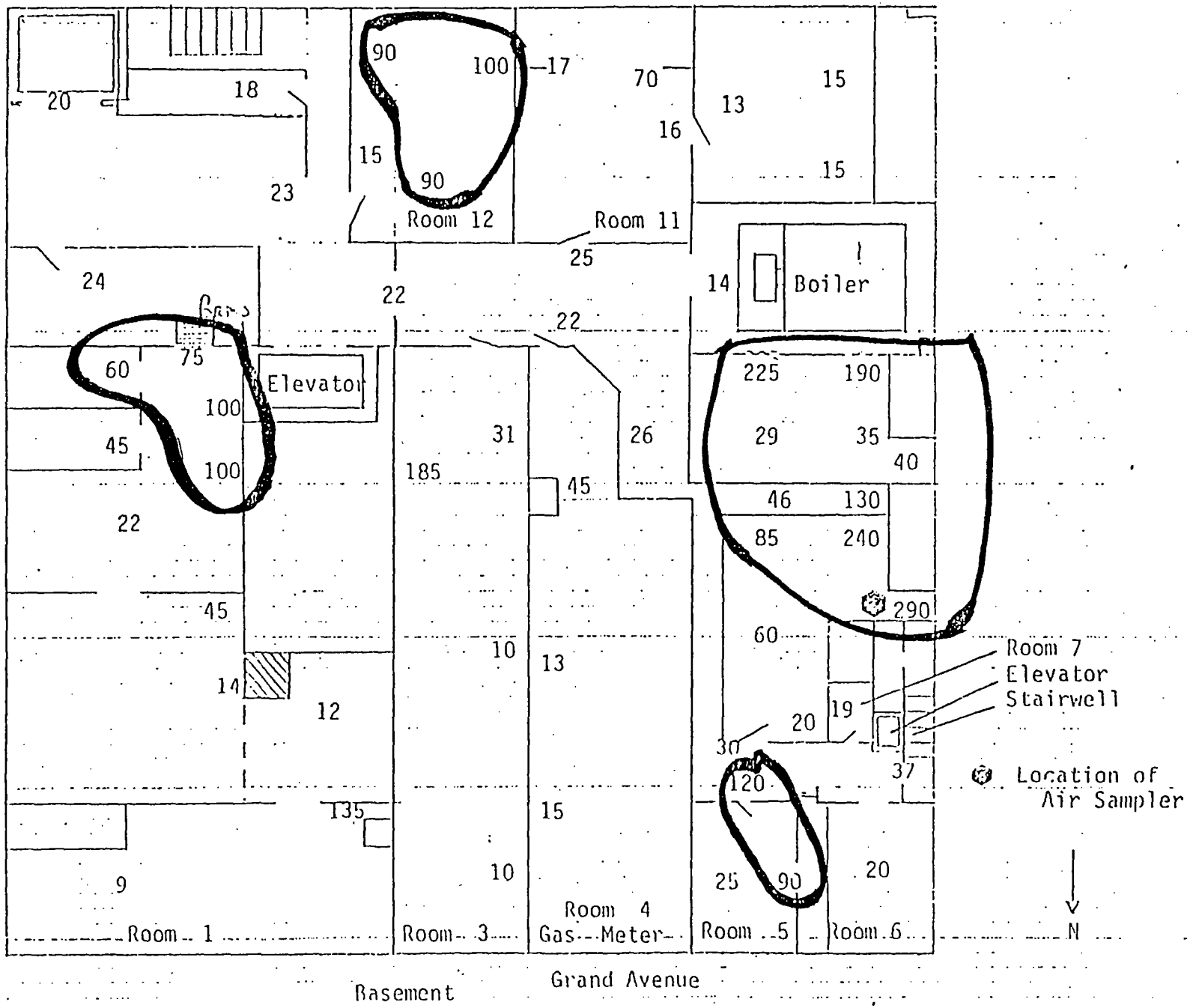
2nd Floor - portions of Rooms 200, 201, 202, 214 and adjacent hallway
- pipe area near service elevator

3rd Floor - portions of Rooms 300, 301, 302, and 303
- portions of Rooms 301 and 319
- section of Room 316
- pipe area near service elevator

4th Floor - west central area of floor
- area in northwest corner of floor

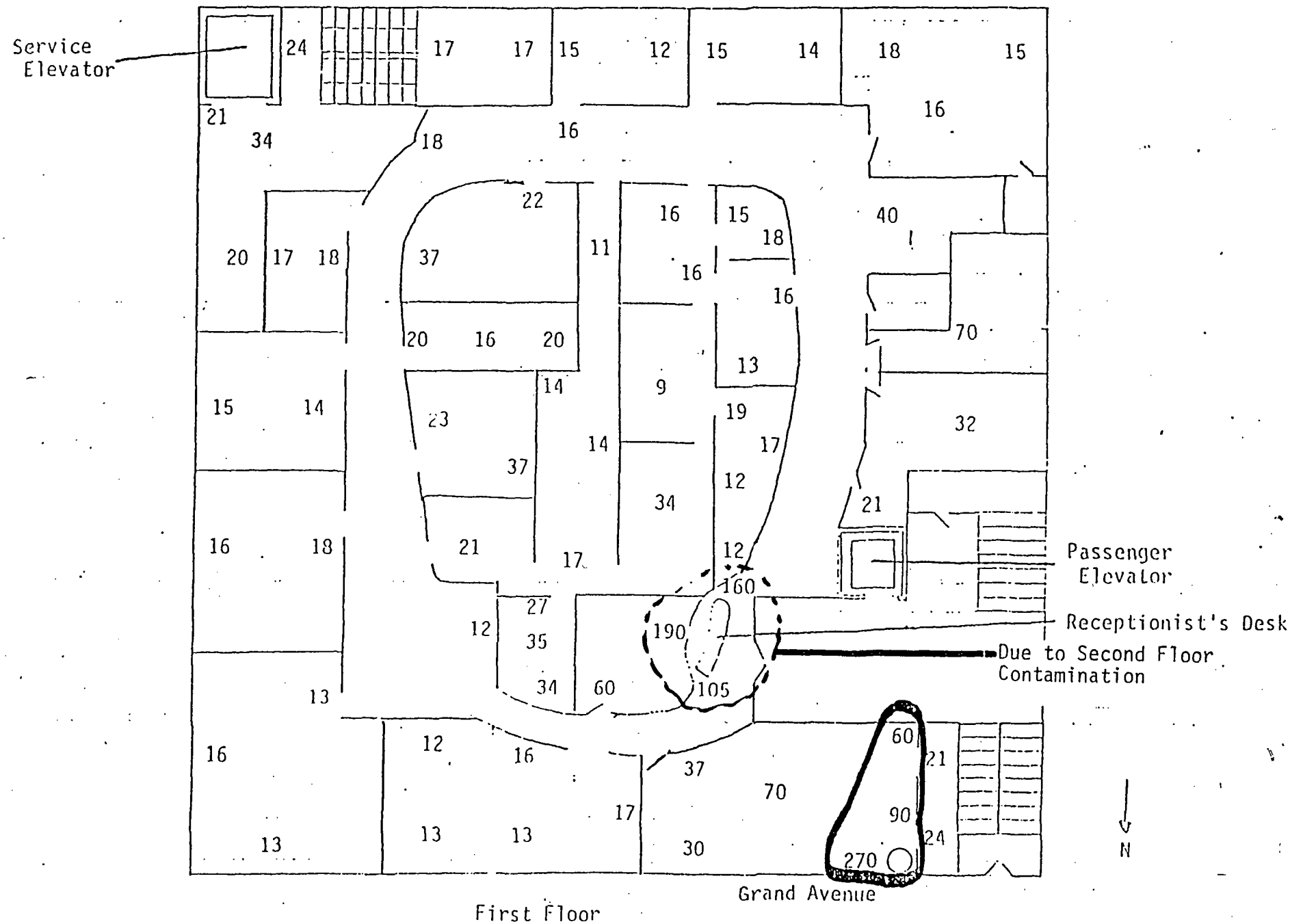
The original room layouts and operational setup in the Lindsay manufacturing process are unknown. However, contaminated areas show several patterns. The northwest corner of each floor generally shows contamination running along a northwest-southeast line. If piping or ductwork run under floorboards in these areas they should be surveyed.

Figure 26 : Basement Regions of Contamination



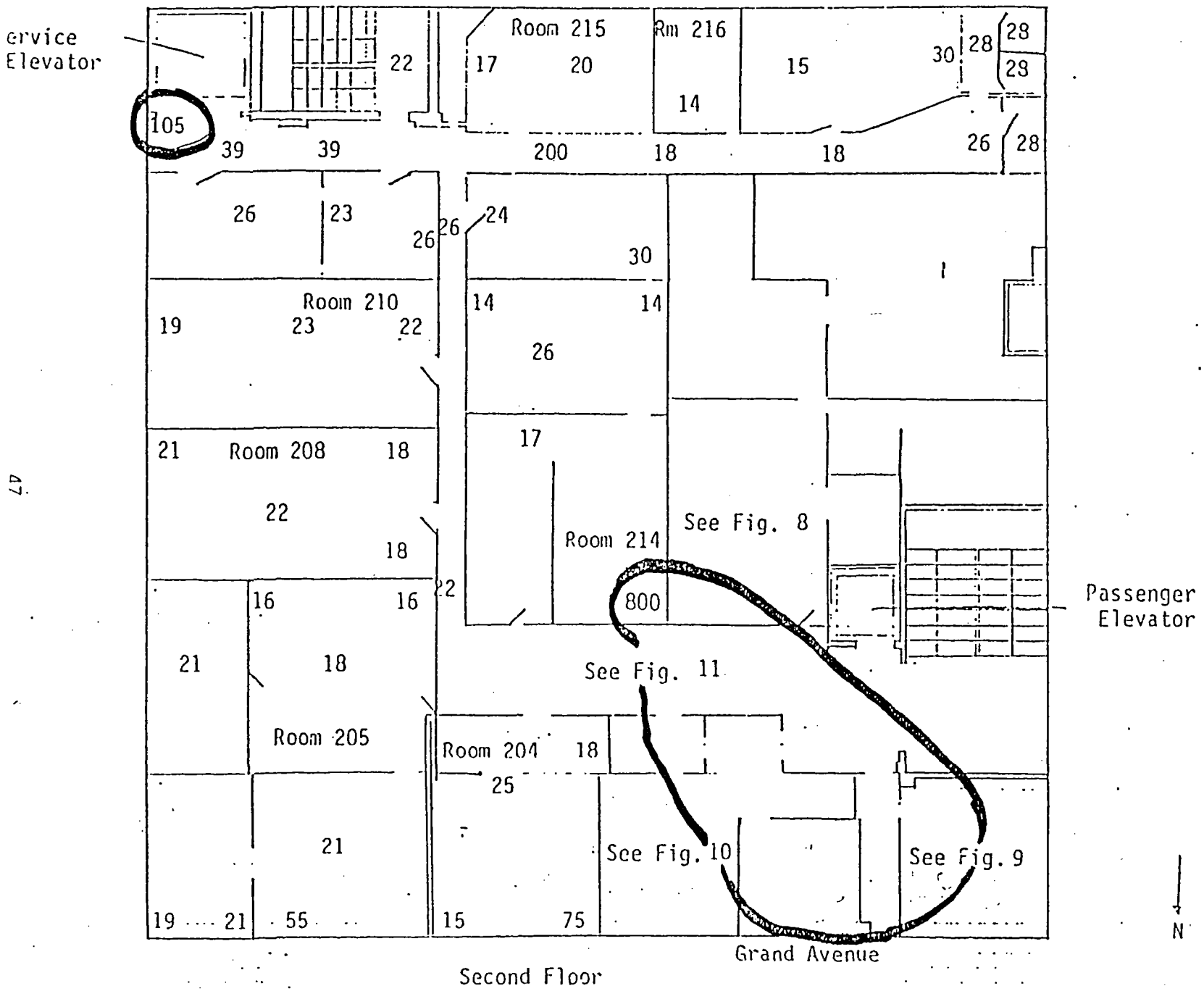
0 0080

Figure 27 : First Floor Regions of Contamination



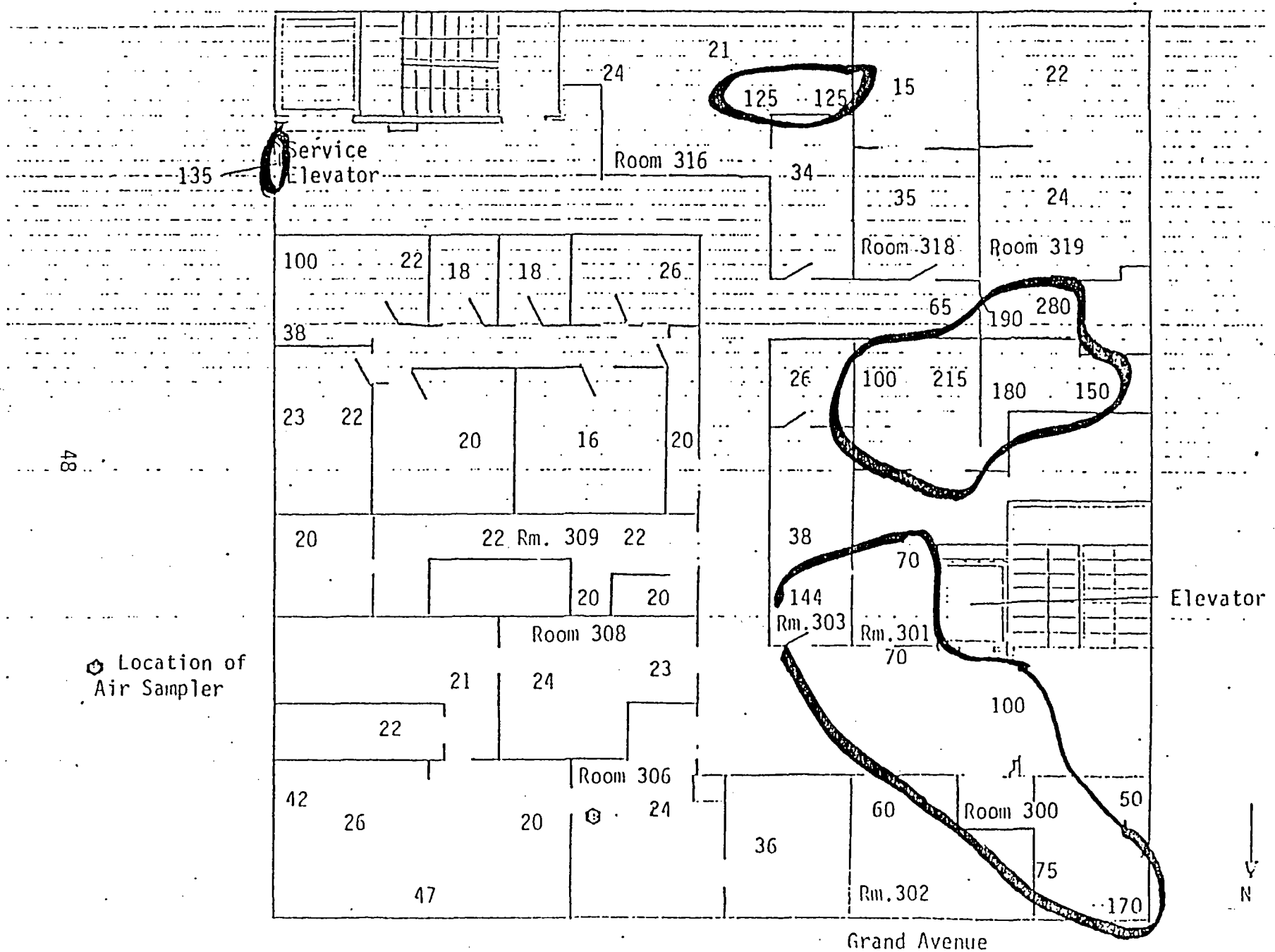
0 0081

Figure 28 : Second Floor Regions of Contaminat



0 0082

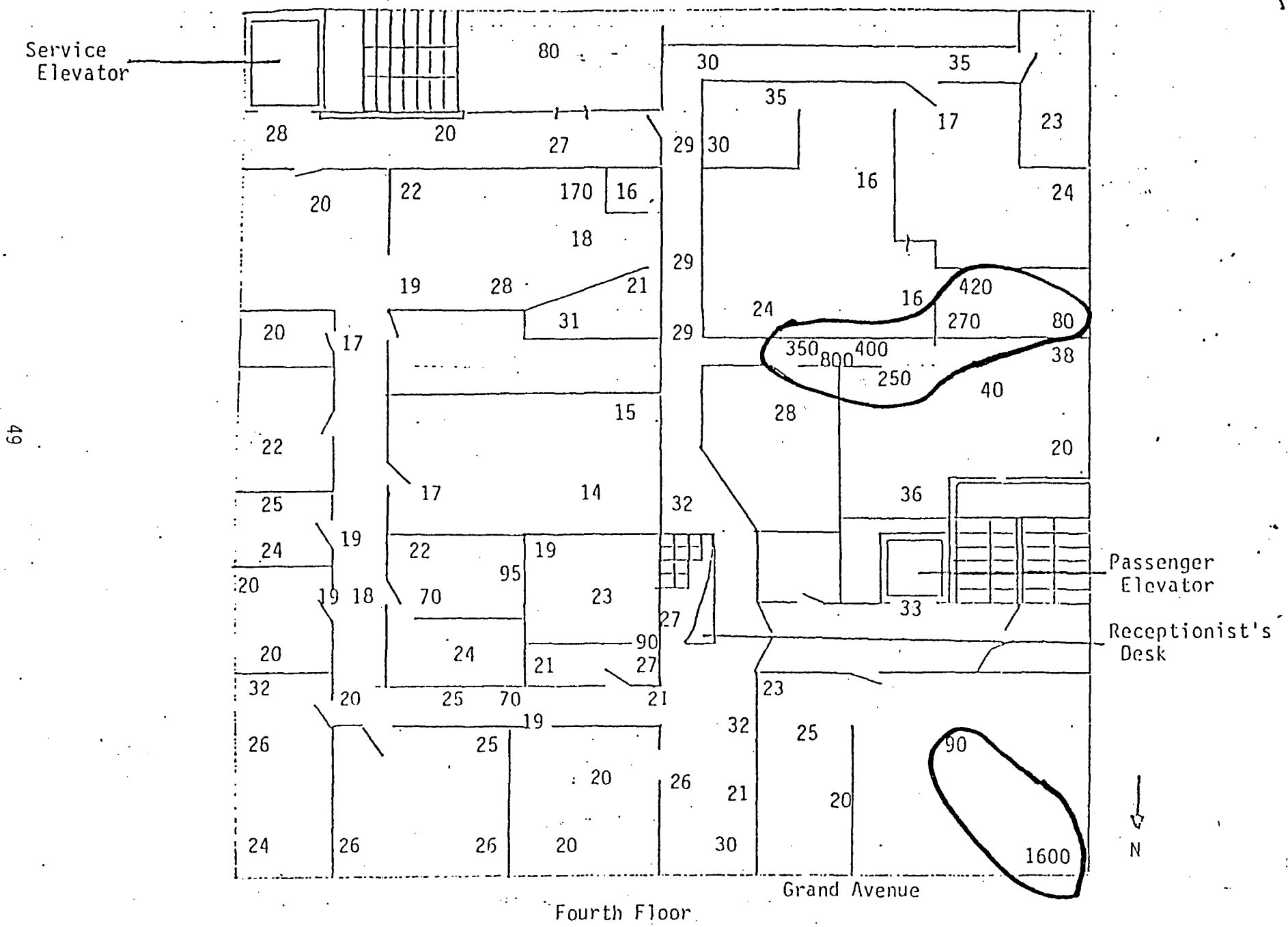
Figure 29 : Third Floor Re ons of Contamination



3rd Floor

0 0083

Figure 30 : Fourth Floor Regions of Contami ion



The west central portions of the basement, 3rd and 4th floors also show contamination. No good reason for this could be found. Finally, the pipeholes near the service elevator on the 2nd and 3rd floors show elevated levels.

The chimney area found contaminated to high levels in the basement did not manifest itself on other floors but this may have been due to considerable absorption by the surrounding brickwork. This chimney definitely should be checked from basement to roof.

C. Identification of the Contamination

The contamination in question is, as suspected from the nature of Lindsay's operation, thorium. The MCA spectrums for Rooms 8 and 202 established this quite well (See Figs. 23 and 24). Thallium-208 gamma peaks at 583 keV, 2615 keV and 3198 keV are strong thorium indicators. Further, the very close correspondences between the spectrums of the Coleman mantle and the thorium dioxide sample with the spectrums for Room 202 and 8, respectively, are strong thorium indicators.

D. Smear Results

The contamination encountered is not removable by normal wiping techniques, at least where we were able to reach surfaces. On-the-spot surveys of two smears with a hand held alpha scintillation detector were negative. Laboratory analyses by the Illinois Department of Nuclear Safety (IDNS) showed the following results.

	Gross Alpha	Gross Beta
Smear #2	5.35 dpm/100 cm^2	2.35 dpm/100 cm^2

*dpm stands for disintegrations per minute. Each disintegration is one radioactive decay.

When compared to the Nuclear Regulatory Commission's "Guidelines For Decontamination of Facilities and Equipment Prior to Release For Unresticted Use or Termination of Licenses For Byproduct, Source, or Special Nuclear Material" these levels are very low.

	NRC Guidelines
Removable Alpha	200 dpm/100 cm^2
Removable Beta	1000 dpm/100^2

E. Air Sample Results

As discussed with regard to the Preliminary Survey a relative comparison of the alpha radiation present in the air of Room 202 compared to Room 302 showed an enhancement of a factor of 3.5. This was not a firm indicator of alpha contamination in the air. Subsequently, air samples were made to assess the degree of alpha air contamination present due to diffusion of thoron and, possibly radon, through carpets and floor coverings from underlying spots of contamination. The results follow:

	Thoron	Radon
Room 306	0.0255 WL	0.00215 WL
Room 202	0.162	0.0105
Room 8	0.229	0.0139

The radon values can be compared to values measured in comparable buildings as reported in the United Nation's Scientific Committee On the Effects of Atomic Radiation, 1977 Report (UNSCEAR)*.

Brick Buildings	0.001 WL
Brick Home	0.0054
Apartment, Brick	0.007

The Lindsay building numbers are not at variance with this data. Radon in buildings is influenced considerably by the degree and rate of ventilation. If the building was tight or the ventilation rate low the radon levels would be expected to be higher. It can also be noted, however, that the radon levels do increase with the measured gamma exposure levels. Room 8 had the highest working levels, Room 202 intermediate and Room 306 low. This would be expected if uranium were present as contamination. From a legal standpoint the Title 10, Part 20 of the Code of Federal Regulations (10 CFR 20) limit for radon of 1/30 WL (.033 WL) is not exceeded in the Lindsay building.

Comparison values for thoron are much more difficult to come by. The same UNSCEAR document reported that indoor equilibrium equivalent concentrations can, for building materials containing thorium, range from 0.0001 WL to 0.008 WL**

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*Table 28, page 77-78, equilibrium equivalent concentrations in pCi/l were converted to WL by dividing by 100 pCi/l per WL.

**Table 30, page 80, equilibrium equivalent concentrations in pCi/l were converted to WL by dividing by 7.5 pCi/l per WL.

EPA's Office of Radiation Programs, Las Vegas Facility did a study in late 1980 on thoron and radon levels in outside air in Las Vegas. Two samples were also collected from inside homes. The thoron levels in homes were 0.00028 WL and 0.00036 WL.

Finally, if one working level of radon is assumed to be equivalent to one working level of thoron then these levels could be compared to standards for contaminated buildings in Grand Junction, Colorado, and in Florida. This is not strictly true. But, because of the limited amount of material available on thoron, it is the best available comparison we have.

Surgeon General's Guidelines for Remedial Action In Grand Junction, Colorado

Radon levels greater than 0.05 WL* - remedial action indicated

Radon levels from 0.01 to 0.05 WL* - remedial action may be suggested

EPA Recommendation For Residences on Florida Phosphate Lands

Annual average radon greater than 0.02 WL** - remedial action should be taken

Annual average radon less than 0.02 WL** - remedial action to reduce concentrations as low as reasonably achievable

*over a background of 0.004 WL

**including background

With these limited comparisons the thoron levels in the Lindsay building appear to be considerably higher than usual. Where higher gamma exposure levels were found the thoron and radon levels were elevated.

From a legal standpoint, the 10 CFR 20, Appendix B, Table II limit for thoron is 10 pCi/l per WL. When converted to working levels based upon UNSCEAR's conversion of 7.5 pCi/l per WL, the equivalent limit is 1.33 WL. The Lindsay building levels do not exceed this standard.

F. Thermoluminescent Dosimeter Results

TLDs were placed in areas deemed critical by the results of the Preliminary Survey. Results are shown in Table 1. Since Site 15 was used as a background location exposure values at the other 14 locations should be adjusted by subtracting off the Site 15 values, 1.56 mrem/week or 78 mrem/year. Background is a level considered normal in the absence of contamination. Site 6 has lower levels but is in the vicinity of a contaminated area and should not be considered as a background location.

The bases for comparison is 10 CFR 20 Section 20.105 where exposures in unrestricted areas are limited to

10 CFR 20 Limits
2 mrem/hour
100 mrem/week
500 mrem/year

Since the building is a workplace, most people would be expected to spend about 40 hours per week or 40 x 50 hours per year there. These should be considered workplace exposures and compared to the Workplace Exposure columns in Table 1. It can be seen that for measured areas of the building, people should not expect to exceed any of the 10 CFR 20 limits.

The Federal Radiation Council (FRC) in Staff Report No. 1 suggested for average population groups exposed to widespread radioactive contamination tht the yearly whole-body exposure not exceed 170 mrem. This criteria is most applicable here.

Thermoluminescent Dosimeter Results For 161 East Grand Avenue, Chicago, Illinois

Table 1

0 0090

TLD ip no.	Location	Dose* (mrem)	Dose* Rate (mrem/hr)	Continuous (mrem/wk	Exposure**** (mrem/yr)	Workplace (mrem/wk)	Exposure** (mrem/yr)
1	Under Secretary's Chair	61	0.065	10.95	569	2.60	130.
2	Under Draftman's Chair	52	0.055	9.27	482	2.20	110
3	Under Draftman's Chair	45	0.048	8.08	421	1.92	96
4	Under Draftman's Chair	39	0.042	7.08	368	1.68	84
5	Under Conference Table	100	0.107	18.03	937	4.28	214
6	On West Wall Above Conference Table	23	0.025	4.2	219	1.00	50
7	On East Wall In Conference Room	61	0.065	10.95	569	2.60	130
8	On West Wall In Main Drawing Room	54	0.058	9.77	508	2.32	116
9	On East Wall In Main Drawing Room	39	0.042	7.08	368	1.68	84
0	On South Wall In Storage Room	40	0.043	7.24	377	1.72	86
1	On West Wall In Entrance Foyer	46	0.049	8.25	429	1.96	98
2	Under Lip Of Reception Desk	56	0.060	10.11	526	2.40	120
3	On Pipe Proximal to Grand Avenue	94	0.100	16.80	880	4.00	200
4	On Side of Desk Near Grand Avenue	65	0.069	11.62	604	2.76	138
5	Over Arch In Middle of Room	37	0.039	6.57	342	1.56	78

*Exposure period 1/22/81, 8:30 p.m. unti 3/2/81 a.m., Total hours 938.5

**Chips 1-11 were located in Room 202, chips 12-14 were located on the first floor, and chip 15 was located in Room 218.

***Continuous exposure is considered to be 168 hours for one week and 8760 hours for one year.

****Workplace exposure is considered to be 40 hours fdor one week and 2000 hours for one year.

However, Site 13 is located beside a desk and typewriter with possibly high occupancy. The net annual occupational exposure at this location would be about 122 mrem (200-78) or 71% the FRC recommendation. Such an exposure should be considered unwarranted. There is no reason to believe at this time that any unmeasured areas of the building are going to be dramatically different from measured areas.

VII. Conclusions

Several conclusions can be drawn from the surveys performed in the Lindsay Light Company Building at 161 East Grand Avenue.

(1) Several areas of the building are contaminated with radioactive materials believed to be residual from the gas light mantle manufacturing operations of the Lindsay Light Company between 1910 and 1936.

(2) The material is thorium.

(3) The distribution of thorium residuals was spotty over an area rather than being uniformly distributed and seemed to be, generally, in the same region of the floor on each floor.

(4) The maximum measured gamma ray exposure rate (one meter off the surface) in an occupied area was 15 times the apparent background and 50 times the apparent background in an unoccupied area. This is clearly excessive although not in violation of hourly or weekly rates in Title 10, Part 20.105 of the Code of Federal Regulations (10 CFR 20.105).

(5) Radon gas levels in contaminated areas increase with increasing gamma exposure levels but do not appear to be out of line with normal levels for similar structures.

(6) Radon gas levels do not exceed the legal limits of 10 CFR 20, Appendix B, Table II for radon-222.

(7) Thoron gas levels in contaminated areas increase with increasing gamma exposure levels. Based upon limited comparison data thoron levels appear much higher than expected.

(8) Thoron gas levels indicate considerable unwarranted lung exposure could arise to persons in the building for long periods of time even though the legal limits of 10 CFR 20, Appendix B, Table II, are not exceeded.

(9) Continued exposure of persons in this workplace to elevated gamma ray emissions and to elevated thoron gas concentrations is contrary to sound health physics practice of maintaining radiation exposures as low as reasonably achievable (ALARA).

VII. Recommendations

The overriding consideration upon which this report is based is well founded in health physics, that where unnecessary radiation exposures can be reduced to lower the possibilities of unwarranted health effects, then steps should be taken to do so, even when regulatory limits are not exceeded. We do not wish to convey the impression there is a substantial crisis or that people are in great peril. These recommendations are made primarily to initiated prudent actions.

It is strongly recommended that a cleanup program to remove residual radioactive materials in those areas shown in Figs. 26-30 be initiated as soon as possible. Cleanup should have the goal of restoring radiation levels in contaminated portions of the building to those comparable with uncontaminated portions of the building.

In no case should such work be performed by any but personnel trained and experienced in handling radioactive materials.

If at any time in the future modifications in this building are made, radiation surveys should be taken to protect personnel and to detect any further contamination. Such modifications could be replacement of carpets, sanding floors, sandblasting walls or altering or replacing piping or ductwork. If new areas of contamination are detected then further cleanup should be initiated before commencing work.

If at any time in the future the building is sold the new owners should be informed of cleanup done and forewarned of the necessity of checking radiation levels before doing work such as suggested above.

The U.S. Environmental Protection Agency and the Occupational Safety and Health Administration offer their assistance in making recommendations about cleanup. Both agencies would expect that they would be allowed to make radiation surveys after cleanup to assure that effective reduction of radiation levels have been achieved.

TECHNICAL APPENDIX

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B. Ogden Method

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I. Instrumentation

Table TA1

Manufacturer	Instrument	Serial Number	Attachment	Serial Number	Preliminary Survey	Comprehensive Survey
Eberline	PRM-5-3	EPA#127371	1"x1" NaI Scintillation Crystal	----------	X	X
Ludlum	Model 19 Micro-R Meter	EPA#164325			X	X
D.S. Davidson	Model 4106 Multi-Channel Analyzer	EPA#164321			X	X
Harshaw			3"x4" NaI Scintillation Crystal, Model 12A12/3A	EPA#101063	X	X
Ludlum	Model 2200 Scaler	EPA#164320	Model 43-10 Alpha Scintillation Counter	EPA#164355	X	X
Eberline	RAS-1 Air Sampler	EPA#164349			X	X
Gelman			47mm Glass Fiber Filters, Type A/E		X	
Gelman			47mm Metricel Filters GN-4, .8 um pore size			X
Rocky Mountain Glass Blowing			Lucas Cells	EPA#164333 164334 164335 164336 164337 164338		X
Harsaw	Model 2000A TLD Reader	EPA#164361	Model 2000B Picoammeter	EPA#164362		X
			TLD-100 Thermoluminescent Dosimeter			X
Reuter-Stokes	Pressurized Ion Chamber	Borrowed, Nuclear Regulatory Commission				X

II. Room Survey Data

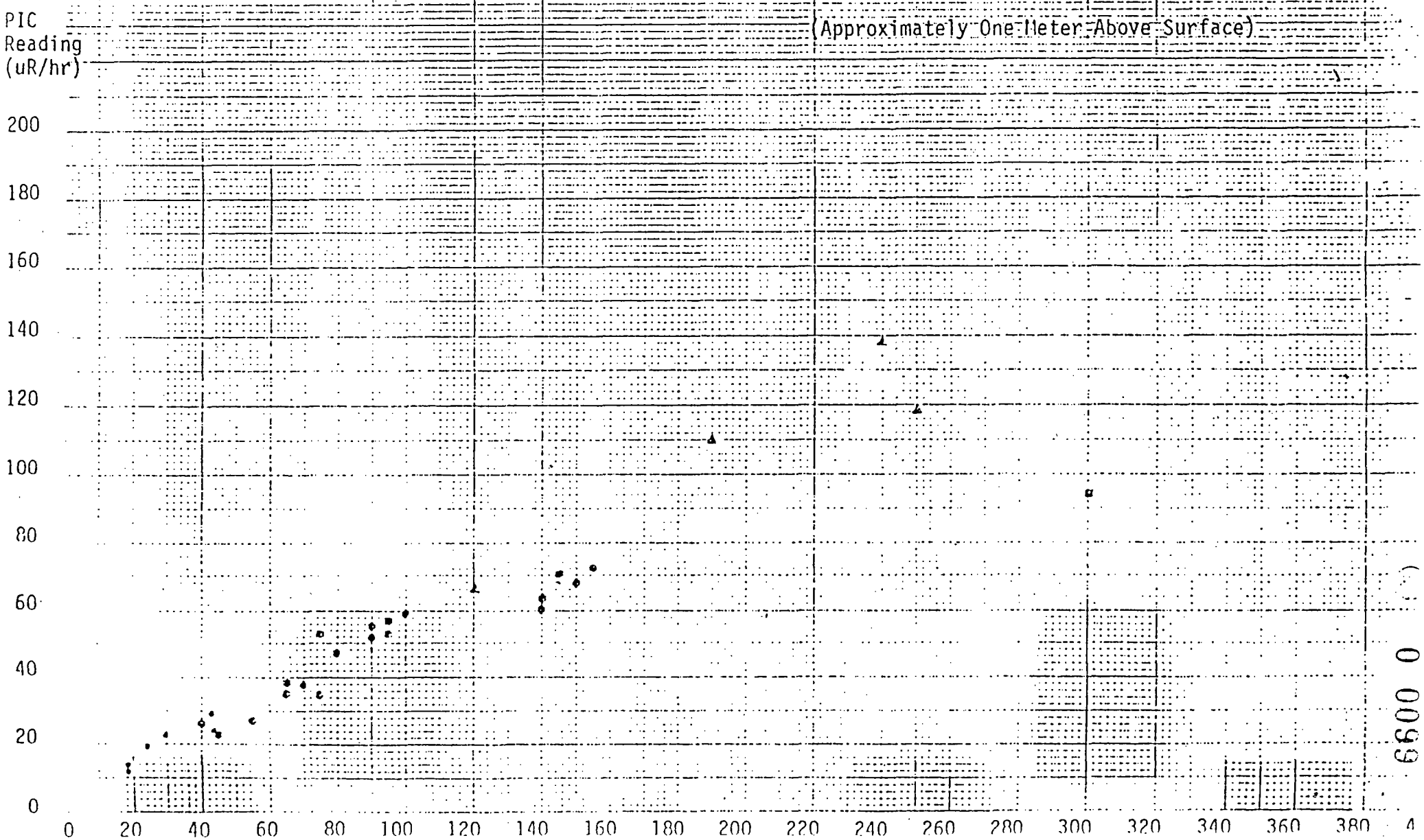
All rooms in the basement and on each of the four floors were surveyed with a micro-roentgen (micro-R) meter at contact with the surface and at one meter above the surface. Rooms 201, 202, and the adjoining hallway area were also surveyed with a pressurized ion chamber (PIC) borrowed from the Nuclear Regulatory Commission's Region III office in Glen Ellyn, Illinois. Simultaneous readings with both the PIC and the micro-R meter were taken in this area of the building to develope a correspondence for the remaining readings using the micro-R meter. The rationale for this being that the PIC does not over respond to low energy gammas the way the micro-R meter does. With a correspondence relationship much of the over response could be allowed for. The average result over four scales of the micro-R meter (0-50, 0-250, 0-500, 0-5000 uR/hr) was a ratio of 0.56:1, PIC:micro-R meter. A reasonable relationship then is that micro-R readings should be reduced by half to more nearly represent the true exposure rate. Room survey results for both instruments were given in Figs. 13-18 in the Main Report. The cross calibration data follows.

Simultaneous Readings, Pressurized Ion Chamber and Micro-Roentgen Meter
(Both approximately one meter above surface)

Table TA2

Micro-R Meter Scale	Micro-R Meter Reading	Pressurized Ion Chamber Reading	Ratio PIC/Micro-R Meter
0-50	19	12	0.63
	19	13	0.68
	25	19	0.76
	30	23	0.77
	43	29	0.67
	44	24	0.55
0-250	40	26	0.65
	45	23	0.51
	55	27	0.49
	65	35	0.54
	65	38	0.58
	70	38	0.54
	75	35	0.47
	75	53	0.71
	80	47	0.59
	90	52	0.58
	90	52	0.58
	90	55	0.61
	95	53	0.56
	95	57	0.60
	100	59	0.59
	140	60	0.43
	140	63	0.45
	145	70	0.48
	145	70	0.48
	150	68	0.45
	155	72	0.46
0-500	120	66	0.55
	190	110	0.58
	240	138	0.58
	250	118	0.47
0-5000	300	94	0.31
		Mean	0.56

Figure TAA : Pressurized Ion Chamber Readings
versus
Micro-R Reading
(Approximately One Meter Above Surface)



III. Multi-Channel Analyzer Spectrums

A. Room 202

The first attempt to identify the contamination found in Room 202 was made during the Preliminary Survey. A 3"x4" sodium iodide crystal was connected to a portable multi-channel analyzer (MCA). The MCA was calibrated to the 661 keV peak of a cesium-137 check source. Also, a Coleman brand gas lantern mantle purchased in a local hardware store and believed to be similar to those manufactured by Lindsay Light Company, was used to obtain a mantle spectrum. The spectrum from Room 202 was obtained by setting the crystal directly on the carpet over one of the highest reading spots in the room. No attempt was made to subtract background.

All three spectrums are plotted in Figs. 23 and 24 in the Main Report. It can be noted that the 583 keV thallium-208 peak corresponds well to a similar peak for the mantle and falls about where expected based on the cesium-137 peak at 661 keV. The distinctive thallium-208 peak at 2615 keV is well defined in the Room 202 spectrum, but much less well defined in the mantle spectrum. Also, probably due to the close proximity of the sodium iodide crystal to the floor source, there is a sum peak formed at 3198 keV (2615+583 keV). Because the MCA was only calibrated at a single point, the energy to channel relationship was not as good as at higher gamma energies. No attempt was made to quantify the floor source activity.

B. Room 8

The highest reading point in the building was located in Room 8 in the basement at what appeared to be an old chimney. A hole about a meter off of the floor was partially filled with concrete.

A spectrum was taken there by placing the sodium iodide crystal in contact with the chimney. See Fig. 24 in the Main Report. For comparison two other spectrums were taken. One again shows the 661 KeV peak for the cesium-137 check source. The other is the spectrum of a small quantity of thorium oxide. Before the Room 8 spectrum was taken the 2615 keV peak of the thorium oxide was used to calibrate the MCA. It appears there may have been some drift of the MCA during collection of the spectrums. No attempt was made to quantify the activity of the chimney source.

IV. Smear Data

Two smears were taken during the Preliminary Survey in the basement at the points shown in Fig. 3 in the Main Report. The Illinois Department of Nuclear Safety Laboratory performed gross alpha, gross beta tests on the smears. The results follow on the computer printout sheet (Table TA3). When converted to disintegrations per minute (dpm) per 100 cm^2 wipe the results are as follows:

Smear #1	Gross Alpha	$2.28 \times 10^{-7} - 1.93 \times 10^{-7}$ uCi/wipe
		0.506 - 0.428 dpm/100 cm^2
	Gross Beta	$<4.91 \times 10^{-7}$ uCi/wipe
		<1.09 dpm/100cm^2
Smear #2	Gross Alpha	$2.41 \times 10^{-6} - 5.00 \times 10^{-7}$ uCi/wipe
		5.35 ± 1.11 dpm/100cm^2
	Gross Beta	$1.06 \times 10^{-6} \pm 6.66 \times 10^{-7}$ uCi/wipe
		2.35 ± 1.48 dpm/100 cm^2

Table TA3

DATE 1/21/81 MICROFILM ----
CCCCF017 LABORATORY INPUT SHEET FOR RADIOLOGICAL SAMPLES PAGE 4

TRAN CODE 45
SAMPLE KEY 8035845059 SAMPLE DATES 11/24/80
PROGRAM CODE FLM 11/24/80
FACILITY ID LINDSAY LIGHT BLDG 161 E GRAND CHICAGO WIPE #1
REGION 2B SAMPLE TYPE WIPE
COLLECTOR ID 646 ANALYSIS DATES 1/ 5/81
1/ 7/81

	PARAMETER ID	R E S U L T			
GROSS ALPHA	4110	.22826881E -6	+-	.19253326E -6	UCI/W (.506 dpm/100 cm^2)
GROSS BETA	4120	LESS THAN		.49125403E -6	UCI/W (1.09 dpm/100 cm^2)

0 0102

DATE 1/21/81 MICROFILM ----

CCGCF017 LABORATORY INPUT SHEET FOR RADIOLOGICAL SAMPLES PAGE 5

TRAN CODE 45
SAMPLE KEY 8030845067 SAMPLE DATES 11/24/80
PROGRAM CODE FLM 11/24/80
FACILITY ID LINDSAY LIGHT BLDG 161 E GRAND CHICAGO WIPE #2
REGION 2B SAMPLE TYPE WIPE
COLLECTOR ID 646 ANALYSIS DATES 1/ 5/81
1/ 7/81

	PARAMETER ID	R E S U L T				
GROSS ALPHA	4110	.24095041E -5	+-	.49959815E -6	UCI/W	(5.35 dpm/100 cm^2)
GROSS BETA	4120	.10596226E -5	+-	.66558740E -6	UCI/W	(2.35 dpm/100 cm^2)

TAB

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The bases of comparison for the smears is the Nuclear Regulatory Commission's "Guidelines For Decontamination of Facilities and Equipment Prior to Release For Unrestrected Use or Termination of Licenses For Byproduct, Source, or Special Nuclear Material". Excerpted Table I is copied here and shows that the natural thorium limits for removable gross alpha are 200 dpm/100 cm^2 and for removable gross beta are 1000 dpm/100 cm^2. All measured values listed above are well below the natural thorium limits.

V. Thermoluminescent Dosimeter Data

A. Calibration Data

Thermoluminescent dosimeters (TLD-100) were first sorted. One hundred TLD's were annealed by the common procedure of 400°C for one hour, one minute cooling at room temperature, 2 hours at 100°C. Annealed chips were all irradiated to 500 mR with a radium source at Argonne National Laboratory (ANL). TLD's were read once and all chips that fell outside 5% of the mean were culled out.

A calibration curve was obtained by irradiating sorted chips with ANL's radium source to levels from 10-100 mR. Each chip was read by the process suggested by the Harshaw Chemical Company, manufacturer of both our TLD's and our reader. The process is to read a chip, turn it over and read it twice (identified as A, B, C, readings, respectively). Annealed but unexposed chips are also read (identified as D reading). The net reading value is obtained by the relationship (A-C) + (B-C) -D. This process gave us the calibration curve in Fig. TAB.

TABLE I

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDE[a]	AVERAGE[b c]	MAXIMUM[b d]	REMOVABLE[b e]
U-nat, U-235, U-238, and associated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm/100 cm^2	3000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5000 dpm β-γ/100 cm^2	15,000 dpm β-γ/100 cm^2	1000 dpm β-γ/100 cm^2

[a]Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b]As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[c]Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

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

[e]The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

[f]The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber

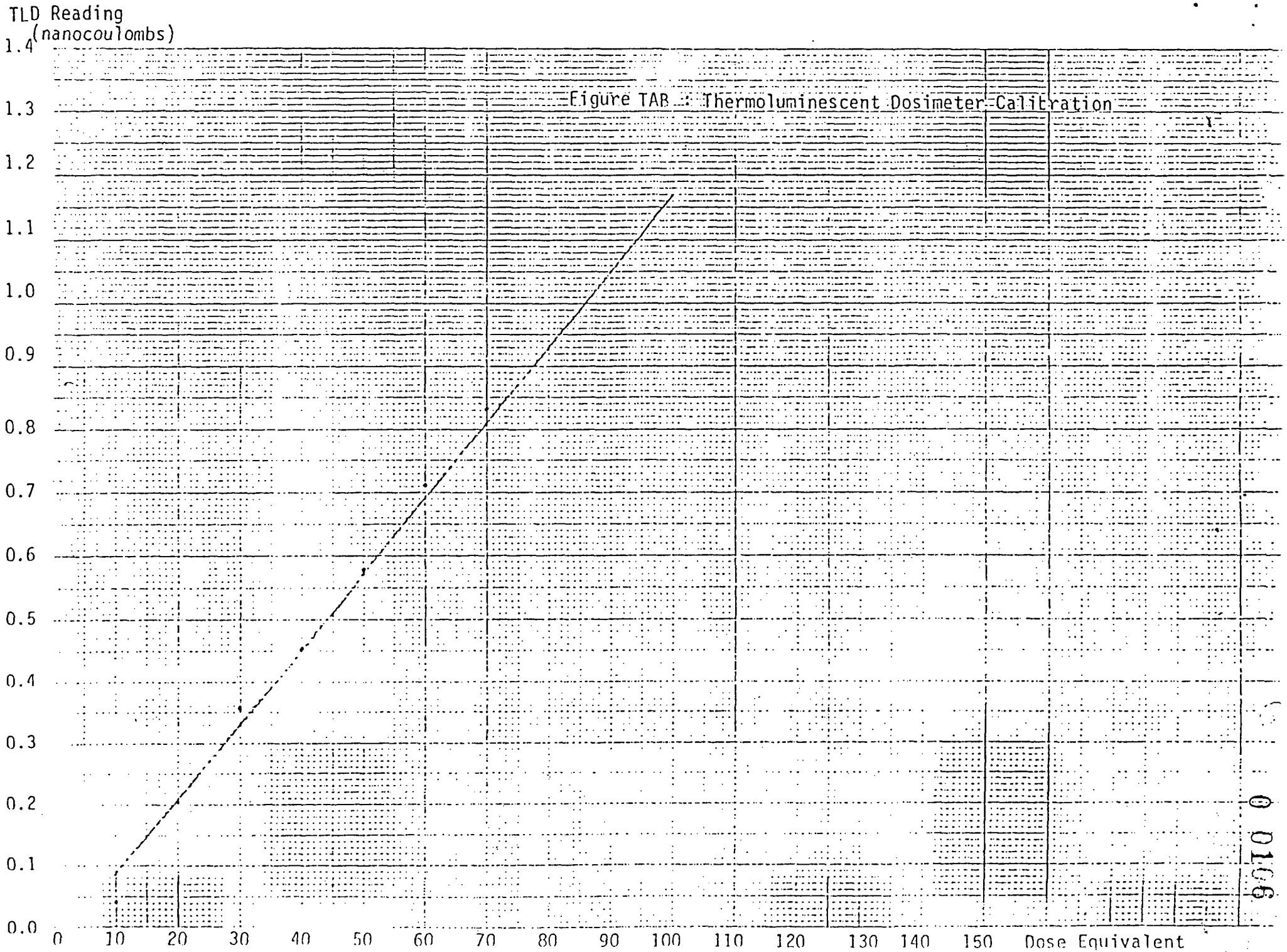

Figure TAB : Thermoluminescent Dosimeter Calibration

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Once the calibration was obtained, sorted chips were annealed and placed in amulets obtained from the Illinois Department of Nuclear Safety. Three chips went in each amulet. Fifteen amulets were hung in areas in the Lindsay building deemed critical by the Preliminary Survey. See Fig. 25 in the Main Report. After a 39 day exposure the amulets were collected and read immediately. The process for reading was as described above except that in place of a reading for an annealed but unexposed chip, the dark current was substituted. Results are given in Table TA4. The period exposure numbers were reduced to hourly exposure rates and then converted to weekly and annual exposures based upon continuous occupancy (168 hours/week, 8760 hours/year) and workplace occupancy (40 hours/week, 2000 hours/year). The latter exposure is most relevant in this situation.

B. Exposure Sites

Exposure sites were chosen based upon the Preliminary Survey results. Namely, Room 202 showed considerable, spotty contamination and the first floor showed elevated gamma readings over the receptionist desk and a wall-pipe area in a front office. A third floor office, Room 318 was selected for background. Based upon the results of the Comprehensive Survey additional TLD's could have been placed in Room 8 in the basement, in the entrance way to Room 319, in the backrooms of Room 301 and in the short 4th floor hallway east of center on the floor. From the TLD results obtained it did not appear further TLD studies were warranted.

Thermoluminescent Dosimeter Results For 161 East Grand Avenue, Chicago, Illinois

able TA4

0 0108

LD Chip	Location	Dose* (mrem)	Dose* Rate (mrem/hr)	Continuous (mrem/wk	Exposure**** (mrem/yr)	Workplace (mrem/wk)	Exposure*** (mrem/yr)
1	Under Secretary's Chair	61	0.065	10.95	569	2.60	130
2	Under Draftman's Chair	52	0.055	9.27	482	2.20	110
3	Under Draftman's Chair	45	0.048	8.08	421	1.92	96
4	Under Draftman's Chair	39	0.042	7.08	368	1.68	84
5	Under Conference Table	100	0.107	18.03	937	4.28	214
6	On West Wall Above Conference Table	23	0.025	4.2	219	1.00	50
7	On East Wall In Conference Room	61	0.065	10.95	569	2.60	130
	On West Wall In Main Drawing Room	54	0.058	9.77	508	2.32	116
9	On East Wall In Main Drawing Room	39	0.042	7.08	368	1.68	84
)	On South Wall In Storage Room	40	0.043	7.24	377	1.72	86
.	On West Wall In Entrance Foyer	46	0.049	8.25	429	1.96	98
?	Under Lip Of Reception Desk	56	0.060	10.11	526	2.40	120
3	On Pipe Proximal to Grand Avenue	94	0.100	16.80	880	4.00	200
4	On Side of Desk Near Grand Avenue	65	0.069	11.62	604	2.76	138
5	Over Arch In Middle of Room	37	0.039	6.57	342	1.56	78

* Exposure period 1/22/81, 8:30 p.m. until 3/2/81 a.m., Total hours 938.5

** Chips 1-11 were located in Room 202, chips 12-14 were located on the first floor, and chip 15 was located in Room 318.

*** Continous exposure is considered to be 168 hours for one week and 8760 hours for one year.

**** Workplace exposure is considered to be 40 hours for one week and 2000 hours for for one year.

VI. Air Sample Data

A. Air Sample Sites

During the Preliminary Survey an air sample was taken in Room 202 where elevated gamma readings were obtained and in Room 302 which was believed to be uncontaminated. Subsequent surveys showed the room to have a slightly elevated exposure level.

During the Comprehensive Survey air samples were collectd in Room 8 (basement) near the highly contaminated chimney, in Room 202 which showed extensive contamination and was fully occupied, and in Room 306 which showed background levels.

B. Air Sample Results

During the Preliminary Survey two air samples were collected in Rooms 202 and 302 to get a rough estimate of the relative alpha radiation air concentrations between a known area of contamination and an area believed to be low or free from contamination. An air sample at 50 liters/minute was used with glass fiber filters. Since then a recalibration has been performed and the actual flow was 41.8 liters/minute. The alpha scintillation detector was also recalibrated and found to have an efficiency of 25%. Although glass fiber filters are not preferable for alpha collections because of deep trapping and self-absorption by the filter, these were all that were available for use at the time. Because of time constraints on overtime personnel in the building we were not able to stay long enough to allow for the normal 5 hour radon decay. Due to all of these drawbacks only a relative concentration is computed here and this is just for the record. Later collections with surface filters are considered superior. (See Table TA5)

Table TA5 Preliminary Survey Air Sample Data and Calculations

Room 202			
Time	Counts/minute*	Time	Counts/minute*
6:52 PM	1710	7:09 PM	1819
6:53	1664	7:10	1829
6:54	1659	7:11	1811
6:56	1685	7:13	1834
6:57	1703	7:14	1752
6:58	1683	7:15	1777
7:02	1777	7:16	1883
7:03	1798	7:17	1824
7:04	1802	7:18	1899
7:05	1735	7:19	1857
7:07	1773	7:21	1841
7:08	1847	Average	1781
		Sampling Time 64 minutes	

* Counting time 1 minute

Room 302	
Time	Counts/minute*
7:35 PM	310
7:38	309
7:39	331
7:40	316
7:41	315
7:42	316
Average	316
Sampling Time 39 minutes	

Blank Filter	
Time	Counts/minute*
7:24 PM	4
7:25	0
7:27	3
Average	2

B. Ogden Method

The method of T.L. Ogden (paper attached) was used in determining the working level* concentrations for radon-220 and radon-222 in Rooms 8,202 and 306.

The method requires at least a 2.5 hour collection, followed by a 20 minute wait and then counting of the filter for 85 and 105 minutes. In this survey collections ranged from 13:26 hours to 18:55 hours. Thoron and radon working levels were computed from:

$$W_T = 6.068 \times 10^{-10} c\ (d \cdot A_2 - A_1)/V$$

$$w_R = 4.736 \times 10^{-9}\ a\ (b \cdot A_1 - A_2)/V$$

where

a, b, c, d = Constants based upon wait times and sampling times, these are obtained from tables or from equations generated by Ogden

A_1, A_2 = counts in 85 and 105 minute periods, respectively, corrected for counter efficiency and blank filter counts

V = collection rate in liters per second

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*Technically the definition for the radon-220 working level is the quantity of lead-212 per liter of air which in decaying through bismuth-212, polonium-212 and thallium-208 to lead-208 will yield 1.3×10^5 MeV of alpha energy. The definition for radon-222 is any combination of polonium-218, lead-214 and bismuth-214 per liter of air which will yield 1.3×10^5 MeV of alpha energy in decaying completely through polomium-214 to lead 210. (From R.L. Rock, "Sampling Mine Atmospheres for Potential Alpha Energy due to the Presence of Radon-220 (Thoron) Daughters", Mining Enforcement and Safety Administration, Informational Report 1015).

AIR SAMPLES

I. Room 202, Average 1781 counts/minute

Background 2 cpm

Net, Room 202 1779 cpm

Air Sampling Rate 41.8 liters/minute

Air Sampling Time 64 minutes

Air Sampling Volume 2675 liters = 2.675×10^6 milliliters

Concentration

$$\frac{1779 \text{ cpm}}{2.675 \times 10^6 \ \frac{\text{ml}}{}} = 6.65 \times 10^{-4} \text{ cpm/ml}$$

II. Room 302, Average 316 cpm

Background 2 cpm

Net, Room 302 314 cpm

Air Sampling Rate 41.8 liters/minute

Air Sampling Time 39 minutes

Air Sampling Volume 1630 liters = 1.63×10^6 ml

Concentration

$$\frac{314 \text{ cpm}}{1.63 \times 10^6 \ \frac{\text{ml}}{}} = 1.93 \times 10^{-4} \text{ cpm/ml}$$

III. Relative Concentration

$$\frac{\text{Room 202}}{\text{Room 302}} = \frac{6.65 \times 10^{-4} \text{ cpm/ml}}{1.93 \times 10^{-4} \text{ cpm/ml}} = 3.45$$

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RADON AND THORON WORKING LEVELS FROM ORDINARY INDUSTRIAL-HYGIENE DUST SAMPLES

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Abstract—The method is an improvement of that of OGDEN (1974), and has the following advantages over other methods: the measurements do not require special samples, but can be made on ordinary airborne dust samples; the long sampling time (> 2½ h) is more suitable for estimating average exposure than the conventional short sample; radon and thoron working levels are both obtained; and the method is very sensitive (0.001 WL is easily measured). Side-by-side comparisons show good agreement with other methods.

INTRODUCTION

WORKERS in many types of mine are exposed to relatively high concentrations of radon and thoron, and it has been proposed that miners exposed to an average radon daughter concentration exceeding 0.1 WL should be subject to medical and environmental surveillance (STRONG *et al.*, 1975). This note describes how average working levels can be determined from dust samples of the type already commonly taken in mines and other industries. The method is an improvement of that described by OGDEN (1974). The earlier method was restricted to dust samples taken at 2.5 l./min (0.0417 l./s) for at least 5.7 h, and required a 50 min wait between the end of sampling and the start of counting. The new version is much more flexible.

METHOD

An airborne dust sample is collected on filter paper at a sampling rate V (l./s) for a period T of at least 2½ h. After a wait t_Q of at least 20 min from the end of sampling the dust-covered filter is exposed to an alpha detector, and the alpha particles given off are counted for two successive periods, the first lasting 85 min and the second 105 min. The counts are corrected for counter efficiency (and the background count in the absence of dust) to give the number of disintegrations A_1 and A_2 in these two periods. The radon working-level value w_R and the thoron value w_T are given by

$$w_R = 4.736 \times 10^{-9}\, a(bA_1 - A_2)/V$$
$$w_T = 6.068 \times 10^{-10}\, c(dA_2 - A_1)/V \qquad (1)$$

where a, b, c and d are given in Table 1 in terms of sampling time T and wait time t_Q (see Appendix for theory).

Although standards are in terms of radon working levels, the thoron contribution is often appreciable when radon levels are low, for example in coal mines or on the surface, and the total working-level value ($w_R + w_T$) is then perhaps a better measure of the hazard. Some uncertainly is introduced by γ, the activity concentration ratio of thorium-C to thorium-B (see OGDEN, 1974). Usually, $\gamma \ll 1$ (DUGGAN, 1973), and the

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TABLE I. VALUES OF a, b, c, AND d FOR SUBSTITUTIONS IN EQUATION (I)

Sampling Time T (min)		Wait time t_q (min) 20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
150	a	5.81	6.51	7.30	8.20	9.21	10.35	11.65	13.12	14.79	16.67	18.81	21.23	23.97	27.08	30.61
	b	1.37	1.37	1.35	1.34	1.32	1.31	1.30	1.28	1.27	1.26	1.26	1.25	1.24	1.23	1.22
	c	22.74	22.27	21.86	21.47	21.16	20.87	20.61	20.37	20.16	19.98	19.81	19.66	19.53	19.41	19.31
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
160	a	5.85	6.50	7.37	8.27	9.25	10.43	11.74	13.21	14.88	16.77	18.91	21.34	24.05	27.20	30.73
	b	1.37	1.36	1.34	1.33	1.31	1.30	1.29	1.28	1.27	1.26	1.25	1.24	1.23	1.22	1.22
	c	21.37	20.93	20.54	20.20	19.89	19.62	19.38	19.16	18.96	18.79	18.64	18.50	18.37	18.27	18.17
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
170	a	5.94	6.64	7.43	8.33	9.35	10.51	11.81	13.29	14.96	16.86	19.00	21.43	24.19	27.31	30.85
	b	1.36	1.35	1.33	1.32	1.30	1.29	1.28	1.27	1.26	1.25	1.24	1.24	1.23	1.22	1.22
	c	20.16	19.75	19.39	19.06	18.78	18.52	18.29	18.09	17.91	17.75	17.60	17.47	17.36	17.26	17.17
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
180	a	5.99	6.70	7.49	8.40	9.42	10.57	11.88	13.36	15.04	16.94	19.09	21.53	24.29	27.41	30.96
	b	1.35	1.34	1.32	1.31	1.30	1.28	1.27	1.26	1.25	1.25	1.24	1.23	1.22	1.22	1.21
	c	19.09	18.70	18.36	18.06	17.79	17.55	17.33	17.14	16.97	16.82	16.68	16.56	16.46	16.35	16.28
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
190	a	6.04	6.75	7.55	8.45	9.43	10.64	11.95	13.43	15.12	17.02	19.18	21.61	24.38	27.51	31.07
	b	1.34	1.33	1.31	1.30	1.29	1.28	1.27	1.26	1.25	1.24	1.23	1.23	1.22	1.21	1.21
	c	18.13	17.77	17.45	17.16	16.90	16.68	16.48	16.29	16.14	15.99	15.86	15.75	15.65	15.55	15.48
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
200	a	6.09	6.80	7.60	8.51	9.54	10.70	12.01	13.50	15.19	17.09	19.25	21.70	24.47	27.60	31.16
	b	1.33	1.32	1.30	1.29	1.28	1.27	1.26	1.25	1.24	1.24	1.23	1.22	1.22	1.21	1.21
	c	17.27	16.93	16.63	16.35	16.11	15.90	15.71	15.54	15.38	15.25	15.13	15.02	14.93	14.83	14.77
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
210	a	6.14	6.85	7.65	8.56	9.59	10.75	12.07	13.56	15.25	17.16	19.33	21.77	24.55	27.69	31.26
	b	1.32	1.31	1.30	1.29	1.28	1.27	1.26	1.25	1.24	1.23	1.23	1.22	1.21	1.21	1.20
	c	16.50	16.17	15.88	15.63	15.40	15.19	15.01	14.85	14.71	14.58	14.46	14.36	14.27	14.19	14.12
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
220	a	6.18	6.89	7.70	8.61	9.64	10.81	12.13	13.62	15.31	17.23	19.39	21.85	24.63	27.77	31.34
	b	1.32	1.30	1.29	1.28	1.27	1.26	1.25	1.24	1.24	1.23	1.22	1.22	1.21	1.20	1.20
	c	15.80	15.49	15.21	14.97	14.75	14.56	14.38	14.23	14.09	13.97	13.86	13.76	13.68	13.60	13.54
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
230	a	6.22	6.93	7.74	8.65	9.69	10.86	12.18	13.68	15.37	17.29	19.46	21.92	24.70	27.85	31.42
	b	1.31	1.30	1.28	1.27	1.26	1.25	1.25	1.24	1.23	1.22	1.21	1.21	1.21	1.20	1.20
	c	15.15	14.86	14.60	14.37	14.16	13.97	13.81	13.66	13.53	13.41	13.31	13.22	13.14	13.07	13.00
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
240	a	6.26	6.97	7.78	8.70	9.73	10.90	12.23	13.73	15.43	17.35	19.52	21.99	24.77	27.92	31.50
	b	1.30	1.29	1.28	1.27	1.26	1.25	1.24	1.23	1.23	1.22	1.21	1.21	1.20	1.20	1.19
	c	14.58	14.29	14.04	13.82	13.62	13.44	13.28	13.14	13.02	12.91	12.81	12.72	12.64	12.57	12.52
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
260	a	6.33	7.05	7.86	8.78	9.81	10.99	12.32	13.82	15.53	17.45	19.63	22.10	24.89	28.06	31.64
	b	1.29	1.28	1.27	1.26	1.25	1.24	1.23	1.23	1.22	1.21	1.21	1.20	1.20	1.19	1.19
	c	13.55	13.29	13.06	12.85	12.67	12.50	12.36	12.23	12.11	12.01	11.92	11.84	11.77	11.71	11.65
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
280	a	6.39	7.11	7.93	8.85	9.89	11.07	12.40	13.91	15.62	17.55	19.73	22.20	25.01	28.18	31.77
	b	1.28	1.27	1.26	1.25	1.24	1.23	1.23	1.22	1.21	1.21	1.20	1.20	1.19	1.19	1.18
	c	12.68	12.43	12.22	12.02	11.85	11.70	11.57	11.45	11.34	11.25	11.16	11.09	11.02	10.97	10.92
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
300	a	6.45	7.17	7.99	8.91	9.95	11.14	12.47	13.98	15.70	17.63	19.82	22.30	25.11	28.29	31.88
	b	1.27	1.26	1.25	1.24	1.23	1.23	1.22	1.21	1.21	1.20	1.20	1.19	1.19	1.18	1.18
	c	11.92	11.69	11.49	11.31	11.15	11.01	10.89	10.77	10.68	10.59	10.51	10.44	10.38	10.33	10.28
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
340	a	6.54	7.27	8.09	9.02	10.07	11.26	12.60	14.12	15.85	17.78	19.99	22.46	25.28	28.47	32.08
	b	1.25	1.24	1.24	1.23	1.22	1.22	1.21	1.20	1.20	1.19	1.19	1.19	1.18	1.18	1.17
	c	10.69	10.48	10.30	10.14	10.00	9.88	9.77	9.67	9.58	9.51	9.44	9.38	9.32	9.28	9.24
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
380	a	6.62	7.35	8.17	9.11	10.16	11.35	12.70	14.22	15.95	17.90	20.10	22.60	25.42	28.62	32.24
	b	1.24	1.23	1.22	1.22	1.21	1.21	1.20	1.20	1.19	1.19	1.19	1.18	1.18	1.17	1.17
	c	9.72	9.54	9.38	9.23	9.11	8.99	8.89	8.80	8.73	8.66	8.60	8.54	8.49	8.45	8.42
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
420	a	6.69	7.42	8.24	9.18	10.24	11.43	12.78	14.31	16.04	18.00	20.21	22.71	25.54	28.74	32.37
	b	1.23	1.22	1.22	1.21	1.20	1.20	1.19	1.19	1.19	1.18	1.18	1.17	1.17	1.17	1.17
	c	8.94	8.78	8.63	8.50	8.38	8.28	8.19	8.11	8.04	7.98	7.92	7.87	7.83	7.79	7.76
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
460	a	6.74	7.47	8.30	9.24	10.30	11.50	12.86	14.39	16.12	18.08	20.30	22.80	25.64	28.85	32.48
	b	1.22	1.21	1.21	1.20	1.20	1.19	1.19	1.18	1.18	1.18	1.17	1.17	1.17	1.16	1.16
	c	8.31	8.15	8.02	7.90	7.79	7.70	7.61	7.54	7.47	7.42	7.37	7.32	7.28	7.25	7.22
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
500	a	6.79	7.52	8.35	9.29	10.35	11.56	12.92	14.45	16.19	18.15	20.37	22.88	25.72	28.94	32.58
	b	1.21	1.21	1.20	1.20	1.19	1.19	1.18	1.18	1.18	1.17	1.17	1.16	1.16	1.16	1.16
	c	7.78	7.64	7.51	7.40	7.30	7.21	7.13	7.06	7.00	6.95	6.90	6.86	6.82	6.79	6.76
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50
540	a	6.82	7.55	8.39	9.34	10.40	11.60	12.97	14.50	16.24	18.21	20.43	22.95	25.79	29.01	32.66
	b	1.21	1.20	1.20	1.19	1.19	1.18	1.18	1.18	1.17	1.17	1.17	1.16	1.16	1.16	1.16
	c	7.33	7.20	7.08	6.97	6.88	6.80	6.73	6.66	6.60	6.55	6.51	6.47	6.44	6.41	6.38
	d	6.31	6.44	6.55	6.66	6.76	6.86	6.95	7.03	7.11	7.19	7.26	7.32	7.39	7.45	7.50

entries in Table 1 assume $\gamma = 0$, but levels for other values of γ can be calculated from the equations in the Appendix. The changes produced by assuming other values of γ are usually <0.001 WL.

The daughter atoms whose activity is measured usually attach to fine dust, and in coal mines the same w values are obtained from respirable and total dust samples. Where dust levels are low, however, a sample from an open filter holder may be preferable. Any size of filter can be used. It may be best to use a membrane filter, where the dust sits on the surface of the filter, but glass fibre filters appear to be satisfactory. For samples of a few milligrams, absorption in the dust should not be a problem. Where concentrations vary with time, the method gives greater weight to the end of the sampling period, but errors in exposure estimate due to this will not usually exceed 20% (OGDEN, 1974). For measuring average exposure to the worker, this method, with its relatively long sampling time, should give a better estimate than a method requiring a very short sample.

Sensitivity is greatest for high values of V and low values of t_Q, but there is no difficulty in measuring a normal surface value of 0.001 WL. The theory assumes $t_Q \gg \tau_{RA}$ (4.5 min), which is why the recommended minimum t_Q is 20 min.

VERIFICATION

As opportunity has arisen, side-by-side comparison has been made with methods used by other workers. The results are given in Table 2.

TABLE 2. RESULTS OF SIDE-BY-SIDE COMPARISONS WITH OTHER METHODS

Comparison method	Duration of test sample (h)	Number and duration of comparison samples	Mean comparison value (WL) (range)	Equation (1) results w_R (WL)	w_T (WL)
JAMES and STRONG (1974)	5.7	8 of 5 min	0.0009* (0.0005–0.0012)	0.0010	0.0004
JAMES and STRONG (1974)	2.7	2 of 5 min	0.0041† (0.0037–0.0045)	0.0033	0.0020
JAMES and STRONG (1974)	3.8	3 of 5 min	0.0054† (0.0046–0.0062)	0.0033	0.0025
Modified Kusnetz‡	2.5	9 of 10 min	0.040† (0.034–0.051)	0.047	0.002
Modified Kusnetz‡	2.5	10 of 10 min	0.134† (0.110–0.147)	0.149	0.006
Modified Kusnetz‡	2.5	10 of 10 min	0.154† (0.127–0.179)	0.177	0.004
Modified Kusnetz‡	2.5	10 of 10 min	0.181† (0.151–0.211)	0.201	0.004

* Corrected for thoron daughters.
† Assuming thoron daughters negligible.
‡ See STRONG *et al.* (1975).

It can be seen that in five of the seven comparisons equation (1) gave radon levels 10–20% higher than the comparison method, a difference well within the expected possible errors. In the other two cases, the comparison method assumed thoron

daughters to be negligible, and our results show this to be unjustified. The comparison method would then be expected to give a result between our w_R and our $w_R + w_T$, as observed. The first three comparisons in Table 2 were carried out in surface buildings, and the other four in an iron-ore mine.

As a check on Table 1, the same sample was evaluated for four different values of t_Q, *viz.* 10, 30, 50 and 70 min. The answers were within a few per cent of each other.

The decay of activity of a coal mine dust sample was followed in detail by taking counts every five minutes for four hours. The decay curve predicted by the calculated values of w_R and w_T fitted the results exactly, confirming that the theory accounted for all the observed activity.

Acknowledgement—Thanks are due to the various NRPB personnel who co-operated in the comparisons with other methods.

REFERENCES

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STRONG, J. C., LAIDLAW, A. J. and O'RIORDAN, M. C. (1975) Radon and its daughters in various British mines. Report NRPB-R39. National Radiological Protection Board, Harwell, Oxfordshire.

APPENDIX—THEORY

THE theory given by OGDEN (1974) was aimed at coal-mine sampling, and covered samples taken for about a shift at 2½ l./min, with a wait time t_Q of 50 min. The theory can be extended as follows (using the symbols of OGDEN, 1974).

Different sampling rates can be accommodated by putting the sampling rate V (l./s) in equations (7) and (14) of OGDEN (1974) instead of the specific value 0.0417 l./s, and carrying V through to equations (16) and (17).

Shorter sampling times than about 5.7 h invalidate the assumption $\exp(-T/\tau_{TC}) \ll 1$, made in equation (12). However, the departure from a shift length of 7 h (2.52×10^4 s) can be allowed for by factors

$$k_{TB} = \{1 - \exp(-T/\tau_{TB})\}/\{1 - \exp(-2.52 \times 10^4/\tau_{TB})\}$$
$$k_{TC} = \{1 - \exp(-T/\tau_{TC})\}/\{1 - \exp(-2.52 \times 10^4/\tau_{TC})\}$$

Equation (12) of OGDEN (1974) then becomes (taking $\tau_{TB} = 5.527 \times 10^4$ s and $\tau_{TC} = 5247$ s; T in seconds)

$$A_T = n_{TB}\{0.4047\, k_{TB} \exp(-1.809 \times 10^{-5}\, t) - 0.09415\,(1.105 - \gamma)\, k_{TC} \exp(-1.906 \times 10^{-4}\, t)\}$$

k_{TB} is the same as k in OGDEN (1974) (k is incorrectly defined in the list of symbols there as the reciprocal of its true value). T must still exceed 2½ h, unless similar corrections are made to the radon daughter terms.

Counting begins at a time t_Q after the end of sampling. A_1 alpha particles are emitted in the next 85 min and A_2 in the following 105 min. The count-rate equation (14) of OGDEN (1974) can be integrated between these limits to give

$$w_R = 4.736 \times 10^{-9}\, a(bA_1 - A_2)/V$$
$$w_T = 6.068 \times 10^{-10}\, c(dA_2 - A_1)/V$$

where

$$a = 10^3 K/(JM - LK)$$
$$b = M/K$$
$$c = 10^3 L\,(1 + 0.0949\gamma)/(JM - LK)$$

$$d = J/L$$
$$J = 3.859\times10^{4}\exp(-4.310\times10^{-4}\,t_Q) - 1.821\times10^{4}\exp(-5.862\times10^{-4}\,t_Q)$$
$$K = 1.972\times10^{3}\,k_{Ta}\exp(-1.809\times10^{-3}\,t_Q) - 309.6\,(1.105-\gamma)k_{Tc}\exp(-1.906\times10^{-4}\,t_Q)$$
$$L = 4.499\times10^{3}\exp(-4.310\times10^{-4}\,t_Q) - 940.6\exp(-5.862\times10^{-4}\,t_Q)$$
$$M = 2.197\times10^{3}\,k_{Ta}\exp(-1.809\times10^{-3}\,t_Q) - 131.7\,(1.105-\gamma)k_{Tc}\exp(-1.906\times10^{-4}\,t_Q)$$
(t_Q in seconds).

The overnight collections which we used foreclosed use of Ogden's tables so that constants a,b,c,d, were derived from the equations and then cross-checked by plotting each constant from the table (See Fig. TAC) and extrapolating to the desired sampling time. Both methods agreed.

In the counting process for the sample filter, total counts during the 85+105 minute periods were recorded every 5 minutes. For each room total counts versus time were plotted in Fig. TAD. No attempt was made to subtract background since this would be a minor correction. No attempt was made to correct for counter efficiency, although multiplying counts by 4 or 1/25% would do this. Two points can be made with this graph. First, all rooms show similar decay rates, only the level is different. Second the flatness of the decay curve is indicative of predominantly thoron decay product content on the filter. As shown by Rock in "Sampling Mine Atmospheres for Potential Alpha Energy due to the Presence of Radon-220 (Thoron) Daughters," Informational Report 1015, Mining Enforcement and Safety Administration, a mixed radon-thoron sample would show a rapid decrease in count rate with a half life on the order of 26.8 minutes followed by a long half-life decay on the order of 10.64 hours. The first is due to the radon (lead-214) the second is due to the thoron (lead-212). Here no rapid decay is evident indicating little radon. The half life is about 14 hours supporting a largely thoron atmosphere.

C. Air Sample Results

Table TA6 gives collection data on air samples taken during the Comprehensive Survey. These collections were aimed at measuring thoron and radon working levels. Data and results using the Ogden Method are given in Table TA7.

0 0120

Figure TAC : Constants' Values versus Sampling Time (minutes)
(Used in Ogden Method for Determination of Radon and Thoron Working Levels)

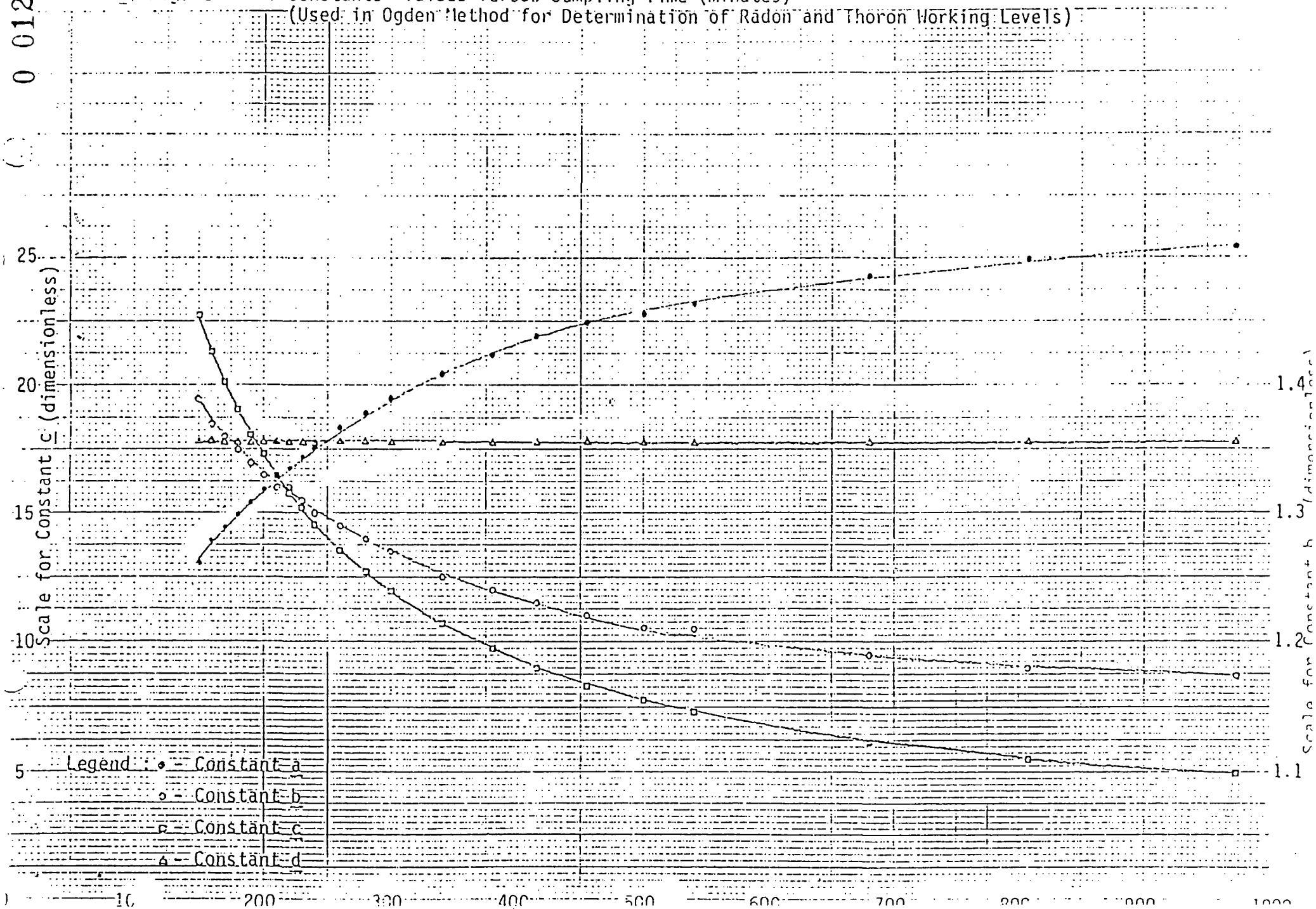


Table TA6: Air Sample (Filter) Collection and Background Counting Periods

Collection Site	Collection Period	Time (min)	Background* Period	Background Time (min)	Flow Rate (l/min)
Room 8	Start 2/25/81, 1:40 P.M. Stop 2/26/81, 8:35 A.M.	1135	2/26/81, 12:10 P.M. 2/25/81, 1:35 P.M.	85	18.42
Room 202	Start 2/24/81, 4:20 P.M. Stop 2/25/81, 8:33 A.M.	973	2/25/81, 12:05 P.M. 2/25/81, 1:30 P.M.	85	18.42
Room 306	Start 2/26/81, 7:10 P.M. Stop 2/27/81, 8:36 A.M	806	2/27/81, 12:10 P.M. 2/27/81, 1:35 P.M.	85	18.42

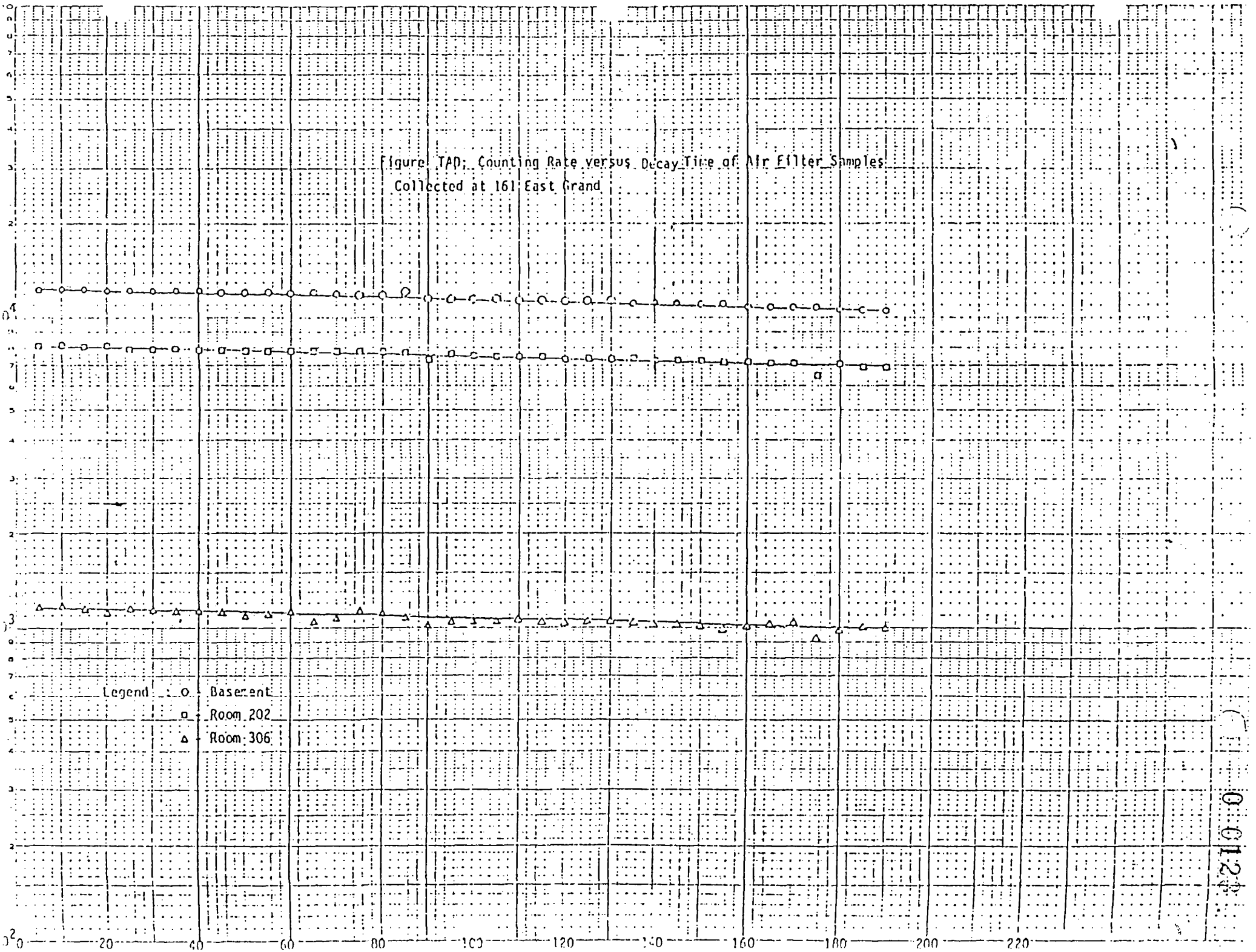
*Sample (Filter) counting times were between the end of collection and the beginning of the background count.

Working Level Results Using Ogden's Method

Table TA7

		Room 8	Room 202	Room 306
Calibrated (1/min)		18.42	18.42	18.42
		0.307	0.307	0.307
Alpha Detector Efficiency		25%	25%	25%
Counting Periods	85 Minutes (counts	1,033,280	670,340	95,320
	105 Minutes		762.722	107,587
Ogden Contants	a	7.071	7.04	6.99
	b	1.169	1.174	1.181
	c	4.533	4.94	5.533
	d	6.315	6.315	6.315
Background Collection Time (min)		85	85	85
	Counts	134	132	74
	Count Rate counts/min	1.58	1.55	0.87
Working Levels	W_T(WL)	0.229	0.162	0.0255
	W_R(WL)	0.0139	0.0105	0.00215

Figure TAD: Counting Rate versus Decay Time of Air Filter Samples
Collected at 161 East Grand



0 0123

RADIATION SAFETY SERVICES, Inc.
827 Simpson Street
Evanston, Illinois 60201

312/866-7744

0 0124

965-1999
FAX 965-1991
Terry Liabol

July 15, 1981

Mr. Chris Ball
Browne & Storch
100 E. Ohio Street
Chicago, IL 60611

Dear Mr. Ball:

Thank you for inviting Radiation Safety Services, Inc., to submit a proposal for supervision of the decontamination of thorium residual activities in the 161 E. Grand building. As you are aware, there are at present no federal or state regulations requiring decontamination of the building. However, good radiological health practice dictates that the building be decontaminated as much as is practical. Radiation Safety Services, Inc., is prepared to assist you in meeting this goal.

Radiation Safety Services, Inc., is a health physics consulting firm offering a wide range of technical and administrative services to clients in government, industry, medicine, education and the legal professions. We differ from other health physics consulting firms in several important ways.

- Qualifications:
  The principals of our firm are Certified Health Physicists (certified by the American Board of Health Physics) and are Registered Professional Engineers. We have successfully organized, administered and executed large-scale and small-scale radiation protection programs. We also have worked with state, national and international agencies in the development of radiation safety standards and practices.

- Personnel assignment:
  Only principals of the firm do consulting. Use of support staff in client facilities is limited to operational services.

- Methodology:
  We use the implementation consulting method. This approach, designed to leave clients with more than reports and additional paperwork, ensures that the consulting process produces tangible and meaningful results.

In addition Radiation Safety Services, Inc., has unique exerience with thorium contamination.

- We have been consultants for over two years to the City of West Chicago regarding thorium residuals on the site where Lindsey Light & Chemical moved in the 1930's. We are also responsible for evaluating and decontaminating approximately 100 residential and commercial properties in the City of West Chicago.

- We utilize instrumentation specifically designed for measuring the type and level of radiation resulting from thorium residual contamination. This instrumentation which was loaned to one of the governmental agencies during its survey of the 161 E. Grand building, is far more suitable for evaluating radiological health problems resulting from thorium contamination than instrumentation routinely available and used in operational health physics.

- We are experienced in managing public and employee relations efforts designed to minimize the concern of the public and workers in areas where thorium contamination is present. This is accomplished by presenting adequate and factual information to concerned individuals in a non-alarming fashion.

Radiation Safety Services, Inc., will supervise 161 E. Grand building employees to insure that decontamination operations are performed in a radiologically safe fashion. The objective of the decontamination operation will be to reduce environmental radiation doses in the building to 100 ~~μ~~rem/hr or less in all accessible areas. Building employees will be supervised and directed as necessary to prevent further spreading of contamination or contamination of themselves. When necessary employees will be decontaminated prior to ending their work day. Air sampling will be conducted in restricted areas and respiratory protection against radioactive dusts will be provided as needed.

Radiation Safety Services, Inc., will provide a Ph.D. health physicist with several years of experience in evaluating and decontaminating thorium contaminated properties. The health physicist will directly supervise building employees in decontaminating the thorium residuals and will work with you to answer questions asked by employees, building tenants, or members of the public. Where additional labor is required, Radiation Safety Services, Inc., will provide a skilled health physics technician to assist building employees in the decontamination operations.

965 - 1991

Radiation Safety Services, Inc., will provide all necessary survey, air monitoring and anticontamination protection including respiratory protection. The duration of operations will depend upon the building employees' available time. Therefore, our charges will be based upon a daily rate which is $350 per day for the Ph.D. health physicist and $150 per day for the health physics technician. Work will start within two weeks of our receipt of a purchase order. You will be billed monthly with payment to be made in 30 days.

We look forward to assisting the management of the 161 E. Grand building in eliminating this unnecessary exposure of irradiation resulting from thorium contamination. If you have any questions, please contact me at 866-7744.

Yours truly,

Eili A. Port

Eili A. Port
Certified, American Board of
Health Physics
Registered Professional Engineer

EAP:ws

DECONTAMINATION ACTIVITIES

AT

LINDSAY LIGHT BUILDING
161 E. Grand Avenue
Chicago, Illinois

INTRODUCTION

The 161 E. Grand Avenue Building housed the Lindsay Light Company from about 1910 to the mid-1930's. The company first imported and then manufactured incandescent gas light mantles employing natural thorium compounds and incidental to its operations deposited thorium materials on surfaces, particularly floors, of the building.

The United States Environmental Protection Agency (EPA) reported on the results of several surveys performed at 161 E. Grand Avenue and recommended that, although there is no statutory requirement, the building be decontaminated where practicable. This recommendation was made to reduce the dose from radiation exposure to members of the general public who work in or frequent the building.

The building management chose Radiation Safety Services, Inc., to evaluate and, where appropriate, attempt to decontaminate the more heavily contaminated floors in the building. This was to be accomplished by removal of contaminated floor surfaces followed by replacement of the floors with new material. The work took place during the month of August, 1981.

Technical Approach.

The building management and Radiation Safety Services identified areas where the gamma dose rate at 1 meter above the floor was 100 microrads per hour or greater. These areas were candidates for decontamination.

The first step for most of the areas was the removal of the existing floor coverings, exposing the oak floors. These floors were surveyed and were frequently found to contain significant surface alpha contamination. The building engineer supplied laborers and tools with which the surface layer of the flooring could be removed.

When contamination was found to extend to a greater depth in the oak flooring, the floor boards were cut and removed. Frequently, the subfloor, which was the original plank flooring in the building, was found to be badly contaminated indicating the oak flooring had been installed subsequent to the initiation of Lindsay Light operations. Since the planking was structural, the decision was made to attempt to chisel out contamination to a depth of 1/2 inch. It was felt that removal of more material might compromise the structural integrity of the floors.

Where contamination did not appear to extend to a great depth into the floor the floors were power sanded. The dust from sanding operations was controlled by the use of plastic

sheets. Personnel respiratory protection and hearing protection was supplied to the building laborers.

The operations were terminated at the request of an owner-tenant. And the areas in which work had been performed were resurveyed. The survey reports are in Appendix A.

Results and Recommendations

Areas on the basement, second and fourth floor levels were decontaminated. The areas for decontamination were selected by the building management and decontamination was interrupted at the request of the owner-tenant. The areas decontaminated represent the most significant contamination for areas which are generally occupied and doses were significantly reduced or eliminated at a height of 1 meter from the floor.

The basement pump room, which is immediately north of the boiler room, had a hot spot due to contaminated material used as fill around a pipe. The contaminated material was removed and the created void was filled with concrete. This reduced the external gamma dose from 225 microrads per hour at contact with the floor to 60 microrads per hour at contact and 50 microrads per hour at 1 meter.

The highest readings in the building were found in the basement in Room 8 which was not decontaminated since this is an area which is not occupied. If this area is to be occupied in the future, decontamination is strongly recommended and would be mandated by State law.

The EPA reported dose rates of 800 microrads per hour at 1 meter from the floor in the vicinity of the secretary's desk in Room 202. The floor covering and oak flooring were removed and the planking chiseled to a depth of 1/2 inch reducing the dose rate in the vicinity of the secretary's desk to 250 microrads per hour at 1 meter from the floor.

We recommend that where possible the planking be sealed with bituminous material to retard radon escape and that a 1/2 inch plate of lead be installed prior to replacement of the floor and floor covering. This should further reduce the dose rate by approximately a factor of 2.

The conference room in 202 received treatment similar to the floor adjacent to the secretary's desk. This reduced the dose rate at 1 meter from the floor from the EPA reported maximum of 155 microrads per hour to a maximum of 90 microrads per hour.

We recommend that the floor be sealed with bituminous material to retard radon escape prior to the replacement of the floor and floor covering material. .

On the fourth floor Streeterville post-production room the thin concrete floor was broken up, the oak flooring removed, and the planking chiseled and sanded. This reduced the dose rate from the 300 microrads per hour reported by the EPA to 150 microrads per hour at 1 meter from the floor.

We recommend that the floor be sealed with bituminous material to retard the release of radon from this floor.

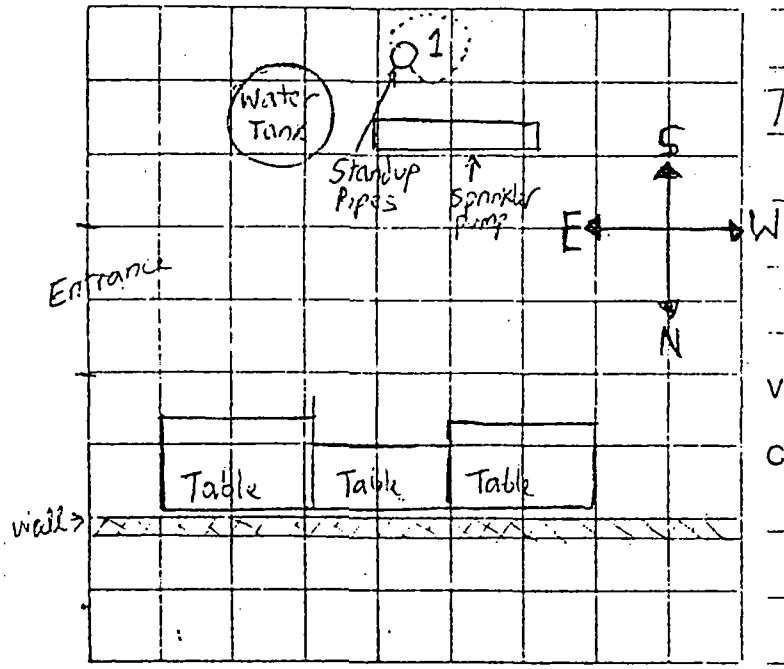
Although decontamination was terminated before completion, the most important occupied areas demonstrated a significant dose reduction consistent with the decontamination effort. Changing space utilization, particularly in the basement, may dictate further decontaminations to the levels recommended by the EPA. It is recognized that there is a very serious trade-off between reductions in already low doses and the expense of decontamination.

SURVEY REPORT

BUILDING: 161 E Grand ROOM: Basement - Pump Room DATE: 9-8-81 BY: BH

Routine ☐ Spot Check ☐ Special ☒ Equipment ☐

Survey Instrument Eberline E-500B, HP-270 Source of Ionizing Radiation



TYPE	FORM	ACTIVITY
Thorium Nat		

Ventilation:

Comments:

SURVEY FINDINGS

AREA	(uR/hr) Contact	(uR/hr) 1 meter above floor	
1 - around standup pipe	60	50	

Background

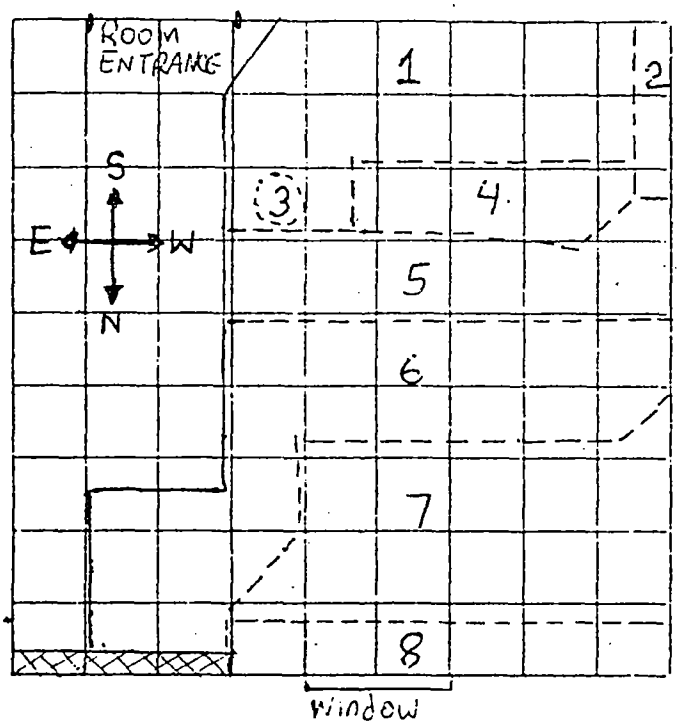
RECOMMENDATIONS:

SURVEY REPORT

BUILDING: 161 E. Grand ROOM: 202 - Conference Room DATE: 9-8-81 BY: BH

Routine ☐ Spot Check ☐ Special ☒ Equipment ☐

Survey Instrument Eberline E-500B, HP-270 Source of Ionizing Radiation



TYPE	FORM	ACTIVITY
Thorium Nat.		

Ventilation:

Comments: All reported exposure rates represent the highest readings observed.

SURVEY FINDINGS

AREA	(uR/hr) CONTACT	(uR/hr) 1 METER ABOVE FLOOR	
1	80	—	
2	550	—	
3	250	—	
4	150	90	
5	100	70	
6	80	60	
7	200	—	
8	500	—	

Background

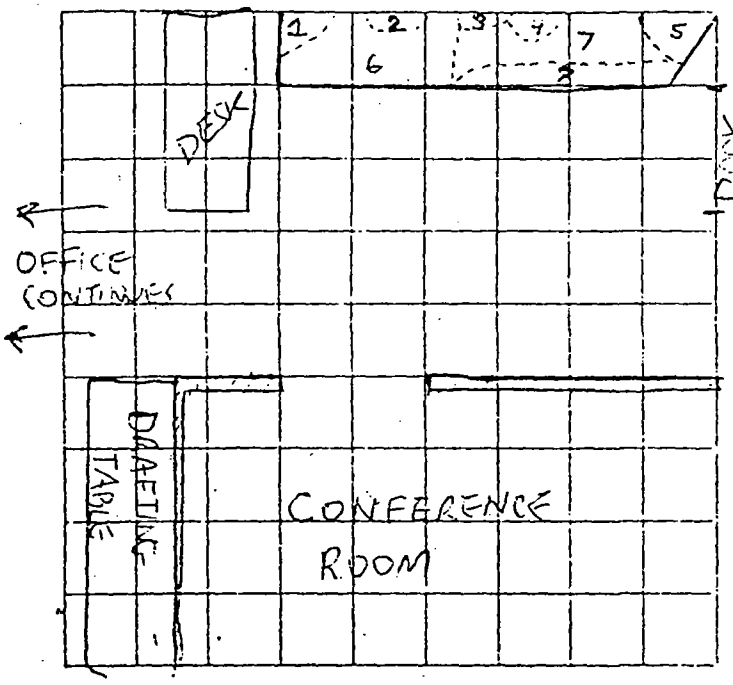
RECOMMENDATIONS:

SURVEY REPORT

BUILDING: 161 E. Grand ROOM: 202 DATE: 9-8-81 BY: BH

Routine ☐ Spot Check ☐ Special ☒ Equipment ☐

Survey Instrument Eberline E-500B, HP-270 Source of Ionizing Radiation



TYPE	FORM	ACTIVITY
Thorium Nat.		

Ventilation:

Comments:

SURVEY FINDINGS

AREA	(uR/hr) CONTACT	(uR/hr) 1 METER ABOVE FLOOR	
1	600	—	
2	900	—	
3	800	—	
4	400	—	
5	400	—	
6	500	250	
7	300	200	
8	200	—	
Background			

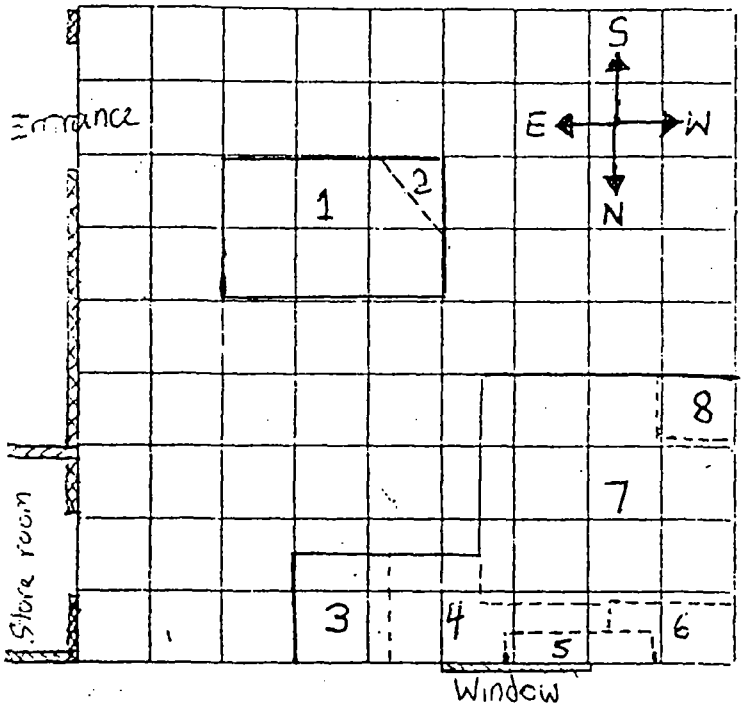
RECOMMENDATIONS:

SURVEY REPORT

BUILDING: 161 E. Grand ROOM: 4th FL. Streeterville Post-Production Rm DATE: 9-8-81 BY: B.H.

Routine ☐ Spot Check ☐ Special ☒ Equipment ☐

Survey Instrument Eberline E-500B, HP-270 Source of Ionizing Radiation



TYPE	FORM	ACTIVITY
Thorium Nat.		

Ventilation:

Comments: All reported readings are the highest readings.

SURVEY FINDINGS

AREA	(uR/hr) CONTACT	(uR/hr) 1 METER ABOVE FLOOR	
1	80	60	
2	90	—	
3	70	40	
4	100	—	
5	700	150	
6	140	—	
7	80	80	
8	120	—	

Background

RECOMMENDATIONS:

GUIDELINES FOR DECONTAMINATION OF FACILITIES AND EQUIPMENT PRIOR TO RELEASE FOR UNRESTRICTED USE OR TERMINATION OF LICENSES FOR BYPRODUCT, SOURCE, OR SPECIAL NUCLEAR MATERIAL

U. S. Nuclear Regulatory Commission
Division of Fuel Cycle and Material Safety
Washington, D.C. 20555

July 1982

The instructions in this guide, in conjunction with Table 1, specify the radionuclides and radiation exposure rate limits which should be used in decontamination and survey of surfaces or premises and equipment prior to abandonment or release for unrestricted use. The limits in Table 1 do not apply to premises, equipment, or scrap containing induced radioactivity for which the radiological considerations pertinent to their use may be different. The release of such facilities or items from regulatory control is considered on a case-by-case basis.

1. The licensee shall make a reasonable effort to eliminate residual contamination.

2. Radioactivity on equipment or surfaces shall not be covered by paint, plating, or other covering material unless contamination levels, as determined by a survey and documented, are below the limits specified in Table 1 prior to the application of the covering. A reasonable effort must be made to minimize the contamination prior to use of any covering.

3. The radioactivity on the interior surfaces of pipes, drain lines, or ductwork shall be determined by making measurements at all traps, and other appropriate access points, provided that contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces of premises, equipment, or scrap which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement shall be presumed to be contaminated in excess of the limits.

4. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated with materials in excess of the limits specified. This may include, but would not be limited to, special circumstances such as razing of buildings, transfer of premises to another organization continuing work with radioactive materials, or conversion of facilities to a long-term storage or standby status. Such requests must:

   a. Provide detailed, specific information describing the premises, equipment or scrap, radioactive contaminants, and the nature, extent, and degree of residual surface contamination.

   b. Provide a detailed health and safety analysis which reflects that the residual amounts of materials on surface areas, together with other considerations such as prospective use of the premises, equipment or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.

5. Prior to release of premises for unrestricted use, the licensee shall make a comprehensive radiation survey which establishes that contamination is within the limits specified in Table 1. A copy of the survey report shall be filed with the Division of Fuel Cycle and Material Safety, USNRC, Washington, D.C. 20555, and also the Administrator of the NRC Regional Office having jurisdiction. The report should be filed at least 30 days prior to the planned date of abandonment. The survey report shall:

   a. Identify the premises.

   b. Show that reasonable effort has been made to eliminate residual contamination.

   c. Describe the scope of the survey and general procedures followed.

   d. State the findings of the survey in units specified in the instruction.

   Following review of the report, the NRC will consider visiting the facilities to confirm the survey.

TABLE 1

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDES[a]	AVERAGE[b c f]	MAXIMUM[b d f]	REMOVABLE[b e f]
at, U-235, U-238, and ociated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
nsuranics, Ra-226, Ra-228, 230, Th-228, Pa-231, 227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
nat, Th-232, Sr-90, 223, Ra-224, U-232, I-126, 31, I-133	1000 dpm/100 cm^2	3000 dpm/100 cm^2	200 dpm/100 cm^2
a-gamma emitters (nuclides h decay modes other than ha emission or spontaneous sion) except Sr-90 and ers noted above.	5000 dpm βγ/100 cm^2	15,000 dpm βγ/100 cm^2	1000 dpm βγ/100 cm^2

ere surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting clides should apply independently.

used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the ounts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

easurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average ould be derived for each such object.

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

he amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft bsorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of own efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced roportionally and the entire surface should be wiped.

he average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed .2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of otal absorber.

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Revision 2
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U.S. NUCLEAR REGULATORY COMMISSION

REGULATORY GUIDE

OFFICE OF NUCLEAR REGULATORY RESEARCH

REGULATORY GUIDE 8.13
(Task OP 031-4)

INSTRUCTION CONCERNING PRENATAL RADIATION EXPOSURE

A. INTRODUCTION

Section 19.12, "Instructions to Workers," of 10 CFR Part 19, "Notices, Instructions, and Reports to Workers; Inspections," requires that all individuals working in or frequenting any portion of a restricted area[1] be instructed in the health protection problems associated with exposure to radioactive materials or radiation, in precautions or procedures to minimize exposure, and in the regulations that they are expected to observe. The present 10 CFR Part 20, "Standards for Protection Against Radiation," has no special limit for exposure of the embryo/fetus.[2] This guide describes the instructions an employer should provide to workers and supervisors concerning biological risks to the embryo/fetus exposed to radiation, a dose limit for the embryo/fetus that is under consideration, and suggestions for reducing radiation exposure.

This regulatory guide takes into consideration a proposed revision to 10 CFR Part 20, which incorporates the radiation protection guidance for the embryo/fetus approved by the President in January 1987 (Ref. 1). This revision to Part 20 was issued in January 1986 for comment as a proposed rule. Comments on the guide as it pertains to the proposed Part 20 are encouraged. If the new Part 20 is codified, this regulatory guide will be revised to conform to the new regulation and will incorporate appropriate public comments.

Any information collection activities mentioned in this regulatory guide are contained as requirements in 10 CFR Parts 19 or 20, which provide the regulatory basis for this guide. The information collection requirements in 10 CFR Parts 19 and 20 have been cleared under OMB Clearance Nos. 3150-0044 and 3150-0014, respectively.

B. DISCUSSION

It has been known since 1906 that cells that are dividing very rapidly and are undifferentiated in their structure and function are generally more sensitive to radiation. In the embryo stage, cells meet both these criteria and thus would be expected to be highly sensitive to radiation. Furthermore, there is direct evidence that the embryo/fetus is radiosensitive. There is also evidence that it is especially sensitive to certain radiation effects during certain periods after conception, particularly during the first 2 to 3 months after conception when a woman may not be aware that she is pregnant.

Section 20.104 of 10 CFR Part 20 places different radiation dose limits on workers who are minors than on adult workers. Workers under the age of 18 are limited to one-tenth of the adult radiation dose limits. However, the present NRC regulations do not establish dose limits specifically for the embryo/fetus.

The NRC's present limit on the radiation dose that can be received on the job is 1,250 millirems per quarter (3 months).[3] Working minors (those under 18) are limited to a dose equal to one-tenth that of adults, 125 millirems per quarter. (See § 20.101 of 10 CFR Part 20.)

Because of the sensitivity of the unborn child, the National Council on Radiation Protection and Measurements (NCRP) has recommended that the dose equivalent

[1] Restricted area means any area that has controlled access to protect individuals from being exposed to radiation and radioactive materials.

[2] In conformity with the proposed revision to 10 CFR Part 20, the term "embryo/fetus" is used throughout this document to represent all stages of pregnancy.

[3] The limit is 3,000 millirems per quarter if the worker's occupational dose history is known and the average dose does not exceed 5,000 millirems per year.

USNRC REGULATORY GUIDES

Regulatory Guides are issued to describe and make available to the public methods acceptable to the NRC staff of implementing specific parts of the Commission's regulations, to delineate techniques used by the staff in evaluating specific problems or postulated accidents, or to provide guidance to applicants. Regulatory Guides are not substitutes for regulations, and compliance with them is not required. Methods and solutions different from those set out in the guides will be acceptable if they provide a basis for the findings requisite to the issuance or continuance of a permit or license by the Commission.

This guide was issued after consideration of comments received from the public. Comments and suggestions for improvements in these guides are encouraged at all times, and guides will be revised, as appropriate, to accommodate comments and to reflect new information or experience.

Written comments may be submitted to the Rules and Procedures Branch, DRR, ADM, U.S. Nuclear Regulatory Commission, Washington, DC 20555.

The guides are issued in the following ten broad divisions:

1. Power Reactors
2. Research and Test Reactors
3. Fuels and Materials Facilities
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to the unborn child from occupational exposure of the expectant mother be limited to 500 millirems for the entire pregnancy (Ref. 2). The 1987 Presidential guidance (Ref. 1) specifies an effective dose equivalent limit of 500 millirems to the unborn child if the pregnancy has been declared by the mother; the guidance also recommends that substantial variations in the rate of exposure be avoided. The NRC (in § 20.208 of its proposed revision to Part 20) has proposed adoption of the above limits on dose and rate of exposure.

In 1971, the NCRP commented on the occupational exposure of fertile women (Ref. 2) and suggested that fertile women should be employed only where the annual dose would be unlikely to exceed 2 or 3 rems and would be accumulated at a more or less steady rate. In 1977, the ICRP recommended that, when pregnancy has been diagnosed, the woman work only where it is unlikely that the annual dose would exceed 0.30 of the dose-equivalent limit of 5 rems (Ref. 3). In other words, the ICRP has recommended that pregnant women not work where the annual dose might exceed 1.5 rem.

C. REGULATORY POSITION

Instructions on radiation risks should be provided to workers, including supervisors, in accordance with § 19.12 of 10 CFR Part 19 before they are allowed to work in a restricted area. In providing instructions on radiation risks, employers should include specific instructions about the risks of radiation exposure to the embryo/fetus.

The instructions should be presented both orally and in printed form, and the instructions should include, at a minimum, the information provided in Appendix A (Instructor's Guide) to this guide. Individuals should be given the opportunity to ask questions and in turn should be questioned to determine whether they understand the instructions. An acceptable method of ensuring that the information is understood is to give a simple written test covering the material included in Appendix B (Pregnant Worker's Guide). This approach should highlight for instructors those parts of the instructions that cause difficulties and thereby lead to appropriate modifications in the instructional curriculum.

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC staff's plans for using this regulatory guide.

Except in those cases in which an applicant or licensee proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the NRC will use the material described in this guide to evaluate the instructional program presented to individuals, including supervisors, working in or frequenting any portion of a restricted area.

APPENDIX A

INSTRUCTOR'S GUIDE

EFFECTS ON THE EMBRYO/FETUS OF EXPOSURE TO RADIATION AND OTHER ENVIRONMENTAL HAZARDS

In order to decide whether to continue working while exposed to ionizing radiation during her pregnancy, a woman should understand the potential effects on an embryo/fetus, including those that may be produced by various environmental risks such as smoking and drinking. This will allow her to compare these risks with those produced by exposure to ionizing radiation.

Table 1 provides information on the potential effects resulting from exposure of an embryo/fetus to radiation and nonradiation risks. The second column gives the rate at which the effect is produced by natural causes in terms of the number per thousand cases. The fourth column gives the number of additional effects per thousand cases believed to be produced by exposure to the specified amount of the risk factor.

The following section discusses the studies from which the information in Table 1 was derived. The results of exposure of the embryo/fetus to the risk factors and the dependence on the amount of the exposure are explained.

1. RADIATION RISKS

1.1 Childhood Cancer

Numerous studies of radiation-induced childhood cancer have been performed, but a number of them are controversial. The National Academy of Science (NAS) BEIR report reevaluated the data from these studies and even reanalyzed the results. Some of the strongest support for a causal relationship is provided by twin data from the Oxford survey (Ref. 4). For maternal radiation doses of 1,000 millirems, the excess number of deaths (above those occurring from natural causes) was found to be 0.6 death per thousand children (Ref. 4).

1.2 Mental Retardation and Abnormal Smallness of the Head (Microcephaly)

Studies of Japanese children who were exposed while in the womb to the atomic bomb radiation at Hiroshima and Nagasaki have shown evidence of both small head size and mental retardation. Most of the children were exposed to radiation doses in the range of 1 to 50 rads. The importance of the most recent study lies in the fact that investigators were able to show that the gestational age (age of the embryo/fetus after conception) at the time the children were exposed was a critical factor (Ref. 7). The approximate risk of small head size as a function of gestational age is shown in Table 1. For a radiation dose of 1,000 millirems at 4 to 7 weeks after conception, the excess cases of small head size was 5 per thousand; at 8 to 11 weeks, it was 9 per thousand (Ref. 7).

In another study, the highest risk of mental retardation occurred during the 8 to 15 week period after conception (Ref. 8). A recent EPA study (Ref. 16) has calculated that excess cases of mental retardation per live birth lie between 0.5 and 4 per thousand per rad.

1.3 Genetic Effects

Radiation-induced genetic effects have not been observed to date in humans. The largest source of material for genetic studies involves the survivors of Hiroshima and Nagasaki, but the 77,000 births that occurred among the survivors showed no evidence of genetic effects. For doses received by the pregnant worker in the course of employment considered in this guide, the dose received by the embryo/fetus apparently would have a negligible effect on descendants (Refs. 17 and 18).

2. NONRADIATION RISKS

2.1 Occupation

A recent study (Ref. 9) involving the birth records of 130,000 children in the State of Washington indicates that the risk of death to the unborn child is related to the occupation of the mother. Workers in the metal industry, the chemical industry, medical technology, the wood industry, the textile industry, and farms exhibited stillbirths or spontaneous abortions at a rate of 90 per thousand above that of workers in the control group, which consisted of workers in several other industries.

2.2 Alcohol

It has been recognized since ancient times that alcohol consumption had an effect on the unborn child. Carthaginian law forbade the consumption of wine on the wedding night so that a defective child might not be conceived. Recent studies have indicated that small amounts of alcohol consumption have only the minor effect of reducing the birth weight slightly, but when consumption increases to 2 to 4 drinks per day, a pattern of abnormalities called the fetal alcohol syndrome (FAS) begins to appear (Ref. 11). This syndrome consists of reduced growth in the unborn child, faulty brain function, and abnormal facial features. There is a syndrome that has the same symptoms as full-blown FAS that occurs in children born to mothers who have not consumed alcohol. This naturally occurring syndrome occurs in about 1 to 2 cases per thousand (Ref. 10).

TABLE 1

EFFECTS OF RISK FACTORS ON PREGNANCY OUTCOME

Effect	Number Occurring from Natural Causes	Risk Factor	Excess Occurrences from Risk Factor
		RADIATION RISKS	
		Childhood Cancer	
Cancer death in children	1.4 per thousand (Ref. 5)	Radiation dose of 1000 millirems received before birth	0.6 per thousand (Ref. 4)
		Abnormalities	
		Radiation dose of 1000 millirads received during specific periods after conception:	
Small head size	40 per thousand (Ref. 6)	4-7 weeks after conception	5 per thousand (Ref. 7)
Small head size	40 per thousand (Ref. 6)	8-11 weeks after conception	9 per thousand (Ref. 7)
Mental retardation	4 per thousand (Ref. 8)	Radiation dose of 1000 millirads received 8 to 15 weeks after conception	4 per thousand (Ref. 8)
		NONRADIATION RISKS	
		Occupation	
Stillbirth or spontaneous abortion	200 per thousand (Ref. 9)	Work in high-risk occupations (see text)	90 per thousand (Ref. 9)
		Alcohol Consumption (see text)	
Fetal alcohol syndrome	1 to 2 per thousand (Ref. 10)	2-4 drinks per day	100 per thousand (Ref. 11)
Fetal alcohol syndrome	1 to 2 per thousand (Ref. 10)	More than 4 drinks per day	200 per thousand (Ref. 11)
Fetal alcohol syndrome	1 to 2 per thousand (Ref. 10)	Chronic alcoholic (more than 10 drinks per day)	350 per thousand (Ref. 12)
Perinatal infant death (around the time of birth)	23 per thousand (Refs. 13, 14)	Chronic alcoholic (more than 10 drinks per day)	170 per thousand (Ref. 15)
		Smoking	
Perinatal infant death	23 per thousand (Refs. 13, 14)	Less than 1 pack per day	5 per thousand (Ref. 13)
Perinatal infant death	23 per thousand (Refs. 13, 14)	One pack or more per day	10 per thousand (Ref. 13)

For mothers who consume 2 to 4 drinks per day, the excess occurrences number about 100 per thousand; and for those who consume more than 4 drinks per day, excess occurrences number 200 per thousand. The most sensitive period for this effect of alcohol appears to be the first few weeks after conception, before the mother-to-be realizes she is pregnant (Refs. 10 and 11). Also, 17% or 170 per thousand of the embryo/fetuses of chronic alcoholics develop FAS and die before birth (Ref. 15). FAS was first identified in 1973 in the United States where less than full-blown effects of the syndrome are now referred to as fetal alcohol effects (FAE) (Ref. 12).

2.3 Smoking

Smoking during pregnancy causes reduced birth weights in babies amounting to 5 to 9 ounces on the average. In addition, there is an increased risk of 5 infant deaths per thousand for mothers who smoke less than one pack per day and 10 infant deaths per thousand for mothers who smoke one or more packs per day (Ref. 13).

2.4 Miscellaneous

Numerous other risks affect the embryo/fetus, only a few of which are touched upon here. Most people are familiar with the drug thalidomide (a sedative given to some pregnant women), which causes children to be born with missing limbs, and the more recent use of the drug diethylstilbestrol (DES), a synthetic estrogen given to some women to treat menstrual disorders, which produced vaginal cancers in the daughters born to women who took the drug. Living at high altitudes also gives rise to an increase in the number of low-birth-weight children born, while an increase in Down's Syndrome (mongolism) occurs in children born to mothers who are over 35 years of age. The rapid growth in the use of ultrasound in recent years has sparked an ongoing investigation into the risks of using ultrasound for diagnostic procedures (Ref. 19).

APPENDIX B

PREGNANT WORKER'S GUIDE

POSSIBLE HEALTH RISKS TO CHILDREN OF WOMEN WHO ARE EXPOSED TO RADIATION DURING PREGNANCY

During pregnancy, you should be aware of things in your surroundings or in your style of life that could affect your unborn child. For those of you who work in or visit areas designated as Restricted Areas (where access is controlled to protect individuals from being exposed to radiation and radioactive materials), it is desirable that you understand the biological risks of radiation to your unborn child.

Everyone is exposed daily to various kinds of radiation: heat, light, ultraviolet, microwave, ionizing, and so on. For the purposes of this guide, only ionizing radiation (such as x-rays, gamma rays, neutrons, and other high-speed atomic particles) is considered. Actually, everything is radioactive and all human activities involve exposure to radiation. People are exposed to different amounts of natural "background" ionizing radiation depending on where they live. Radon gas in homes is a problem of growing concern. Background radiation comes from three sources:

	Average Annual Dose
Terrestrial - radiation from soil and rocks	50 millirem
Cosmic - radiation from outer space	50 millirem
Radioactivity normally found within the human body	25 millirem
	125 millirem*
Dosage range (geographic and other factors)	75 to 5,000 millirem

The first two of these sources expose the body from the outside, and the last one exposes it from the inside. The average person is thus exposed to a total dose of about 125 millirems per year from natural background radiation.

In addition to exposure from normal background radiation, medical procedures may contribute to the dose people receive. The following table lists the average doses received by the bone marrow (the blood-forming cells) from different medical applications.

X-Ray Procedure	Average Dose*
Normal chest examination	10 millirem
Normal dental examination	10 millirem
Rib cage examination	140 millirem
Gall bladder examination	170 millirem
Barium enema examination	500 millirem
Pelvic examination	600 millirem

*Variations by a factor of 2 (above and below) are not unusual.

*Radiation doses in this document are described in two different units. The rad is a measure of the amount of energy absorbed in a certain amount of material (100 ergs per gram). Equal amounts of energy absorbed from different types of radiation may lead to different biological effects. The rem is a unit that reflects the biological damage done to the body. The millirad and millirem refer to 1/1000 of a rad and a rem, respectively.

NRC POSITION

NRC regulations and guidance are based on the conservative assumption that any amount of radiation, no matter how small, can have a harmful effect on an adult, child, or unborn child. This assumption is said to be conservative because there are no data showing ill effects from small doses; the National Academy of Sciences recently expressed "uncertainty as to whether a dose of, say, 1 rad would have any effect at all." Although it is known that the unborn child is more sensitive to radiation than adults, particularly during certain stages of development, the NRC has not established a special dose limit for protection of the unborn child. Such a limit could result in job discrimination for women of child-bearing age and perhaps in the invasion of privacy (if pregnancy tests were required) if a separate regulatory dose limit were specified for the unborn child. Therefore, the NRC has taken the position that special protection of the unborn child should be *voluntary* and should be based on decisions made by workers and employers who are well informed about the risks involved.

For the NRC position to be effective, it is important that both the employee and the employer understand the risk to the unborn child from radiation received as a result of the occupational exposure of the mother. This document tries to explain the risk as clearly as possible and to compare it with other risks to the unborn child during pregnancy. It is hoped this will help pregnant employees balance the risk to the unborn child against the benefits of employment to decide if the risk is worth taking. This document also discusses methods of keeping the dose, and therefore the risk, to the unborn child as low as is reasonably achievable.

RADIATION DOSE LIMITS

The NRC's present limit on the radiation dose that can be received on the job is 1,250 millirems per quarter (3 months).* Working minors (those under 18) are limited to a dose equal to one-tenth that of adults, 125 millirems per quarter. (See § 20.101 of 10 CFR Part 20.)

Because of the sensitivity of the unborn child, the National Council on Radiation Protection and Measurements (NCRP) has recommended that the dose equivalent to the unborn child from occupational exposure of the expectant mother be limited to 500 millirems for the entire pregnancy (Ref. 2). The 1987 Presidential guidance (Ref. 1) specifies an effective dose equivalent limit of 500 millirems to the unborn child if the pregnancy has been declared by the mother; the guidance also recommends that substantial variations in the rate of exposure be avoided. The NRC (in § 20.208 of its proposed revision to Part 20) has proposed adoption of the above limits on dose and rate of exposure.

ADVICE FOR EMPLOYEE AND EMPLOYER

Although the risks to the unborn child are small under normal working conditions, it is still advisable to limit the radiation dose from occupational exposure to no more than 500 millirems for the total pregnancy. Employee and employer should work together to decide the best method for accomplishing this goal. Some methods that might be used include reducing the time spent in radiation areas, wearing some shielding over the abdominal area, and keeping an extra distance from radiation sources when possible. The employer or health physicist will be able to estimate the probable dose to the unborn child during the normal nine-month pregnancy period and to inform the employee of the amount. If the predicted dose exceeds 500 millirems, the employee and employer should work out schedules or procedures to limit the dose to the 500-millirem recommended limit.

It is important that the employee inform the employer of her condition as soon as she realizes she is pregnant if the dose to the unborn child is to be minimized.

INTERNAL HAZARDS

This document has been directed primarily toward a discussion of radiation doses received from sources outside the body. Workers should also be aware that there is a risk of radioactive material entering the body in workplaces where unsealed radioactive material is used. Nuclear medicine clinics, laboratories, and certain manufacturers use radioactive material in bulk form, often as a liquid or a gas. A list of the commonly used materials and safety precautions for each is beyond the scope of this document, but certain general precautions might include the following:

1. Do not smoke, eat, drink, or apply cosmetics around radioactive material.
2. Do not pipette solutions by mouth.
3. Use disposable gloves while handling radioactive material when feasible.
4. Wash hands after working around radioactive material.
5. Wear lab coats or other protective clothing whenever there is a possibility of spills.

Remember that the employer is required to have demonstrated that it will have safe procedures and practices before the NRC issues it a license to use radioactive material. Workers are urged to follow established procedures and consult the employer's radiation safety officer or health physicist whenever problems or questions arise.

*The limit is 3,000 millirems per quarter if the worker's occupational dose history is known and the average dose does not exceed 5,000 millirems per year.

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4. Upon request, the Commission may authorize a licensee to relinquish possession or control of premises, equipment, or scrap having surfaces contaminated with materials in excess of the limits specified. This may include, but would not be limited to, special circumstances such as razing of buildings, transfer of premises to another organization continuing work with radioactive materials, or conversion of facilities to a long-term storage or standby status. Such requests must:

   a. Provide detailed, specific information describing the premises, equipment or scrap, radioactive contaminants, and the nature, extent, and degree of residual surface contamination.

   b. Provide a detailed health and safety analysis which reflects that the residual amounts of materials on surface areas, together with other considerations such as prospective use of the premises, equipment or scrap, are unlikely to result in an unreasonable risk to the health and safety of the public.

5. Prior to release of premises for unrestricted use, the licensee shall make a comprehensive radiation survey which establishes that contamination is within the limits specified in Table 1. A copy of the survey report shall be filed with the Division of Fuel Cycle and Material Safety, USNRC, Washington, D.C. 20555, and also the Administrator of the NRC Regional Office having jurisdiction. The report should be filed at least 30 days prior to the planned date of abandonment. The survey report shall:

   a. Identify the premises.

   b. Show that reasonable effort has been made to eliminate residual contamination.

   c. Describe the scope of the survey and general procedures followed.

   d. State the findings of the survey in units specified in the instruction.

   Following review of the report, the NRC will consider visiting the facilities to confirm the survey.

TABLE 1

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDES[a]	AVERAGE[b c f]	MAXIMUM[b d f]	REMOVABLE[b e f]
nat, U-235, U-238, and sociated decay products	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
ansuranics, Ra-226, Ra-228, -230, Th-228, Pa-231, -227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
-nat, Th-232, Sr-90, -223, Ra-224, U-232, I-126, 131, I-133	1000 dpm/100 cm^2	3000 dpm/100 cm^2	200 dpm/100 cm^2
ta-gamma emitters (nuclides th decay modes other than pha emission or spontaneous ssion) except Sr-90 and hers noted above.	5000 dpm βγ/100 cm^2	15,000 dpm βγ/100 cm^2	1000 dpm βγ/100 cm^2

here surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitt uclides should apply independently.

s used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the ounts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentatio

Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average hould be derived for each such object.

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

he amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft bsorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument o known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

he average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of otal absorber.

0 0150

OPTIMUS

March 8, 1983

David Kee
USEPA Region V5 AMD
230 S. Dearborn Street
Chicago, Illinois 60604

Dear Mr. Lee,

About two years ago your department conducted a survey of the building at 161 East Grand Avenue and found spots in the building contaminated with thorium.

As you know our efforts to decontaminate the building were not as successful as we wanted them to be. To be completly successful we would have to disassemble the building.

Since there are only about 12 of these spots and some of them are not directly in the work stations of the people occupying the building, we would greatly appreciate your department surveying the actual work stations. This would enable us to evaluate the work stations and if necessary restrict those areas to a minimum use or make them completly restricted.

I feel this survey would take about 4 hours, and myself as well as the owners and other occupants would sincerly appreciate your cooperation in this matter.

Awaiting your reply,

Respectfully,

James M. Smyth

cc: Marty Rubenstein

161 E. Grand Ave., Chicago, IL 60611 (312) 321-0880

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

REPLY TO ATTENTION OF:

5AR

AUG 0 9 1983

Mr. James M. Smyth
Optimus
161 East Grand Avenue
Chicago, Illinois 60611

Dear Mr. Smyth:

Re: Film Badge Results

On May 27, 1983, the U.S. Environmental Protection Agency provided you with six film badge dosimeters to monitor employees and to monitor specific work stations in the Lindsay Light Company Building at 161 East Grand Avenue. Exposure dates were May 27, - July 7, 1983. For the record, this project arose from concern expressed by you and your partners about the consequences of the thorium contamination present in the building. Film badge results are attached.

An explanation of the reporting form is required. M designates minimal dose equivalent which is any dose equivalent under 14 millirems in the reporting period. Such a number is fixed by the inherent sensitivity of the dosimeteric film. 20 represents any dose equivalent between 15 and 24 millirem since results are rounded to the nearest multiple of ten.

In interpreting the results, it should be noted that the exposure period was 1/10th year (25 work days out of 250 work days per year, 5 days per week times 50 weeks per year). To convert an exposure period dose equivalent to an annual dose equivalent multiply by ten. Thus a reporting period dose equivalent of minimal represents a possible annual dose equivalent of 0-140 millirems. This is the background radiation level for the building. A reporting period dose equivelent of 20 millirems represents a possible annual dose equivalent of 150-240 millirems, including normal radiation background. The net dose equivalent above background is the difference between a given dose equivalent and the background level.

Assuming, to be conservative, that the only time a film badge was affected was when it was worn by an employee or when it was at a critical location then a minimal reading represents no more than 140 millirems per year dose equivalent. This is consistent with normal background values. In general, health physicists use 100 millirems as a representative national average for background. For film badges that read 20 millirems, the net dose equivalent above background levels in the building would be no more than 240 millirems per year but more likely would be about 100 millirems per year. This is consistent with the results reported to you in the "Final Report on a Survey of the Former Lindsay Light Company Building at 161 East Grand Avenue, Chicago, Illinois." In other words, a reporting period dose equivalent of 20 millirems represents an excess dose equivalent of 1-2 times over normal background levels. Such a level is not extreme but it would be

prudent to consider reasonable measures to keep the excess dose equivalent as low as possible. You should consider moving the work station.

We do suggest that each monitored individual be given the results of their film badge reading along with an explanation of what it means. Generally there is a fair degree of anxiety whenever the issue of radiation exposure arises. We would be happy to discuss the film badge results with any of your people if they so desire.

The U.S. Environmental Protection Agency was glad to assist you in this project. If you have any further questions in this matter, please feel free to call me at (312) 886-6175.

Sincerely yours,

Larry Jensen

Larry Jensen
Radiation Specialist

Attachments

Badge Number	Exposure Dates	Badge Type	Name/Location	Social Security Number	Sex	Birthdate	Dose Equivalent For Exposure Period
00000	5/25-7/5/83	G1	Control, EPA Desk	None			Minimal
00001	5/25-7/5/83	G1	Control, EPA Desk	None			Minimal
00002	5/27-7/5/83	G1	Ellen Manlewicz, Production Office	358-52-8259	F	11/25/56	Minimal
00003	5/25-7/5/83	G1	Corrine Lomax, Reception	319-34-8937	F	4/20/38	Minimal
00004	5/31-7/5/83	G1	Marge Therriault, Accounting Dept.	340-24-9428	F	10/8/31	20 millirem
00005	5/27-7/5/83	G1	President's Desk, President's Office	None			Minimal
00006	5/27-7/5/83	G1	Terry's Chair, Production Office	None			Minimal
00007	5/31-7/5/83	G1	Johnston Bell's Desk, Accounting Dept.	235-42-2504	M	10/7/28	20 millirem
00008	5/27-7/5/83	G1	President's Desk In-Box, President's Office	None			Minimal

U S ENVIRONMENTAL
PROTECTION AGENCY RM108
ATTN LARRY JENSEN
230 S DEARBORN SAR-26
CHICAGO IL 60425

ACCOUNT NO.	SERIES CODE
46739	

EXPOSURE PERIOD	PROCESS NO.	PREPARATION DATE	DOSIMETER RECEIVED	REPORTING TIME	SPC.	NO COPIES	NOTIFICATION LEVEL	PAGE NO.
SPECIAL	M6524	7/12/83	7/02/83	5 WORK DAYS	3	1	77777	1

RADIATION DOSIMETRY REPORT

Landauer
a Technical Operations company

R. S. Landauer, Jr. & Co.
Glenwood Science Park
Glenwood, Illinois 60425
Telephone (312)755-7000

QUALITY CONTROL RELEASE
PDW

PR 2635 - 23326

PARTICIPANT ID NUMBER	NAME	SOCIAL SECURITY NUMBER	NOTE (SEE REVERSE SIDE)	DOSIMETER TYPE	EXPOSURE TYPE	EXPOSURE TO BADGE (IN MILLIREMS) FOR THE PERIOD OR PERIODS INDICATED BELOW: GAMMA X-RAY	BETA	THERMAL NEUTRON	FAST NEUTRON	TOTAL	ENERGY RANGE	CUMULATIVE TOTALS-IN MILLIREMS: CALENDAR QUARTER	YEAR-TO DATE	PERMANENT	ADJUSTMENTS	UNUSED PART OF PERMISSIBLE ACCUMULATED DOSE (IN MILLIREMS)	SEX	BIRTH DATE MO	DA	YR	NO. OF BADGE REPORTS TO DATE	NO. OF REPORTS THIS QUARTER	NO. OF ADJUSTMENTS TO DATE	INCEPTION DATE OF PERMANENT TOTAL MO	YR
		FOR EXPOSURE PERIOD 06/25/83																							
00000				G	1	M				M				NOTOTAL											
00001				G	1	M				M				NOTOTAL											
00002				G	1	M				M				NOTOTAL											
00003				G	1	M				M				NOTOTAL											
00004				G	1	20				20				NOTOTAL											
00005				G	1	M				M				NOTOTAL											
00006				G	1	M				M				NOTOTAL											
00007				G	1	20				20				NOTOTAL											
00008				G	1	M				M				NOTOTAL											

0015

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

UARCO Business Forms - W

City of Chicago
Harold Washington, Mayor

Department of
Inspectional Services
Harry L. Manley
Acting Commissioner

City Hall, Room 900
121 North LaSalle Street
Chicago, Illinois 60602
(312) 744-3401

January 31, 1984

161 East Grand Associates
James Smyth, Partner
161 East Grand Avenue
Chicago, IL 60611

Re: Radioactive Thorium Radiation

Dear Mr. Smyth:

The Department of Inspectional Services has been notified of the presence of radioactive thorium contamination, as a result of gas lantern mantle manufacturing prior to 1936, in the building at 161 East Grand Avenue.

To protect the health of any construction workers, occupants, guests and general public from excessive radiation, it is recommended that your files contain certified evidence of adherence to the following precautions.

1. That all repair work was done in conformance with "Illinois Rules and Regulations for Radiation Protection", Parts A & D issued by the Illinois Department of Nuclear Safety.

2. That all workers have been informed concerning the nature and possible hazards involved.

3. That appropriate health and safety measures were instituted to:
   a. protect workers and other building occupants and
   b. assure property in the building is not further contaminated.

4. That survey data was collected for alpha, beta and gamma or other radiation measurements of air and water samples, together with any dosimetry results.

5. That a survey was made listing the quantity (in pounds) and activity (curies) of thorium waste, plus the name and number of the waste disposal carrier licensed by the Illinois Environmental Protection Agency.

6. That the name and address of the disposal site did conform to the ban on dumping of any radioactive waste within the City of Chicago pursuant to section 17-6.2 of the Municipal Code of Chicago.

7. That minimum representative smear samples from surfaces on the 1st and 2nd floors of the building were taken to substantiate work related wastes were not further spread throughout the building.

8. That representatives of the City of Chicago, the Illinois Department of Nuclear Safety and the U. S. Environmental Protection Agency were allowed to observe and monitor the construction work during the critical demolition period.

Sincerely,

T. T. Kason

T. T. Kason
Deputy Commissioner

:y of Chicago
ɔrold Washington, Mayor

:partment of
:pectional Services
ırry L. Manley
.ting Commissioner

:y Hall, Room 900
'1 North LaSalle Street
ıicago, Illinois 60602
12) 744-3401

January 31, 1984

0 0158

161 East Grand Associates
James Smyth, Partner
161 East Grand Avenue
Chicago, IL 60611

Re: Radioactive Thorium Radiation

Dear Mr. Smyth:

The Department of Inspectional Services has been notified of the presence of radioactive thorium contamination, as a result of gas lantern mantle manufacturing prior to 1936, in the building at 161 East Grand Avenue.

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2. That all workers have been informed concerning the nature and possible hazards involved.

3. That appropriate health and safety measures were instituted to:
   a. protect workers and other building occupants and
   b. assure property in the building is not further contaminated.

4. That survey data was collected for alpha, beta and gamma or other radiation measurements of air and water samples, together with any dosimetry results.

5. That a survey was made listing the quantity (in pounds) and activity (curies) of thorium waste, plus the name and number of the waste disposal carrier licensed by the Illinois Environmental Protection Agency.

6. That the name and address of the disposal site did conform to the ban on dumping of any radioactive waste within the City of Chicago pursuant to section 17-6.2 of the Municipal Code of Chicago.

7. That minimum representative smear samples from surfaces on the 1st and 2nd floors of the building were taken to substantiate work related wastes were not further spread throughout the building.

8. That representatives of the City of Chicago, the Illinois Department of Nuclear Safety and the U. S. Environmental Protection Agency were allowed to observe and monitor the construction work during the critical demolition period.

Sincerely,

T. T. Kason

T. T. Kason
Deputy Commissioner

cc: Eli Port

Paul D. Eastvold
Bernadine Wright
James Barrett
George Wienold
John Evanoff

RECEIVED
FEB 2 1984
AIR PROGRAMS BRANCH
U.S. EPA, REGION V, AMD

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DATE: FEB 2 - 1984

SUBJECT: Renovation at Lindsay Light Company Building, 161 East Grand Avenue, Chicago, Illinois

FROM: Larry Jensen
Air and Radiation Branch

TO: Gary Gulezian, Chief
Regulatory Analysis Section

The U.S. Environmental Protection Agency (USEPA) surveyed the Lindsay Light Company Building in 1981 and established that residual radioactive thorium contamination existed in several places, presumably due to past gas light mantle manufacturing activities of the Lindsay Light Company from about 1910 to 1935. The USEPA has attempted to maintain contact on activities in the building since decontamination could not be performed because residual radioactive materials were fixed in structural members of the building. Some areas of the building represent potential sources of unwarranted exposure to occupants. Owner-tenants have been given recommendations on ways to minimize these potential exposures.

Optimus, the first floor tenant-owner, called the USEPA in November of 1983 and inquired how they should deal with the radioactive materials during a planned expansion to the second floor. Considerable renovation was anticipated. Discussions between the USEPA, the Illinois Department of Nuclear Safety, the Illinois Attorney General and the City of Chicago on the most appropriate way to handle this situation resulted in a letter of recommendations by the City of Chicago, Department of Inspectional Services, to the 161 East Grand Associates (letter attached, Appendix A).

On February 7, 1984, Optimus called in representatives of the USEPA, the Illinois Department of Nuclear Safety and the City of Chicago to observe renovation activities to be conducted under the supervision of their consultant, Radiation Safety Services, Inc. The following persons were present on February 7;

Optimus - Ron Klyber
- Chester Brown and helper

City of Chicago, Department of Consumer Services - Environmental Control
- Nick Davlantes

Illinois Department of Nuclear Safety
- Ken Barat

U.S. Environmental Protection Agency
- Larry Jensen
- Les Johnson

Radiation Safety Services
- Eli Port
- Dave Derenzo

It was readily apparent considerable alteration of the second floor had gone on before February 7. Several interior walls present in 1981 were gone, replaced in some cases by new plaster board walls. See Figure 1. Old ductwork had been removed and new ducts installed. A hole about 10 feet x 12 feet had been cut between the first and second floors. Workmen said renovations had been going on for about 4 weeks.

It appears that in most cases alterations were performed in areas not identified as contaminated in our 1981 report. This is the case with the 10 foot by 12 foot hole. However, walls in the northwest corner of the floor that were removed were in the region designated as contaminated. Walls along the north hallway and the flooring between the walls had been left undisturbed by Optimus for supervised removal on February 7. This appears to have been done under the mistaken impression that contamination had been identified in the walls as well as in the floor. Except for this one hallway area it unfortunately appears all work on the floor had been performed unsupervised.

Prior to demolition of the hallway area, Ron Klyber and Chester Brown received radiation safety training from Radiation Safety Services. Mr. Brown's helper did not receive training. Workers and observers were given protective coveralls and dust masks. The USEPA set up a continuously operating pressurized ion chamber for gamma-ray exposure measurements and operated an air sampler for measuring radon (radon-222) and thoron (radon-220) daughter concentrations. Radiation Safety Services and the Illinois Department of Nuclear Safety had gamma-ray scintillometers, gas flow proportional counters, and geiger-mueller survey meters.

Wall demolition was begun by Mr. Klyber and Mr. Brown. Once the studs were exposed these were surveyed for alpha and gamma radiation. Smears were taken of dusty interior surfaces. No contamination was found inside the walls. When the base of the south wall was removed from the floor, fixed alpha contamination was measured on the floor and on two-by-fours that had been the wall base. These contaminated boards were set aside. All other material was treated as trash, surveyed in the dumpsters, and discarded.

Strip charts for gamma-ray exposure rates measured with the pressurized ion chamber are given in Figure 2. These were elevated over the normal building background of 15 microroentgen per hour but remained constant throughout the work effort.

Background airborne radon and thoron daughter concentrations were measured on February 7, before demolition activities. Thoron daughter concentrations were collected for 30 minute intervals during the day. Samples were collected at 20 liters per minute on Metricel filters with 0.45 micron pore size. Collection and analysis was by the method given in "Radiation Monitoring" published by the U.S. Department of Labor, Mine Safety and Health Administration. Results are given in Table 1 and in Figure 3. The background radon daughter concentration was 0.005 working levels, a normal indoor level, but the thoron daughter concentration was 0.038 working levels, showing the presence of thoron decay products in the air. Generally, it would be expected thoron daughter levels would be less than radon daughter levels. During the course of demolition activities thoron daughter levels fluctuated, reaching a maximum of 0.060 working levels.

On February 8, demolition activities resumed. Ron Klyber and Chester Brown were present. Mr. Brown had three new helpers. Dave Derenzo (Radiation Safety Services) was present all day. I was present until about 1:15 p.m. Les Johnson was present from about 10:00 a.m. on. Nick Davlantes (City of Chicago) stopped in twice during the day. It was not observed that Mr. Brown's helpers received radiation safety training or were advised of the potential hazards of the materials they were dealing with.

Walls were gradually disassembled and rubble surveyed before it was released for trash disposal. Wall supports nailed to the ceiling were surveyed to check for radioactive material entering from the contaminated flooring above. None was identified. The only piece of material showing contamination was a two-by-four taken from the base of the north wall. This board was set aside with the other contaminated boards.

Gamma-ray exposure rates measured with the pressurized ion chamber remained constant throughout the workday. Air samples taken were too dust packed to be analyzed for thoron daughter concentrations but were subjected to gamma-ray spectroscopy and shown to have collected the thoron daughters lead-212 and thallium-208. See Figure 4

On February 9, demolition activities resumed. Dave Derenzo and myself were present all day. Nick Davlantes stopped in twice during the day. The remaining walls were removed and surveyed. No contamination was identified. Flooring materials were broken up and surveyed as work progressed. Tar paper overlying the main floor (there were overlying floorings of linoleium, concrete and tar paper) in some sections was found to be contaminated up to an estimated 30,000 disintegrations per minute per 100 square centimeters. Contaminated rubble was separated and set aside with the contaminated two-by-fours. Linoleum was left on the main floor in some sections to cover contaminated flooring. Exposed, contaminated areas were painted with expoxy paint to fix the contamination and to serve to identify contaminated regions in the future. It was also felt epoxy paint might aid in keeping contamination on the floors from being dissolved.

In trying to explain the origin of the contamination on the two-by-fours and on the tar paper, it was discovered that the floor had been flooded with water a few years previously. Thorium nitrate used in gas mantle manufacturer is water soluble. It is hypothesized that the contamination might have been spread from the old floor to newer materials (two-by-fours, tar paper) by water. This is an important item to keep in mind in dealing with this contamination in the future.

Before the floors were painted, Radiation Safety Services took beta-gamma count rate (counts per minute) and tissue equivalent dose rate (microrads per hour) measurements at 2 foot intervals at contact along two lines running the length of the exposed contaminated floor. These measurements will appear in their report.

Disposition of the contaminated trash was unresolved at the end of the work activities. Eli Port, Radiation Safety Services, argued that anything less than 15 pounds of thorium could be disposed of without restriction according to the Nuclear Regulatory Commission regulations in Title 10 Part 40 of the Code of Federal Regulations. I argued that Nuclear Regulatory Commission "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source or Special Nuclear Material" were appropriate.

With regard to the City of Chicago's letter of recommendations to 161 East Grand Associates, January 31, 1984, the following comments are offered.

Item 1. The USEPA is not in a position to determine if the Illinois Department of Nuclear Safety regulations were adhered to.

Item 2. Ron Klyber and Chester Brown received radiation safety training. It was decided in a discussion between Eli Port and Ken Barat that it was not necessary for Mr. Brown's helper on February 7 to receive training. Mr. Brown's three helpers on February 8 and 9 did not receive radiation training.

Item 3. The health and safety measures taken were appropriate.

Item 4. Survey data was collected. No water samples were necessary. Dosimeters were not issued.

Item 5,6. Fulfillment of these recommendations depends upon resolution of the proper designation for the contaminated material.

Item 7. Smears were taken from contaminated flooring on the second floor. It was not observed that smears were taken elsewhere on the second floor or on the first floor.

Item 8. Representatives of the City of Chicago, the Illinois Department of Nuclear Safety and the U.S. Environmental Protection Agency were allowed to observe and monitor activities.

Attachment

cc: Ted Kason, City of Chicago
Paul Eastvold, Ken Barat, IDNS
July Goode, IAG
Jim Smith, 161 East Grant Associates
Eli Port, Radiation Safety Services

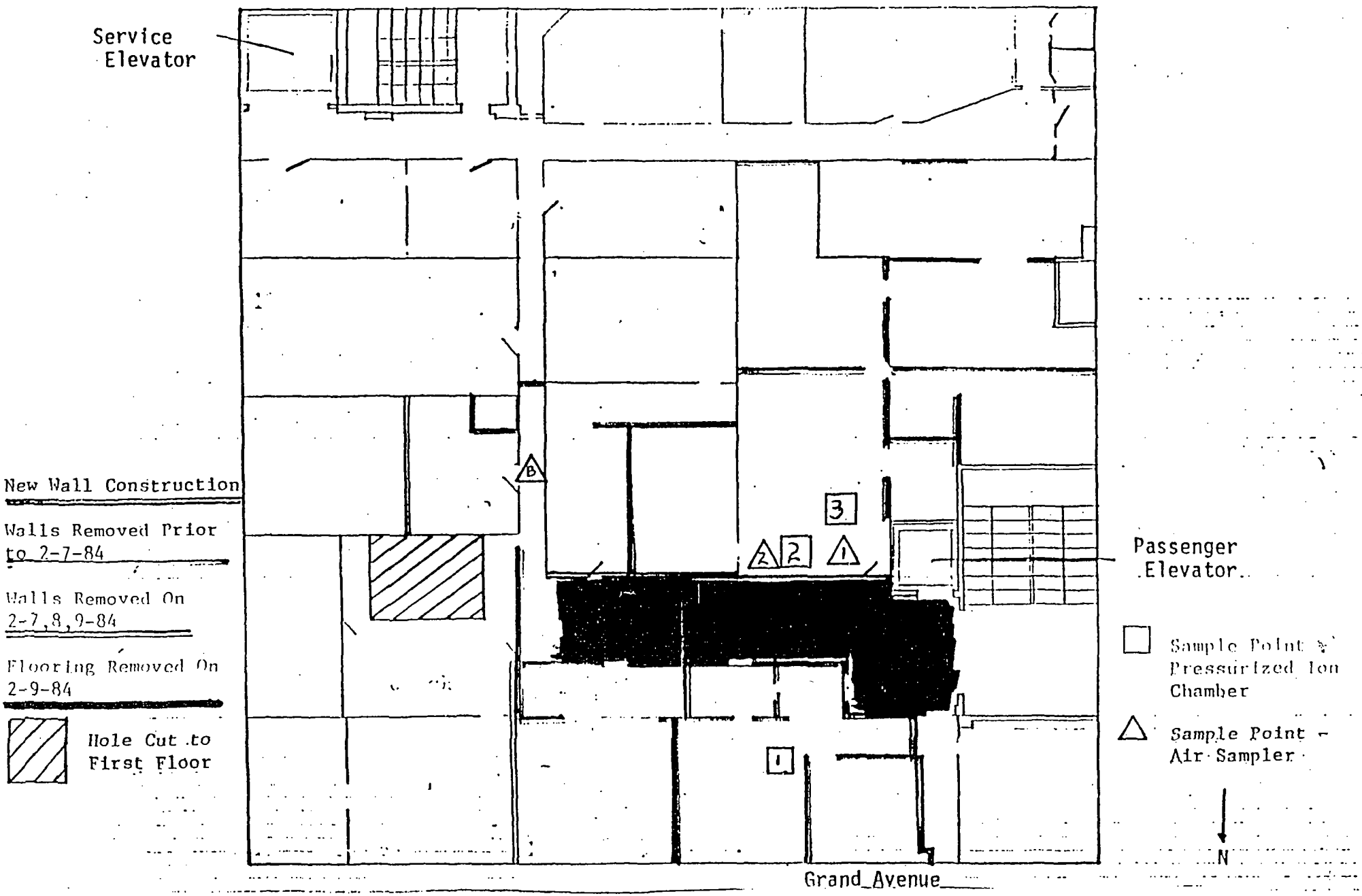
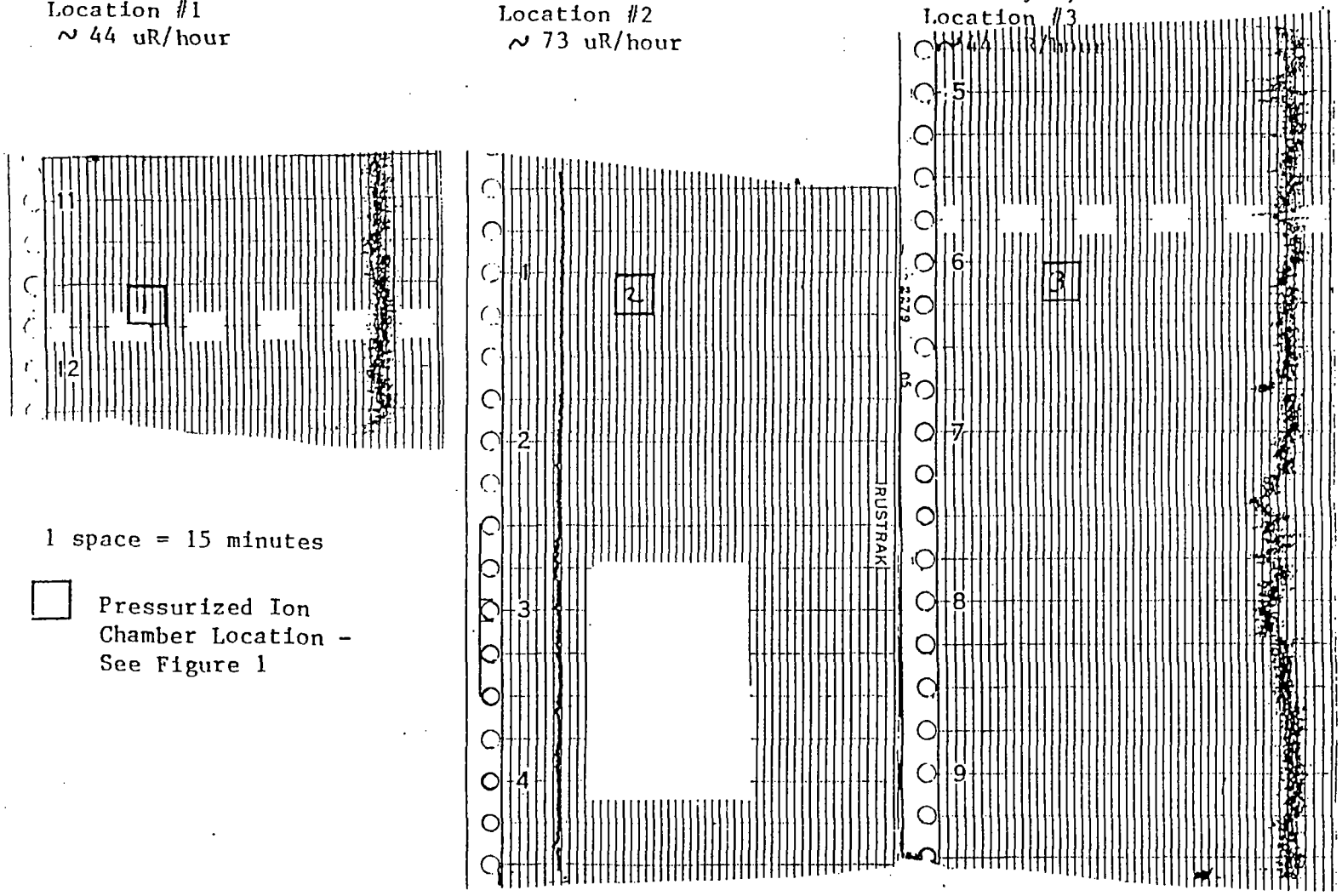


Figure 1: Floor Plan of Second Floor Showing Work Areas and Sample Collection Results

February 7, 1984
Location #1
~ 44 uR/hour

February 8, 1984
Location #2
~ 73 uR/hour

February 9, 1984
Location #3
~ 44 uR/hour



1 space = 15 minutes

Pressurized Ion Chamber Location - See Figure 1

Figure 2: Gamma-ray Exposure Rates - Pressurized Ion Chamber Results

0 0165

RADIOLOGICAL ASPECTS OF THE FEBRUARY 1984 REMODELING OF THE 161 E. GRAND AVENUE BUILDING

Prepared by

RADIATION SAFETY SERVICES, INC.

April 9, 1984

INTRODUCTION

Remodeling on the second floor of the 161 E. Grand Avenue building during February 1984 included work in areas previously identified by the EPA as contaminated with small quantities of natural thorium. Monitoring was performed to locate contamination on building materials disturbed or removed during the remodeling. Protective actions were taken by workers as recommended by the City of Chicago Department of Inspectional Services.

TRAINING

A one-hour training session was conducted by Eli A. Port, CHP. The sign-up sheet is attached in Appendix A.

The training was based upon a presentation developed by the Health Physics Society for non-technical audiences and included information regarding the production of radiation and its interaction with matter, biological effects, dose-effect relationships, the concept of risk and protective measures.

PROTECTIVE ACTIONS

Workers and ancillary personnel in the construction area were issued Tyvek coveralls and 3-M dust masks. Instructions were given regarding proper wearing and use of the protective apparel. Workers' clothing, gloves and shoes were checked for contamination at the end of each work period. As contaminated portions of the original floor were uncovered, surface wipes were taken to determine if removable contamination was present. While the contaminated floor was uncovered a rope barrier was erected to prevent access. The exposed portions of the contaminated floor were covered with an epoxy paint to seal the surface and prevent dispersal of contamination.

RADIATION SURVEY RESULTS

No removable contamination was detected at a 95% confidence level on filter paper wipes taken from the contaminated floor. Contamination was not found on dust which had accumulated in the walls.

Low-level contamination was detected on several 2" x 4" wood beams in direct contact with the contaminated floor. Water stains on the beams suggest that water-soluble contamination may have been transferred during a past flood which originated on the

roof. Slight contamination was found on tar paper which was in direct contact with the original floor under several superficial layers of flooring.

Dose rate and surface contamination surveys were conducted after the contaminated floor was uncovered. The contaminated areas ranged up to 5,000 dpm/100cm^2. From the data the size and shape of the contaminated area was determined. See Appendix B for survey results.

No contamination was found on any shoes, coveralls, gloves or tools. Surveyed dust masks also revealed no contamination. Air samples were collected and used as an early indicator of possible airborne contamination. The results of air sampling from a cooperative effort were obtained from the USEPA and are reproduced in Appendix C.

WASTE DISPOSAL

Debris from contaminated areas was surveyed with a Ludlum Model 6/Eberline HP210T survey meter. Contaminated material was segregated pending disposal. Uncontaminated debris and debris from uncontaminated areas was collected in waste bins and surveyed with a Ludlum Model 2220 analyzer utilizing an Eberline SPA-2" x 2" NaI (Tl) detector in a low background area. No additional contamination was detected on this material which was

released to a scavenger service. Material with detectable activity was collected in a DOT spec container and will be transferred by ADCO, a licensed radioactive waste collector, for transfer to a radioactive waste disposal site in Richland, Washington.

CONCLUSIONS

Radiation surveys demonstrate that radioactive contamination in the construction area was not readily transferable. A small amount of contamination was transferred to building materials in direct contact with the contaminated floor for many years. Remaining removable contamination was sealed into the floor with epoxy paint which will inhibit the release of Rn-220, a gaseous daughter of Th-232.

Contamination detected on a small quantity of debris slightly exceeded 3,000 dpm/100 cm^2, the USNRC limit for release of thorium contaminated facilities for unrestricted use. While consumer products containing significantly larger quantities of radioactive material are routinely and legally disposed of as ordinary trash, the rubble was transferred to a USNRC licensed radioactive waste collector for disposal.

No contamination was detected on protective apparel or tools used during the construction. Results of air sampling by the EPA and RSSI did not indicate an increase in airborne radioactivity levels in the work area.

APPENDIX A

TRAINING

SIGN-UP SHEET

Feb 7, 1984 1 hr Training 0 0173

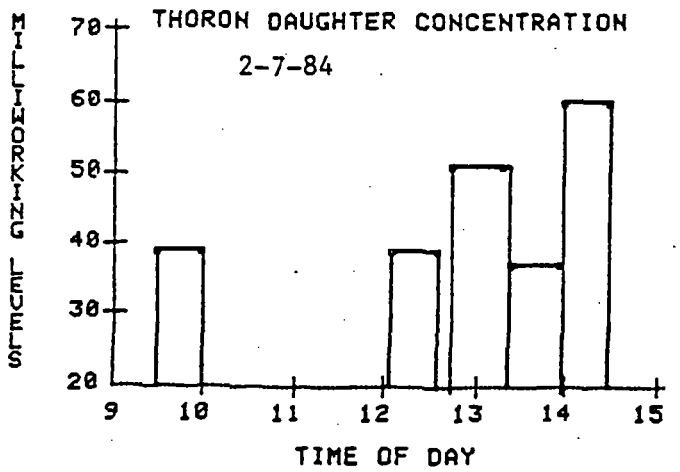
Attendance List 161 E. Grand Ave.

Marge Therriault
Johnston Bell
Chester Brown
Ron Klyber
Ellen Mancewicz
Joseph Stancle

Table 1: Radon/Thoron Daughter Concentrations - Air Sample Results

	DATE	TIME PERIOD	DAUGHTER CONCENTRATION RADON (MILLIWORKING LEVELS)	DAUGHTER CONCENTRATION THORON (MILLIWORKING LEVELS)	
B	2-7-84	9:12 - 9:17	5	39	BACKGROUND
1	2-7-84	9:28 - 9:28		39	
1	2-7-84	12:04 - 12:34		51	
1	2-7-84	12:43 - 1:16		37	
1	2-7-84	1:22 - 1:55		60	
1	2-7-84	1:59 - 2:29			
2	2-9-84	12:18 - 12:48		28	
2	2-9-84	12:55 - 1:25		45	
2	2-9-84	1:25 - 1:55		35	
2	2-9-84	1:56 - 2:26		35	

△ Air Sampler Location - See Figure 1



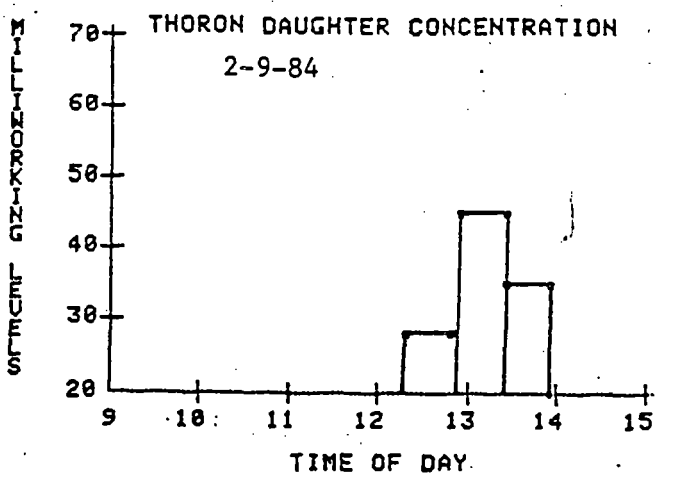


Figure 3: Radon/Thoron Daughter Concentrations - Air Sample Results

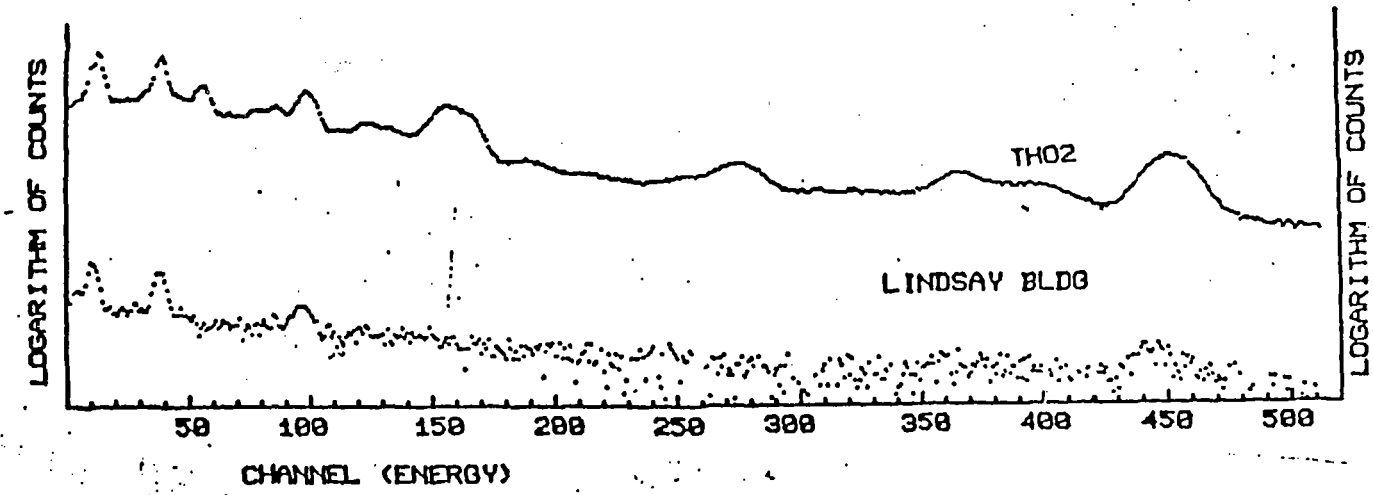


Figure 4: Gamma-ray Spectra - 2/8/84 Air Filters versus Thorium Oxide

APPENDIX A

City of Chicago Letter

to

161 East Grand Associates

APPENDIX B

RADIATION SURVEY RESULTS

SURVEY REPORT

0 0178

BUILDING: 161 E. Grand ROOM: 2nd floor DATE: 02/07&08/84 BY: Dave Derenzo & Eli A. Port

Routine ☐ Spot Check ☐ Special ☒ Equipment ☐

Survey Instrument: ~~Dose Rate- HPI 1010~~ Wipes-Ludlum 2220/HP-210

Source of Ionizing Radiation: Natural Thorium

See Attached Drawing

TYPE	FORM	ACTIVITY

Ventilation:

Comments:

SURVEY FINDINGS

AREA	WIPES		DOSE RATE
1 Floor	131 c/1min	→ 158c/1min (After 2x4 removed)	See separate survey attached
2 Floor	125c/1min		
3 Floor	118c/1min		
4 Floor	105c/1min		
5 Floor after removal of tile	133 c/1min		
6 Floor after removal of tile	142c/1min		
7 Floor after removal of tile	123c/1min		
Background	680 c/6 min = 113cpm		

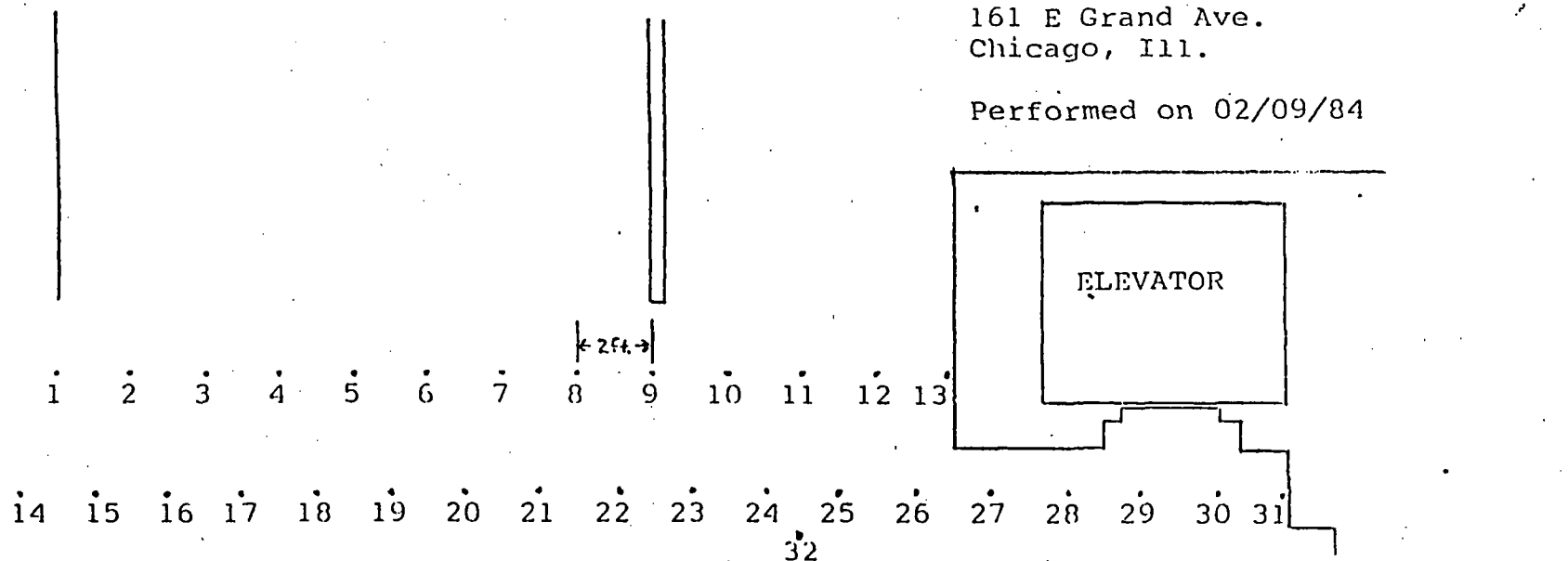
RECOMMENDATIONS:

Ld 95% = 40.5 cpm ∴ Activity detected at 95% confidence level if 113 + 40.5 = 154 cpm is exceeded.

Radiation Safety Services, Inc.

2nd Floor
161 E Grand Ave.
Chicago, Ill.

Performed on 02/09/84



	CPM*	urad/hr*		CPM*	urad/hr*
1.	----	<10	17.	100	20
2.	----	<10	18.	170	85
3.	----	30	19.	400	150
4.	----	25	20.	800	250
5.	----	55	21.	20,000	650
6.	----	200	22.	----	600
7.	----	875	23.	----	600
8.	----	350	24.	----	400
9.	----	300	25.	16,000	300
10.	----	250	26.	2,000	100
11.	----	200	27.	1,100	60
12.	----	100	28.	2,100	80
13.	----	90	29.	900	65
14.	60	15	30.	2,000	50
15.	60	10	31.	1,300	60
16.	70	10	32.	90,000	---

PERFORMED BY:
Radiation Safety Services, Inc
1564 Ashland Ave
Evanston, Ill. 60201
312-866-7744

DJD 02/13/84

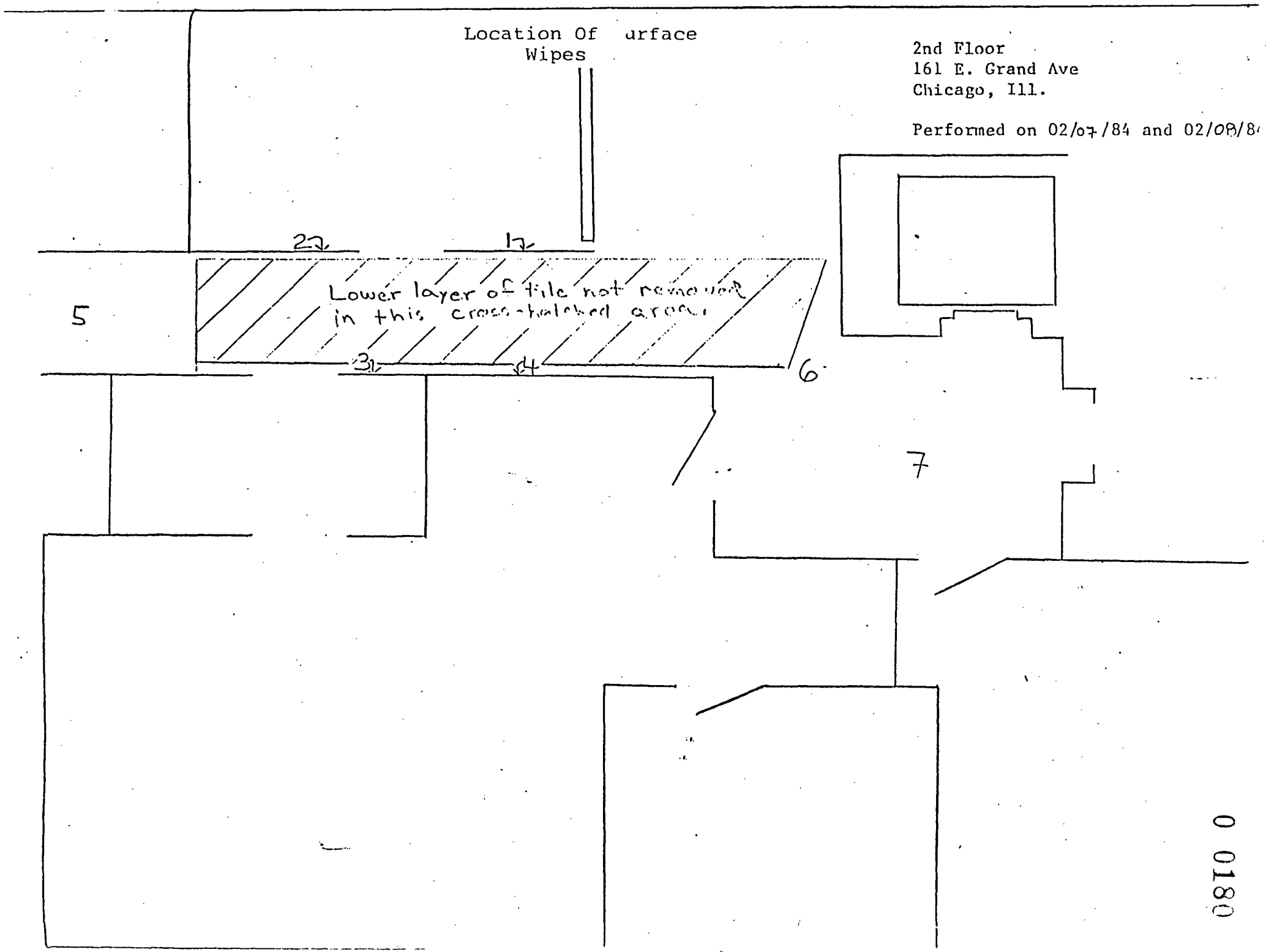
INSTRUMENTS: All CPM readings taken with a Ludlum Model 16 using an Eberline HP-210T detector. All urad/hr readings taken with a Health Physics Instruments, Inc Model 1010.

BACKGROUND: The background in relatively uncontaminated portions of the building are 10 to 15 urad/hr. In these areas the Model 16/HP-210T background was 50-70 CPM.

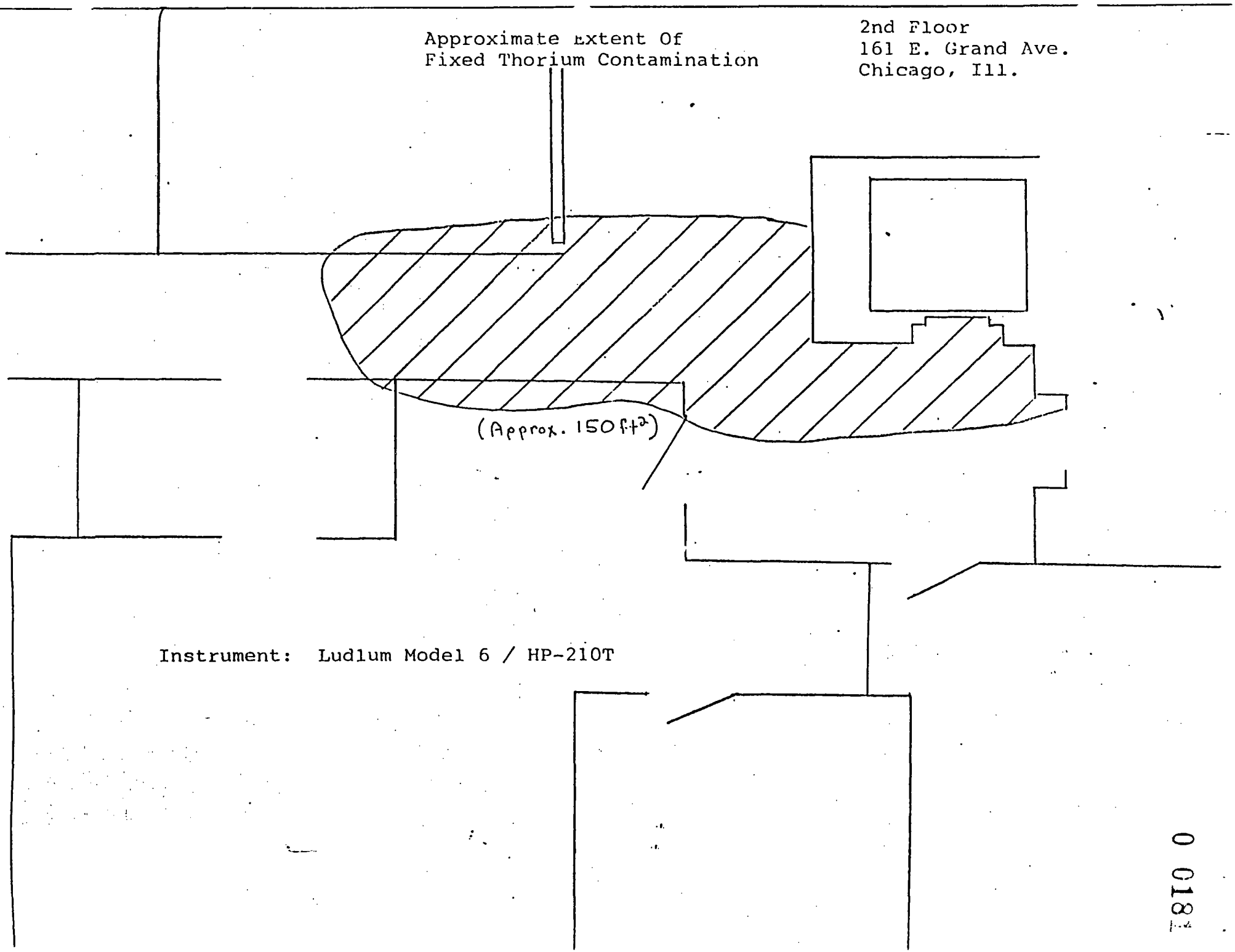
*Readings taken at the surface of the existing floor. The HPI 1010 chamber center is 2 5/16" from the floor with instrument on floor.

SCALE
1"=5'

0 0179


Location Of urface
Wipes
2nd Floor
161 E. Grand Ave
Chicago, Ill.
Performed on 02/07/84 and 02/08/8
2
1
5
Lower layer of tile not removed
in this cross-hatched area.
3
4
6
7

0 0180


Approximate Extent Of
Fixed Thorium Contamination
2nd Floor
161 E. Grand Ave.
Chicago, Ill.
(Approx. 150 ft²)
Instrument: Ludlum Model 6 / HP-210T

0 0181

APPENDIX C

AIR SAMPLING RESULTS

FROM

USEPA REPORT

Dated

February 2, 1984

Background airborne radon and thoron daughter concentrations were measured on February 7, before demolition activities. Thoron daughter concentrations were collected for 30 minute intervals during the day. Samples were collected at 20 liters per minute on Metricel filters with 0.45 micron pore size. Collection and analysis was by the method given in "Radiation Monitoring" published by the U.S. Department of Labor, Mine Safety and Health Administration. Results are given in Table 1 and in Figure 3. The background radon daughter concentration was 0.005 working levels, a normal indoor level, but the thoron daughter concentration was 0.038 working levels, showing the presence of thoron decay products in the air. Generally, it would be expected thoron daughter levels would be less than radon daughter levels. During the course of demolition activities thoron daughter levels fluctuated, reaching a maximum of 0.060 working levels.

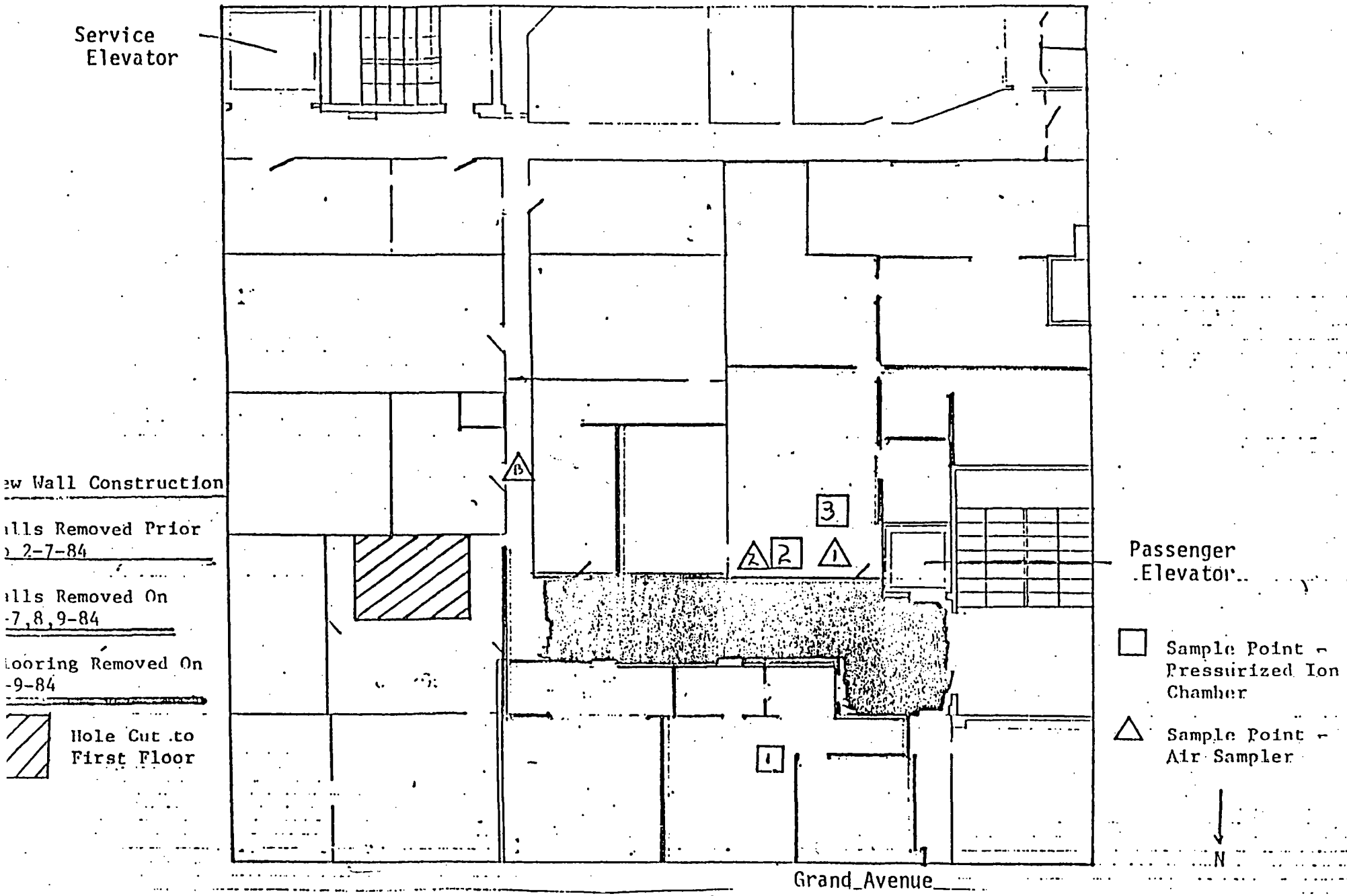
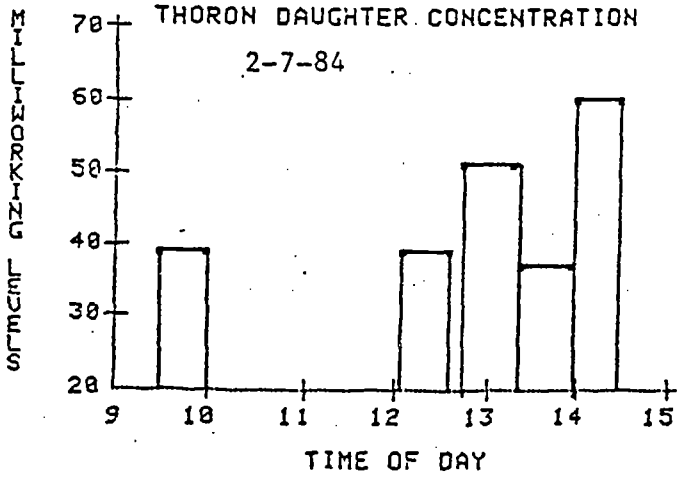


Figure 1: Floor Plan of Second Floor Showing Work Areas and Sample Collection Results

Table 1: Radon/Thoron Daughter Concentrations - Air Sample Results

	DATE	TIME PERIOD	DAUGHTER CONCENTRATION RADON (MILLIWORKING LEVELS)	DAUGHTER CONCENTRATION THORON (MILLIWORKING LEVELS)	
6	2-7-84	9:12 - 9:17	5	39	BACKGROUND
1	2-7-84	9:23 - 9:28		39	
1	2-7-84	12:04 - 12:34		51	
1	2-7-84	12:43 - 1:16		37	
1	2-7-84	1:22 - 1:55		60	
1	2-7-84	1:59 - 2:29			
2	2-9-84	12:18 - 12:48		28	
2	2-9-84	12:55 - 1:25		45	
2	2-9-84	1:25 - 1:55		35	
2	2-9-84	1:56 - 2:26		35	

△ Air Sampler Location - See Figure 1



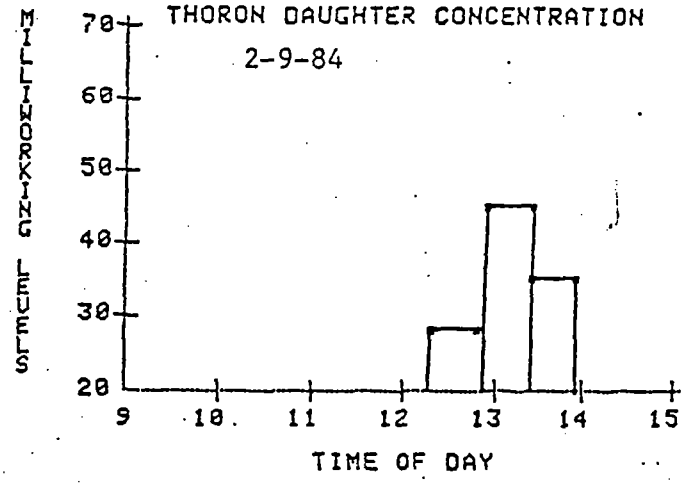


Figure 3: Radon/Thoron Daughter Concentrations - Air Sample Results

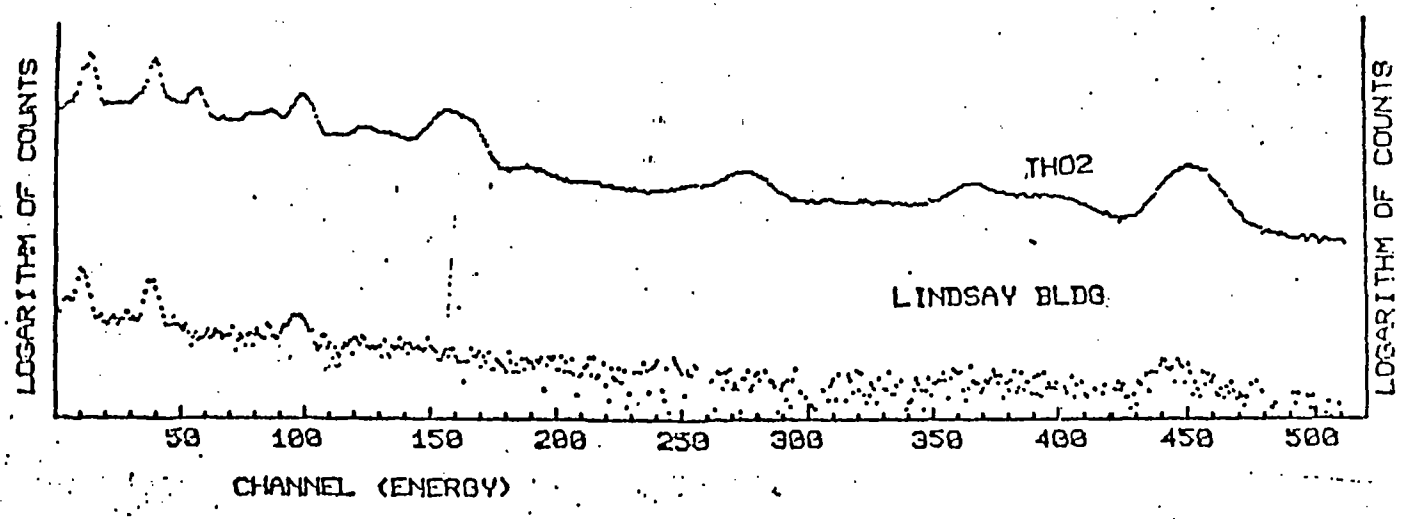


Figure 4: Gamma-ray Spectra - 2/8/84 Air Filters versus Thorium Oxide

APPENDIX D

USNRC GUIDELINES
FOR THE RELEASE OF FACILITIES
FOR UNRESTRICTED USE

RADIATION SAFETY SERVICES, Inc.
1564 Ashland Avenue
Evanston, Illinois 60201
312/866-7744

0 0188

April 11, 1984

Ron Klyber
161 East Grand Associates
161 East Grand Avenue
Chicago, IL 60611

Dear Ron:

Attached is the final report of the radiological aspects of the remodeling operation. As is clear in the report, no construction workers or other individuals were exposed to any significant radiological hazard nor was there any significant amount of radioactive rubble produced.

Should you have any questions or require further information regarding these activities or contamination of the building, please feel free to contact me at 866-7744.

Sincerely,

Eli A. Port
Certified, American Board of Health Physics
Registered Professional Engineer (Safety)

EAP:ts

Enclosure

161 E. GRAND ASSOCIATES

161 E. Grand Avenue
Chicago, Illinois 60611

Phone: 312-467-5440 Fax: 312-467-0867

June 22, 1993

Mr. Terry Liabol
Radiation Safety Services, Inc.

Fax #965-1991

Dear Mr. Liabol,

Per our phone conversation, please fax the contractors report for work performed at 161 E. Grand (The Lindsey Light Building) in September of 1981. This was originally performed for Browne & Storch, our building manager at that time. We now manage the building ourselves.

Sincerely,
161 E. Grand Associates

Ronald A. Steele, Mgr.

0 0190

RSSI

6312 West Oakton Street
Morton Grove, IL 60053-2723
1999

June 30, 1993

Ronald A. Steele
Manager
161 E. Grand Associates
161 E. Grand Avenue
Chicago, IL 60611

Dear Mr. Steele:

As you requested in our telephone conversation on June 22, enclosed are two reports prepared by RSSI regarding decontamination activities at the 161 E. Grand building. I apologize for the delay in sending these reports to you. We had difficulty finding the file in our archived records.

If you have any questions, please call me at 708-965-1999.

Sincerely,

Terry W. Liaboe, CIH
Vice-President

Enclosures
twl\misc\steel01.let

SITE ASSESSMENT REPORT
FOR
LINDSAY LIGHT COMPANY SITE

U.S. EPA ID: N/A
SSID#: N/A
TDD: T05-9305-014
PAN: EIL0794SAA

August 2, 1993

Prepared By: Ronald W Bugg Date: 8/5/93
Reviewed By: William Sass Date: 8/5/93
Approved By: [signature] Date: 8/5/93

ecology and environment, inc.
111 WEST JACKSON BLVD., CHICAGO, ILLINOIS 60604, TEL. 312-663-9415
International Specialists in the Environment

recycled paper

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2.0	SITE HISTORY	1
3.0	SITE ACTIVITIES	3
4.0	ANALYTICAL RESULTS	7
5.0	DISCUSSION OF POTENTIAL THREATS	7
6.0	CONCLUSION	10

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2	SECOND FLOOR READINGS	4
3	THIRD FLOOR READINGS	5
4	FOURTH FLOOR READINGS	6
5	FIRST FLOOR READINGS	8
6	BASEMENT READINGS	9

1.0 SITE DESCRIPTION

The Lindsay Light Company Building is a four story commercial building located at 161 E. Grand, at the corner of Grand Avenue and St. Clair Street, in Downtown Chicago, Illinois. Grand Avenue is about one-half mile north of the central Chicago "Loop" area. The geographical location is 41° 53' 30" north latitude and 88° 36' 30" west longitude (See Figure 1 for site location). The site is currently being occupied several companies including audio/video production companies called Optimus and Streeterville Studio, Inc..

2.0 SITE HISTORY

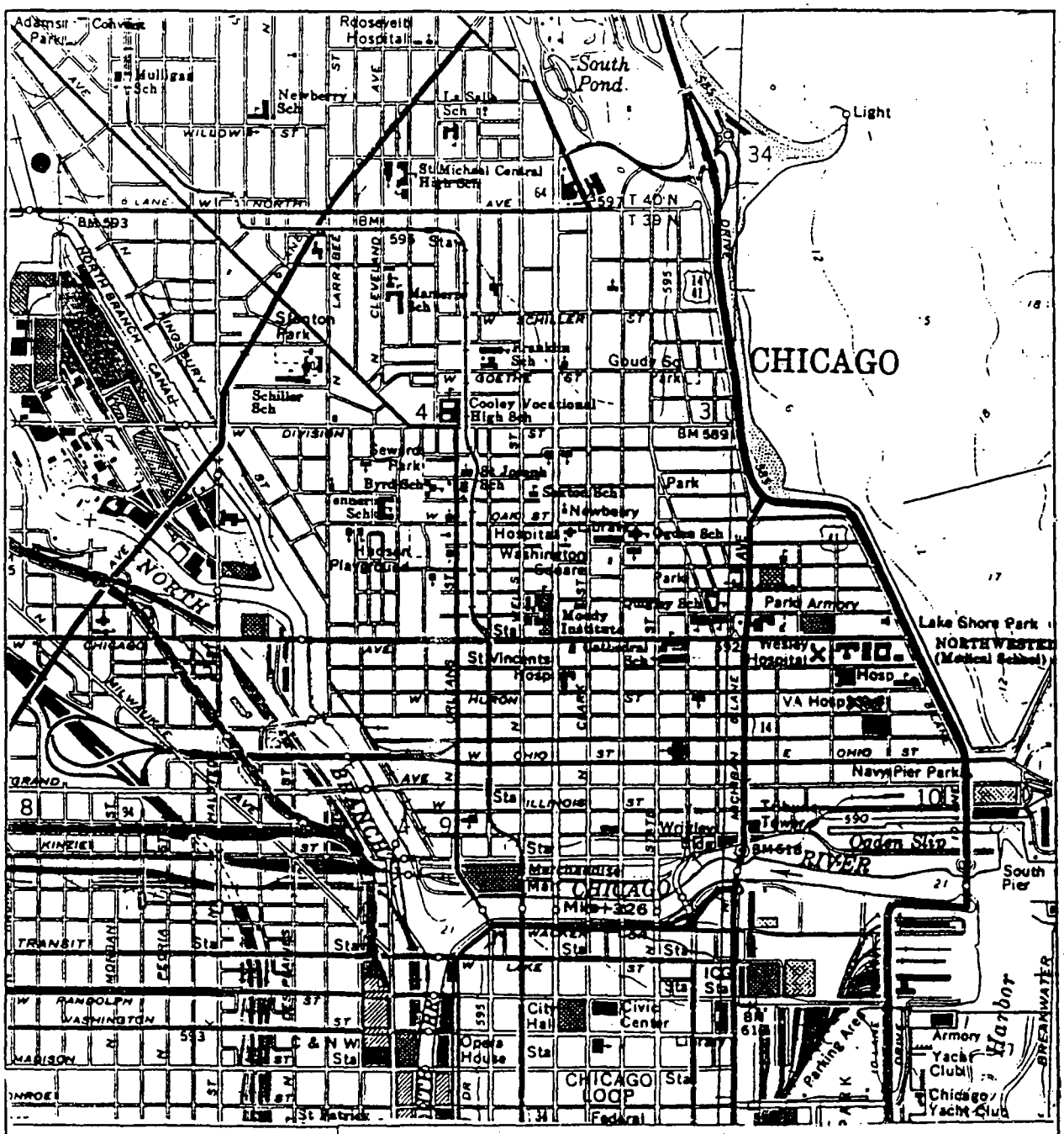
The Lindsay Light Company manufactured incandescent gas mantles for home and street lighting in this building from at least 1910 until 1936. Lindsay Light moved to West Chicago and was later purchased by American Potash, which was later purchased by Kerr McGee Chemical Company in 1967. The principal ingredient in gas mantle manufacture are the gauze mantle bags which were dipped into thorium nitrate solution. Small amounts of cerium, beryllium and magnesium nitrates were also used. The present owners of the building, Browne and Storch, a real estate firm, purchased the building in 1978.

In August of 1981, The building owners attempted to decontaminate part of the second and fourth floor. The building owners hired Radiation Safety Services (RSSI) to determine the contaminated areas. RSSI identified areas of gamma dose rate at one meter above the floor in the building. Any readings above 100 micro-Roentgen per hour at one meter above the floor were candidates for decontamination. The building owners supplied the laborers and tools to assist RSSI in decontamining the second and fourth floor.

After the area of oak floor was determined to be contaminated, the floor was removed. All subflooring found to be contaminated was either removed or chiseled down a half inch. The decontamination was only performed on occupied work areas.

During June of 1983, as part of the U.S. EPA survey, 7 film badges were placed at specific locations of concern to collect dose measurements. The range of the 25 day gross dose equivalent ranged from minimal (5 badges) to 20 millirem (2 badges).

In February 1984, The building owners began reconstruction on the second floor. Prior to performing the reconstructioning project, RSSI conducted one hour training on radiation and collected wipe samples at the areas of concern. RSSI surveyed the area while the removal of the contaminated material was being conducted.



ecology and environment, Inc.

Technical Assistance Team
Region V

TITLE: Site Location Map	FIGURE #: Figure 1
SITE: **Lindsay Light Co.**	SCALE: 1 : 24,000
CITY: Chicago IL	PAN: **EILO797SAA**

3.0 SITE ASSESSMENT

At 1700 hours, on June 2, 1993, U.S. EPA On-Scene Coordinator (OSC) Verneta Simon, U.S. EPA Emergency Response Team (ERT) Art Ball, U.S. EPA Air and Radiation Division (ARD) personnel Larry Jensen, Betsy Karr, and Michael Murphy, Illinois Department of Nuclear Safety (IDNS) representatives Tim Runyon and Vince Muzzalupo, and Technical Assistance Team (TAT) member Ron Bugg met with the building manager Ron Steele of 161 E. Grand Associates to perform a site assessment using gamma survey meters. The meters used were Micro-R meters, Ludlum Model 19 (measuring in micro-Roentgens per hour), radiation count rate meter with a sodium iodide (NaI) probe (measuring in counts per minute (cpm)) and a radiation count rate meter with an alpha probe (cpm). The four floor building, plus a basement was divided into floors to conduct a survey readings throughout each floor.

At 1745 hours, the group began to perform monitoring of the third floor with the micro-R meter and radiation monitors using a NaI probe. Due to the Ludlum Model 19 crystal over response to thorium, the levels were compensated by dividing the readings by a factor of 2. The correction factor was determined by comparing the results to other comparable instruments. All readings are gross exposure, no background subtraction, and are measured at contact. The background for the area was determined to be 6 micro-R/hr for naturally occurring radiation. The micro-R meter reading of the northwest corner office was as high as 95 micro-R/hr and 110 in a studio area near the west side of the building (See Figure 3 for third floor results). During the surveying of the third floor, The main party split up into two groups. OSC Simon, ERT Ball, IDNS Muzzalupo, and TAT Bugg (group 1) prepared for surveying the fourth floor. The remaining individuals (group 2) continued to survey the third floor.

At 1830 hours, group 1 began surveying the fourth floor. Group 1 could only perform a partial survey on the fourth floor due to the recording session in the booth located on the east section of the floor. The area where work was performed by the building owners contractor in 1987 to remove an area of contaminated material, had a reading of 350 micro-R/hr at floor contact and 200 microR/hr waist high (See Figure 4 for fourth floor results).

At 1900 hours, Group 2 conducted the survey on the second floor. The northwest corner office had high readings of up to 300 micro-R/hr. A window of the east adjacent room from the corner office had readings of 80 micro-R/hr (See Figure 2 for second floor results).

At 1920 hours, group 1 began to survey the first floor. Ron Steele requested the survey be performed away from the northeast section of the floor due to a client presentation that was taking place in that area. Group 1 began to survey the front lobby and the

secretary area in the northwest corner of the floor. The reading near the secretary was 100 micro-R/hr. The lobby area ranged from 30 to 75 micro/hr (See Figure 5 for first floor results).

At 2000 hours, group 1 began to survey the basement area. The area of concern in the basement with the highest gross exposure rate was measured on contact with a concrete plug in the chimney. The micro-R survey indicated level of 2,250 micro-R/hr at contact of the chimney and 250 micro-R/hr at one meter away from the chimney (See Figure 6 for basement results).

At 2015 hours, group 2 completed the second floor survey and assisted group 1's survey of the basement. Near the central area of the basement where records were kept in storage, the micro-R read 20 to 100 uR/hr. Readings of 18 to 20 micro-R/hr were found near the freight elevator. Group 1 also surveyed the stairs leading into the building area (See Figure 5 for result).

At 2040 hours, the OSC, ERT member, ARD representatives, IDNS representatives, and TAT went over the results with the building spokesman Ron Steele. It was suggested that due to the high readings from the chimney, the janitor's supplies near the chimney should be immediately relocated. After the meeting the groups left the site at 2100 hours.

On June 30, 1993, 12 thermoluminescent dosimeter (TLD) badges were placed near occuppied work areas throughout the four story building for one month.

4.0 ANALYTICAL RESULTS

The results of the survey revealed the presence of radioactive material in flooring and chimney which potentially contains contaminated waste ash. Earlier work performed by the building owner's contractor determined that the thorium materials appeared to have been absorbed into porous flooring material and possibly spread due to flood caused by a leaking roof. The analytical results were not available for the wipe sample and the TLD badges.

5.0 DISCUSSION OF POTENTIAL THREATS

The conditions at the former Lindsay Light site at 161 E. Grand, Chicago, Illinois that may warrant a removal action, as set forth in paragraph (b) (2) of Section 300.415 of the National Contingency Plan (NCP), included:

<u>Actual or potential exposure to nearby populations, animals, or the food chain from hazardous substances or pollutants or contaminants:</u> The site investigation with micro-R meter indicated substantially elevated levels of radioactivity in several areas throughout the

building. Gamma-ray emissions from the radioactive thorium decay series producing potential human exposures will continue as long as contaminants remain in the building. Continual gamma-ray exposure increases the risk for cancer due to ionizing radiation. Thorium dust may cause an increase chance of developing cancer of the lung decades after being exposed. Ingestion of thorium can increase the risk of liver cancer. Thorium radiactively decays to radon-220 and then to its decay products. Radon-220 decay products con increase thr risk of lung cancer.

Other situations or factors that may pose threats to public health or welfare or the environment.

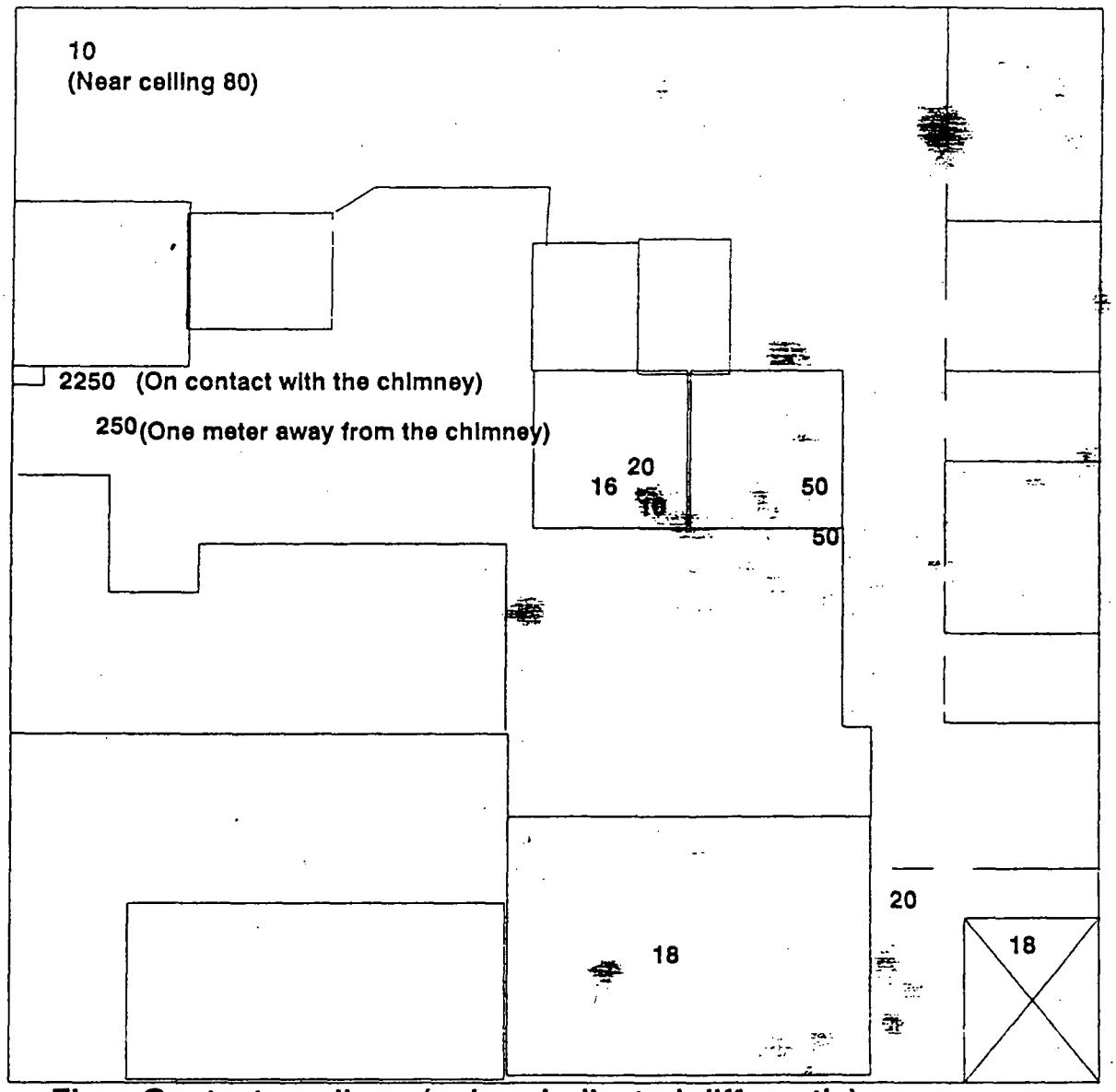
Due to the contaminant of concern, one may be exposed to radioactive isotopes and the effects may occur many years after exposure. Thorium occurs principally as the parent radionuclide thorium-232 in association with its daughter products in a decay sequence known as the Thorium Decay Series. Thorium-232 has a half-life of 14 billion years. Several daughter products of concern are Radon-220 and Radon-222 (See Table 1 for Thorium Decay Series).

6.0 CONCLUSION

After conducting the survey at 161 E. Grand Street, formerly Lindsay Light Company site, had readings 400 times greater than background. High exposure rates were found in work areas and near the chimney in the basement. The latter indicated radioactive material inside the chimney. The isotope of concern is believed to be thorium. To determine the level of radiation, TLD badges were placed near the work areas that had high micro-R meter readings.

B

Readings: Micro-R/hr



Floor Contact readings (unless indicated differently)

Readings include the correction factor
The instrument reads higher by a factor of 2

LEGEND

N

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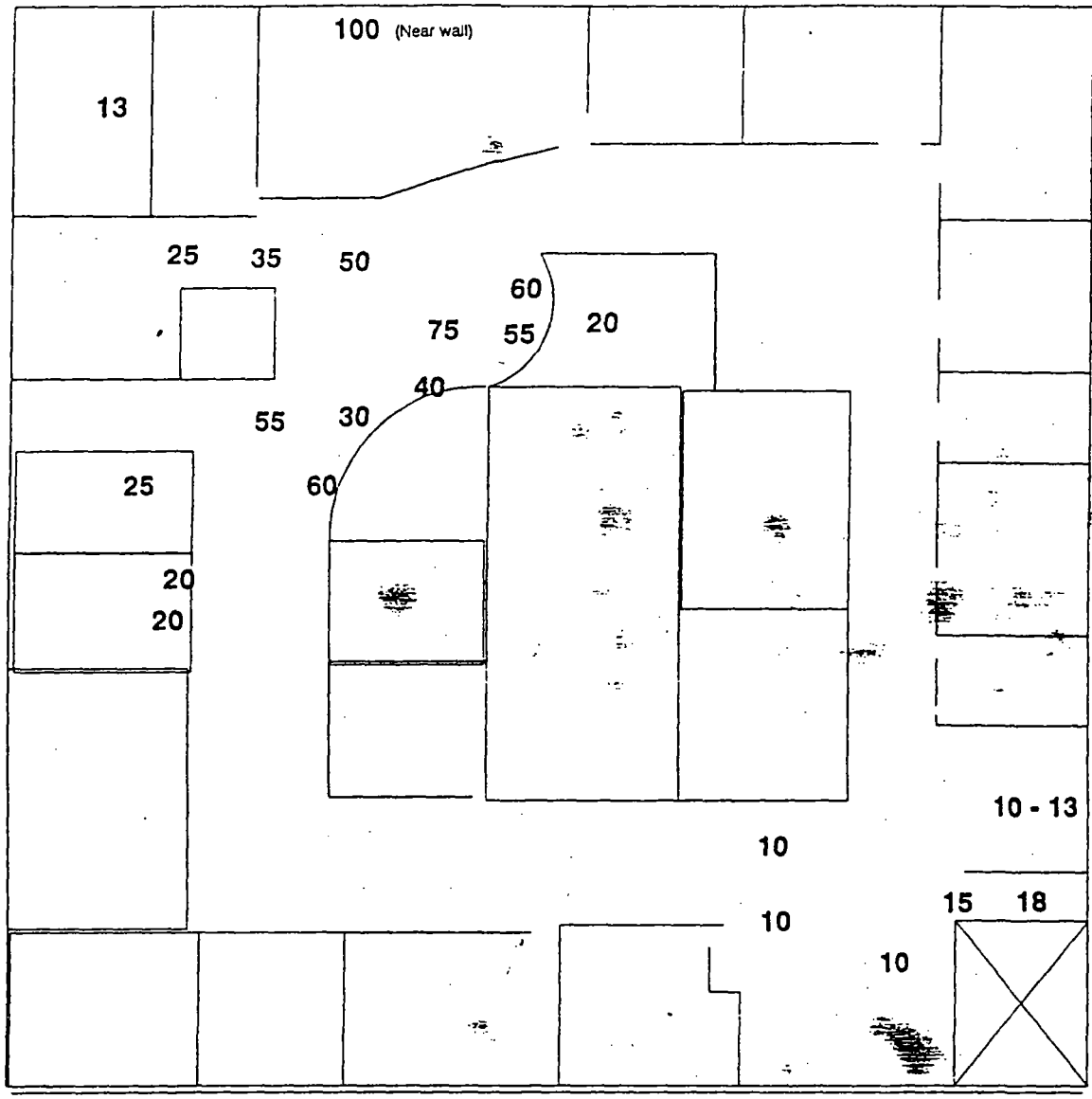
Region V

TITLE 161 E. Grand Ave. Basement (Optumus)	FIGURE # Figure 6
SITE Lindsay Light Company	TDD# T05-9305-014
CITY Chicago STATE IL	SCALE Not to Scale
SOURCE Instrument: Ludlum Model 19	DATE July 16, 1993
	REVISED

1



Readings include correction factor of 2
The instrument reads higher by a factor of 2

LEGEND

N

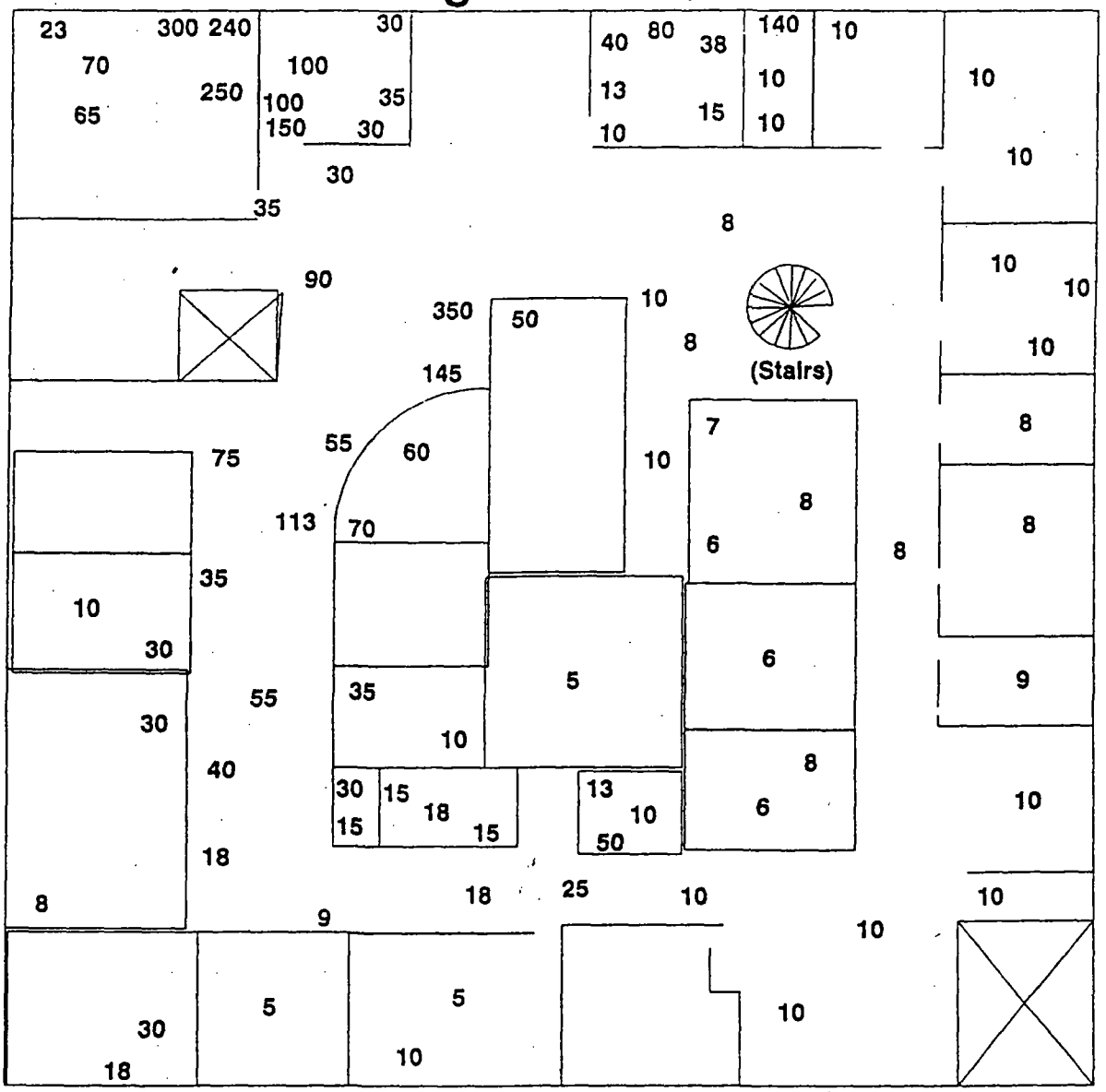
Readings: MicroR/Hr

ecology and environment, inc.
Technical Assistance Team
Region V
111 W. Jackson Blvd., Chicago, Illinois 60604

TITLE 161 E. Grand Ave. 1st Floor Readings **Optumus**	FIGURE # Figure 5
SITE Lindsay Light Co.	SCALE T05-9305-014
CITY Chicago STATE IL	PAM Not to Scale
SOURCE Instrument: Ludlum Model 19	DATE
	REVISED

2

Reading: micro-R/hr



Readings include correction factor
The instrument reads higher by a factor of 2

N

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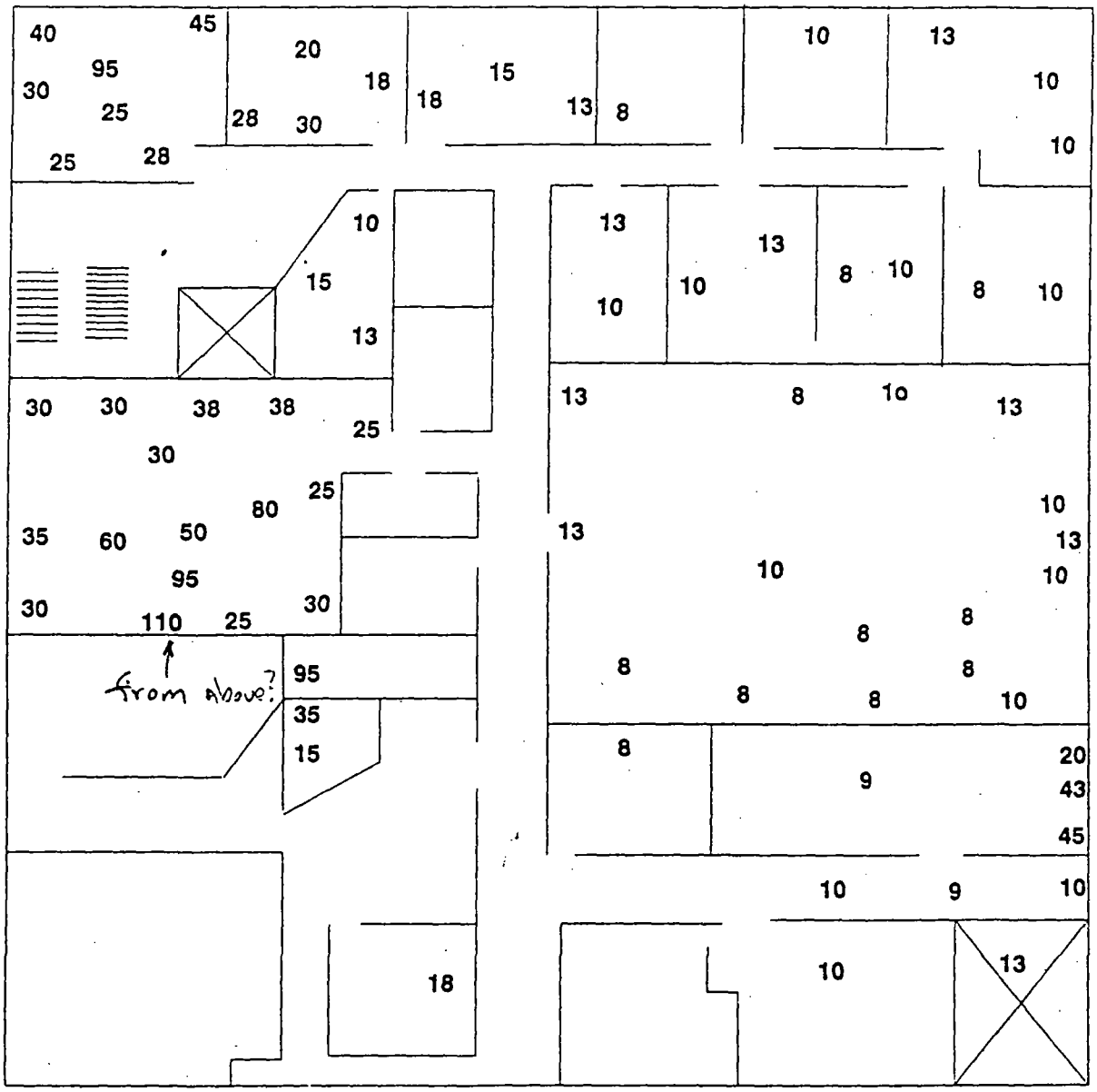
Region V

TITLE 161 E. Grand Ave. 2nd Floor (Optumus)	FIGURE # Figure 2
SITE Lindsay Light Company	TDO# T05-9305-014
CITY Chicago STATE IL	SCALE Not to Scale
SOURCE Instrument: Ludlum Model 19	DATE July 16, 1993
	REVISED

3

Readings: Micro-R/hr



Floor Contact Readings
Readings include the correction factor
The instrument reads higher by a factor of 2

LEGEND

N

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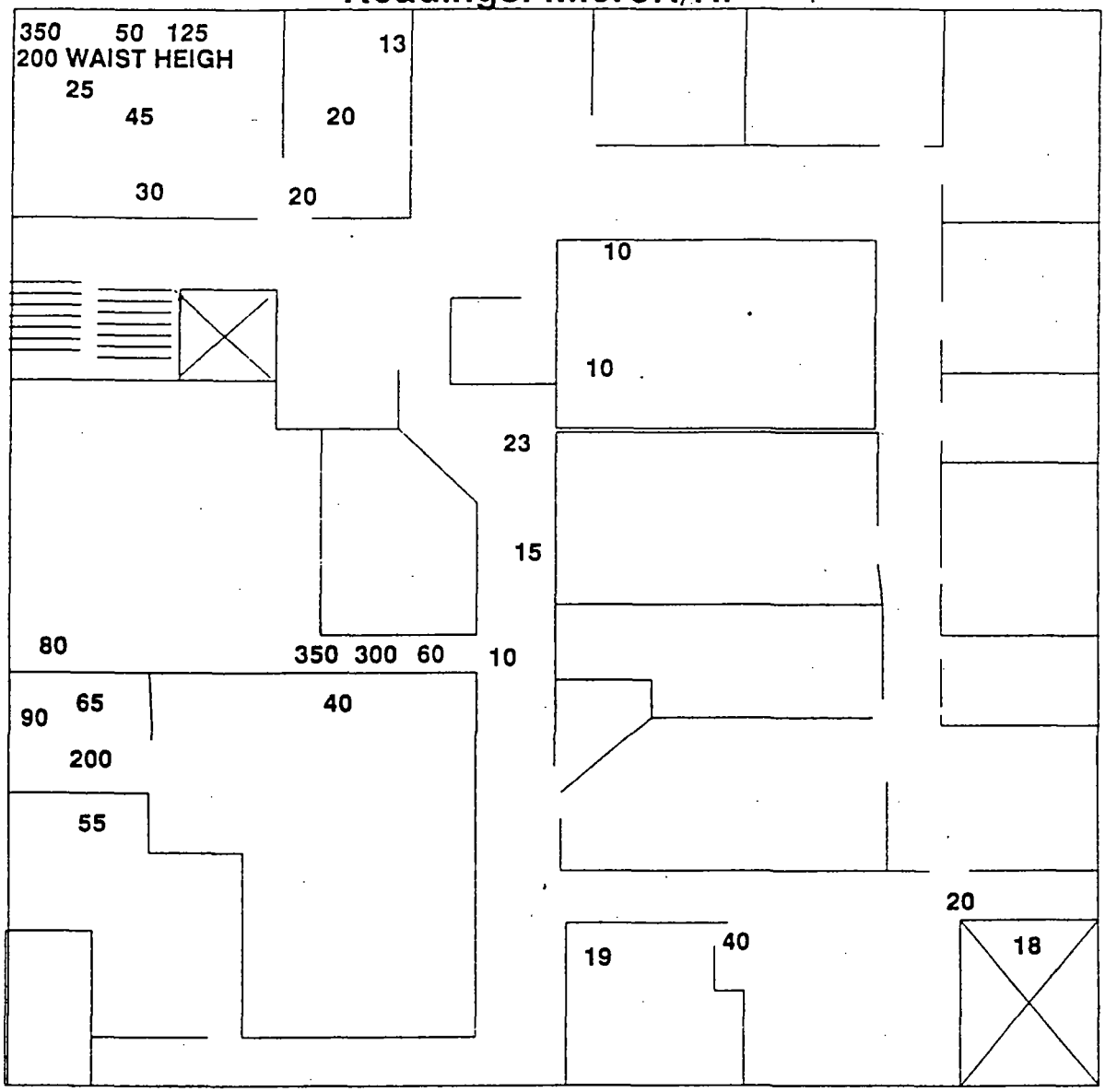
Region V

TITLE 161 E. Grand 3rd Floor (Optumus)	FIGURE # Figure 3
SITE Lindsay Light Company	TDD# T05-9305-014
CITY Chicago STATE IL	SCALE Not to Scale
SOURCE Instrument: Ludlum Model 19	DATE July 16, 1993
	REVISED

4

Readings: MicroR/Hr



Floor Contact readings (unless indicated differently)

Readings include the correction factor
The instrument reads higher by a factor of 2.

LEGEND

N

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Technical Assistance Team
Region V

TITLE 161 E. Grand Ave. 4th Floor (Streeterville)	FIGURE # Figure 4
SITE Lindsay Light Company	TDD# T05-9305-014
CITY Chicago STATE IL	SCALE Not to Scale
SOURCE Instrument: Ludlum Model 19	DATE July 15, 1993
	REVISED

APPENDIX A

SITE PHOTOGRAPHS

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Lindsay Light Company PAGE 1 OF 5

U.S.EPA ID: TDD: T05-9305-014 PAN:EIL0794SAA

DATE: 6/2/93

TIME: 2030

DIRECTION OF PHOTOGRAPH: West

WEATHER CONDITIONS: N/A

PHOTGORAPHED BY: Ron Bugg

SAMPLE ID (if applicable):

DESCRIPTION: Reading at contact of the chimney (2250 uR/hr). The chimney is located near the northwest section of the basement.

DATE: 6/2/93

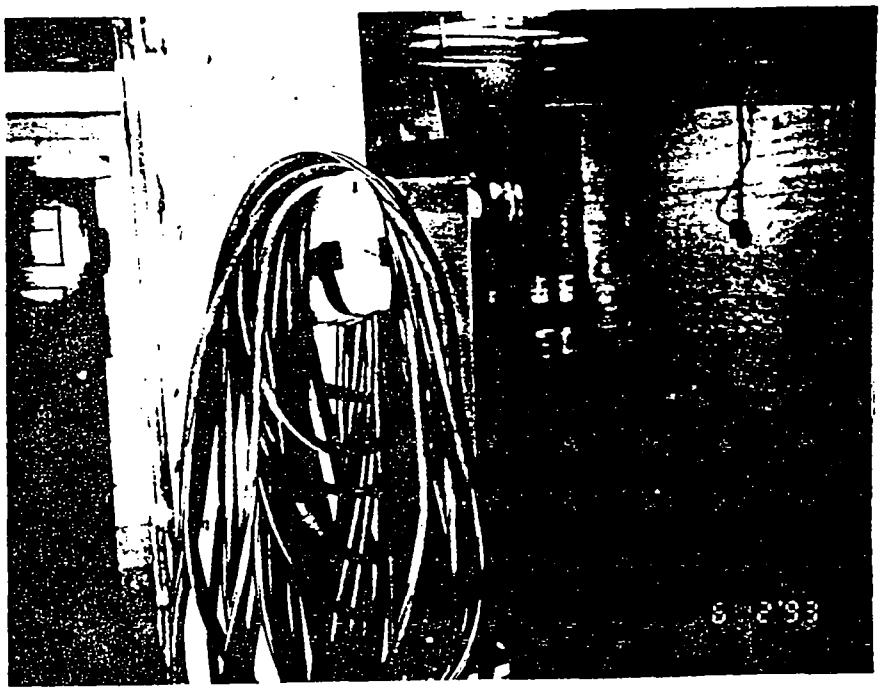
TIME: 2030

DIRECTION OF PHOTOGRAPH: Northwest

WEATHER CONDITIONS: N/A

PHOTOGRAPHED BY: Ron Bugg

SAMPLE ID (if applicable):



DESCRIPTION: The janitors area located near the chimney. One meter away from the chimney the readings were reduced by a factor of 10.

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Lindsay Light Company PAGE 2 OF 5

U.S.EPA ID: TDD: T05-9305-014 PAN:EIL0794SAA

DATE: 6/2/93

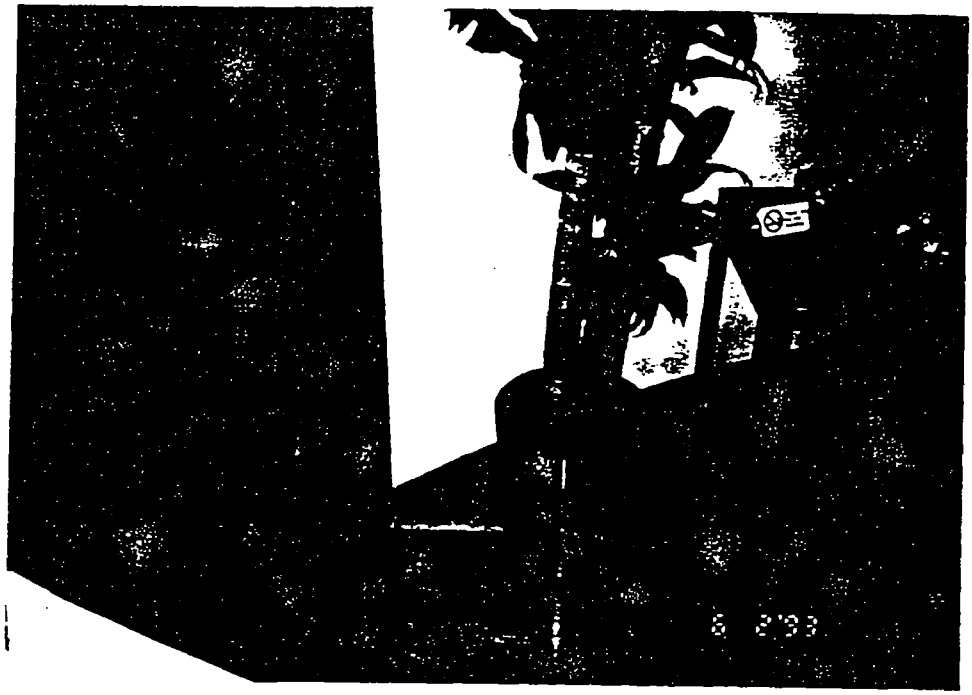
TIME: 1930

DIRECTION OF PHOTOGRAPH: East

WEATHER CONDITIONS: N/A

PHOTGORAPHED BY: Ron Bugg

SAMPLE ID (if applicable):



DESCRIPTION: Reading at contact near the receptionist area (receptionist is to the north (left of the photo).

DATE: 6/2/93

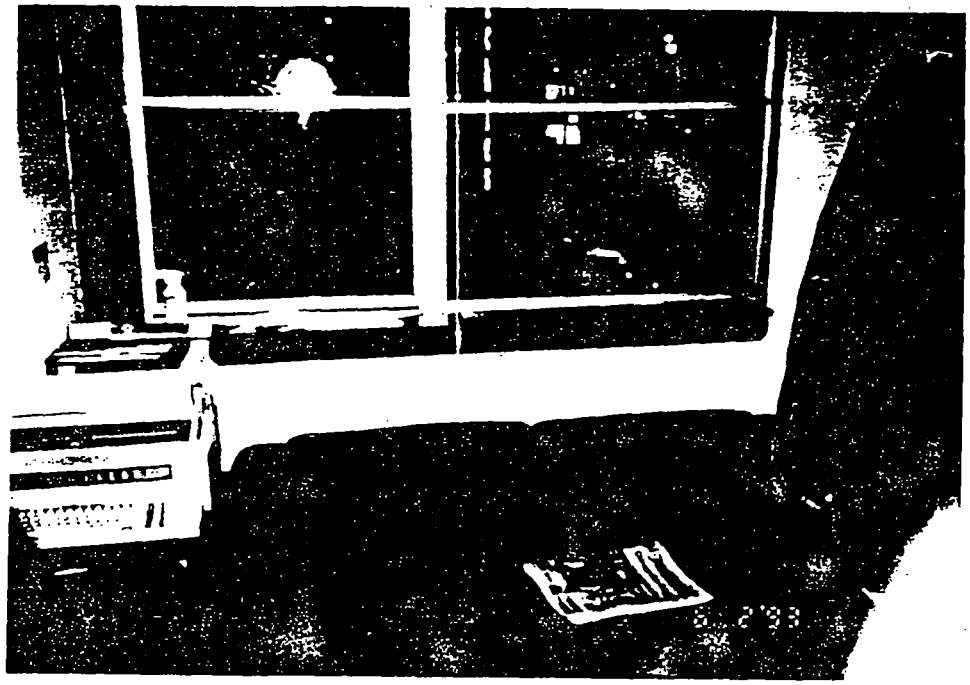
TIME: 2000

DIRECTION OF PHOTOGRAPH: North

WEATHER CONDITIONS: N/A

PHOTOGRAPHED BY: Ron Bugg

SAMPLE ID (if applicable):



DESCRIPTION: The Second floor photo of the area where the window area had a reading of 80 uR/hr.

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Lindsay Light Company

U.S.EPA ID: TDD: T05-9305-014 PAN:EIL0794SAA

DATE: 6/2/93

TIME: 1745

DIRECTION OF PHOTOGRAPH: North

WEATHER CONDITIONS: N/A

PHOTGORAPHED BY: Ron Bugg

SAMPLE ID (if applicable):

DESCRIPTION: Reading at contact near the northeast corner of the third floor.

DATE: 6/2/93

TIME: 1830

DIRECTION OF PHOTOGRAPH: North

WEATHER CONDITIONS: N/A

PHOTOGRAPHED BY: Ron Bugg

SAMPLE ID (if applicable):

DESCRIPTION: The third floor sound booth that had readings of 95 uR/hr on contact with the floor. The sound booth is located near the southwest side of the third floor.

FIELD PHOTOGRAPHY LOG SHEET

S"TE NAME: Lindsay Light Company PAGE 4 OF 5

U.S.EPA ID: TDD: T05-9305-014 PAN:EIL0794SAA

DATE: 6/2/93

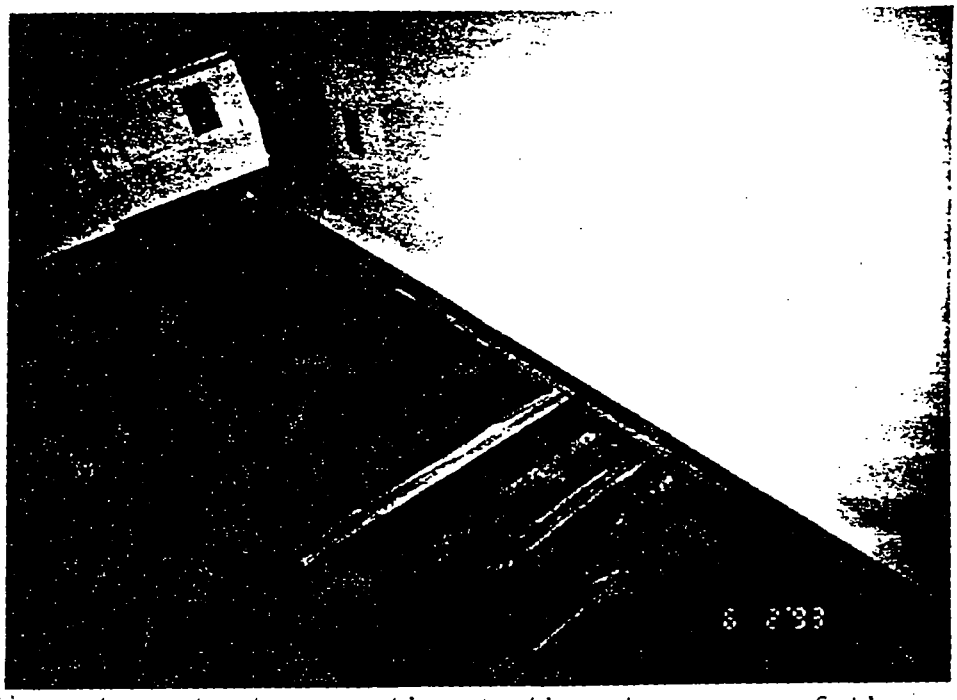
TIME: 1745

DIRECTION OF PHOTOGRAPH: North

WEATHER CONDITIONS: N/A

PHOTGORAPHED BY: Ron Bugg

SAMPLE ID (if applicable):



DESCRIPTION: Reading at contact near the northwest corner of the second floor at the east wall of the office. Readings were 250 uR/hr.

DATE: 6/2/93

TIME: 1830

DIRECTION OF PHOTOGRAPH: North

WEATHER CONDITIONS: N/A

PHOTOGRAPHED BY: Ron Bugg

SAMPLE ID (if applicable):

DESCRIPTION: The third floor northeast office on contact with the east wall. Readings were 10 uR/hr.

FIELD PHOTOGRAPHY LOG SHEET

SITE NAME: Lindsay Light Company PAGE 5 OF 5

U.S.EPA ID: TDD: T05-9305-014 PAN:EIL0794SAA

DATE: 6/2/93

TIME: 1845

DIRECTION OF PHOTOGRAPH: North

WEATHER CONDITIONS: N/A

PHOTGORAPHED BY: Ron Bugg

SAMPLE ID (if applicable):

DESCRIPTION: The reading was collected inside a sound booth located on the fourth floor and is near the southwest section of the floor. The reading was 200 uR/hr.

DATE: 6/2/93

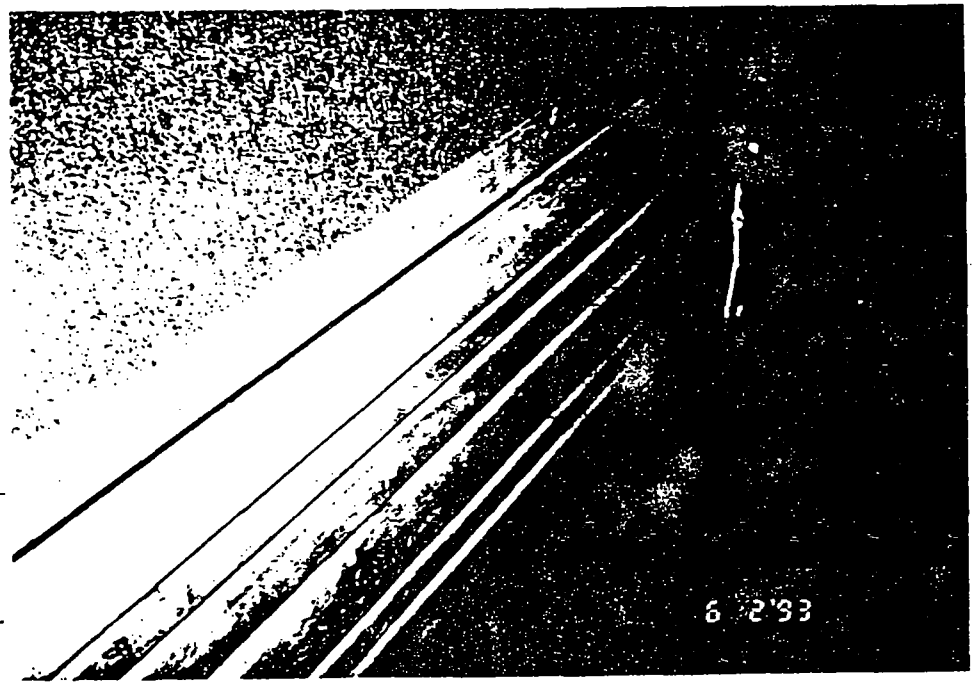
TIME: 1845

DIRECTION OF PHOTOGRAPH: West

WEATHER CONDITIONS: N/A

PHOTOGRAPHED BY: Ron Bugg

SAMPLE ID (if applicable):



DESCRIPTION: A hallway leading into a sound booth located on the fourth floor. The reading at that point was 350 uR/hr.

APPENDIX B

THORIUM DECAY SERIES

Thorium Series (4n)*

Nuclide	Historical name	Half-life	Major radiation energies (MeV) and intensities† α	β	γ
$^{232}_{90}Th$	Thorium	1.41×10^{10}y	3.95 (24%) 4.01 (76%)	---	---
$^{228}_{88}Ra$	Mesothorium I	6.7y	---	0.055 (100%)	---
$^{228}_{89}Ac$	Mesothorium II	6.13h	---	1.18 (35%) 1.75 (12%) 2.09 (12%)	0.34c‡ (15%) 0.908 (25%) 0.96c (20%)
$^{228}_{90}Th$	Radiothorium	1.910y	5.34 (28%) 5.43 (71%)	---	0.084 (1.6%) 0.214 (0.3%)
$^{224}_{88}Ra$	Thorium X	3.64d	5.45 (6%) 5.68 (94%)	---	0.241 (3.7%)
$^{220}_{86}Rn$	Emanation Thoron (Tn)	55s	6.29 (100%)	---	0.55 (0.07%)
$^{216}_{84}Po$	Thorium A	0.15s	6.78 (100%)	---	---
$^{212}_{82}Pb$	Thorium B	10.64h	---	0.346 (81%) 0.586 (14%)	0.239 (47%) 0.300 (3.2%)
$^{212}_{83}Bi$	Thorium C	60.6m	6.05 (25%) 6.09 (10%)	1.55 (5%) 2.26 (55%)	0.040 (2%) 0.727 (7%) 1.620 (1.5%)
64.0% / 36.0%					
$^{212}_{84}Po$	Thorium C' ^{212}Po	304ns	8.78 (100%)	---	---
$^{208}_{81}Tl$	Thorium C'' ^{208}Tl	3.10m	---	1.28 (25%) 1.52 (21%) 1.80 (50%)	0.511 (23%) 0.583 (85%) 0.860 (12%) 2.614 (100%)
$^{208}_{82}Pb$	Thorium D	Stable	---	---	---

*This expression describes the mass number of any member in this series, where n is an integer.
Example: $^{232}_{90}Th$ (4n).....w(58) = 232

†Intensities refer to percentage of disintegrations of the nuclide itself, not to original parent of series.

‡Complex energy peak which would be incompletely resolved by instruments of moderately low resolving power such as scintillator

Data taken from: Lederer, C. M., Hollander, J. M., and Perlman, I., Table of Isotopes (6th ed.; New York: John Wiley & Sons, Inc., 1967) and Hogan, O. M., Zigman, P. E., and Mackin, J. L., Beta Spectra (USNRDL-TR-802 (Washington, D.C. U.S. Atomic Energy Commission, 1964)).

FIGURE 1: Thorium Decay Series
(Source: Radiological Health Handbook, U.S. Department of Health, Educ and Welfare, Revised January 1970)

ID #: P A C 4 Date: 9/14/93 Time: 8:30 am 0 0212

Site Name: Lindsey Light City: Chicago Cnty: ___ State: IL

CERCLIS #: _____ Cost Recovery #: 60YL Region: V

Site Status (1) _ NPL _ Federal _ Non-NPL _ RCRA _ Non-Site specific
(2) _ Emergency Response _ Remedial _ Other

Activities

_ Incoming Call _ Public Meeting* _ Health Consult* _ Site Visit*
X Outgoing Call _ Other Meeting _ Health Referral _ Info Provided
_ Conference Call _ Data Review _ Written Response _ Training
_ Incoming Mail _ Other

Requestor and Affiliation: (1) Vernita Simon, OSC
Phone: 312/886-3601 Address: _____
City: _____ State: _____ Zip Code: _____

Contacts and Affilation

( ) _____ ( ) _____
( ) _____ ( ) _____

1-EPA	2-USCG	3-OTHER FED	4-STATE ENV	5-STATE HLT
6-COUNTY HLTH	7-CITY HLTH	8-HOSPITAL	9-LAW ENFORCE	10-FIRE DEPT
11-POISON CTR	12-PRIV CITZ	13-OTHER	14-UNKNOWN	15-DOD
16-DOE	17-NOAA	18-OTHR STATE	19-OTHR COUNTY	20-OTHR CITY
21-INTL	22-CITZ GROUP	23-ELECT. OFF.	24-PRIV. CO	25-NEWS MEDIA
26-ARMY	27-NAVY	28-AIR FORCE	29-DEF LOG AGCY	30-NRC
31-ATSDR				

_ Health Assessment _ Health Studies _ Tox Info-profile _ Worker Hlth
_ Petition Assessment _ Health Survellnc _ Tox Info-Nonprofil _ Admin
X Emergency Response _ Disease Regstry _ Subst-Spec Resch _ Other
_ Health Consultation _ Exposr Regstry _ Health Education

Narrative Summary: As a follow-up to the site visit to Lindsey Light, EPA has supplied the results of the TLD monitoring at several locations around the city of Chicago that may have radiological contamination. The TLD results were supplied as a function of exposure per week (24 hour exposure). To equate this to exposure of individuals who may receive excessive levels of exposure, the following procedure was used. I used 2000 hours per year for a worker (50 weeks per year, 40 hours per week). The current exposure limit is 100 millirem per year or 0.05 mrem per hour. Since there are 168 hours in a week, any TLD with an exposure of 8.4 millirem per week was considered excessive (168 x 0.05). Using this procedure, 4 TLDs in the 161 E. Grand Avenue location were considered excessive. These were TLD numbers 9021, 9022, 9026, and 9027. 9021 and 9022 appear to be in the basement and it is unlikely that excessive exposures could occur. However, 9026 and 9027 appear to be within an office on the second floor. I would recommend that either that office be vacated and sealed or the office be remediated to a level that is considered radiologically safe (<100 millirem per year).

Action Required/Recommendations/Info Provided: None at this time.

Signature: Robert L. Williams for Paul A. Charp, Ph.D. Date: September 14, 1993

cc:
Robert L. Williams, Region V (via email)
RIMB

LINDSAY LIGHT COMPANY RAW TLD DATA

EXPOSURE PERIOD 31 DAYS

DOSIMETER READINGS

Draft

(MREM/EXPOSURE PERIOD)

	TLD NUMBER	TLD #1	TLD #2	TLD #3	TLD #4	TLD #5	MEAN
161 E. GRAND	.....	.....	.....	.....	.....	.....	.....
	9021	3280	3224	3253	3334	2921	3202.4
EXPOSED	9022	182	245	208	226	190	210.2
(7/2-8/2, 1993)	9023	33	26	32	39	31	32.2
	9024	28	36	35	42	40	36.2
	9025	35	36	44	42	39	39.2
	9026	199	183	251	194	185	202.4
	9027	432	548	436	442	535	478.6
	9028	49	51	56	46	47	49.8
	9029	46	43	35	41	35	40.0
SITE BACKGROUND	9031	17	14	14	12	16	14.6
	9032	15	20	16	13	15	15.8
	9033	33	34	29	40	35	34.2

LINDSAY LIGHT COMPANY RELATED DOSE READINGS

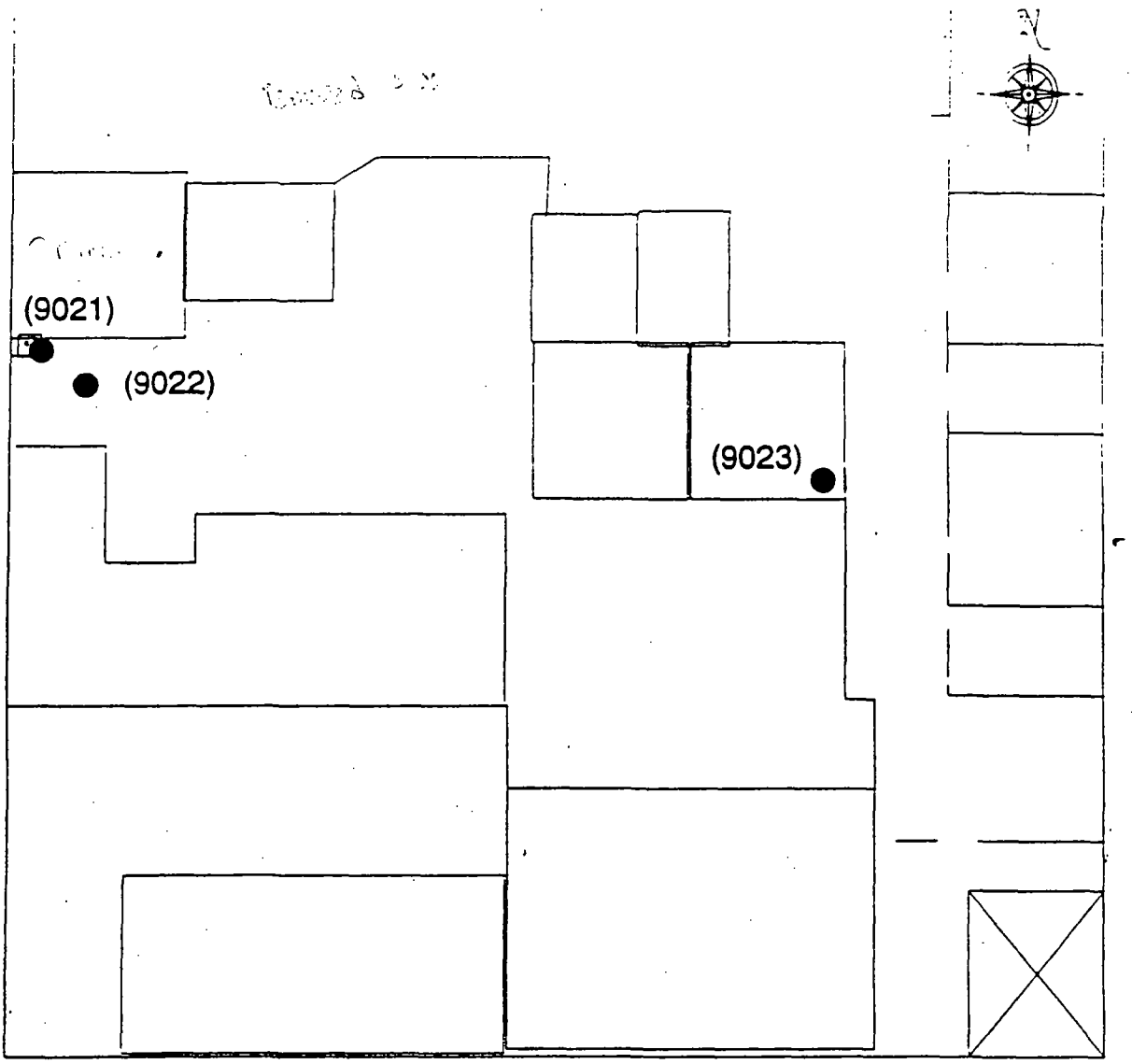
	TLD NUMBER	NET DOSE PER HOUR (MREM/HR)	NET DOSE PER 40 HOUR WEEK MREM/WK)	NET DOSE PER 2000 HOUR WORK YEAR (MREM/YR)	CANCER INCIDENCE RISK PER 2000 HOUR WORK YEAR	CANCER INCIDENCE RISK PER 50 WORK YEARS
161 E. GRAND	.....	.....	.....	.....	.....	.....
	9021	4.28929	171.6	8578.6	5.3E-03	2.7E-01
EXPOSED	9022	0.26751	10.7	535.0	3.3E-04	1.7E-02
(7/2-8/2, 1993)	9023	0.02827	1.1	56.5	3.5E-05	1.8E-03
	9024	0.03364	1.3	67.3	4.2E-05	2.1E-03
	9025	0.03768	1.5	75.4	4.7E-05	2.3E-03
	9026	0.25703	10.3	514.1	3.2E-04	1.6E-02
	9027	0.62827	25.1	1256.5	7.8E-04	3.9E-02
	9028	0.05192	2.1	103.8	6.5E-05	3.2E-03
	9029	0.03875	1.6	77.5	4.8E-05	2.4E-03
SITE BACKGROUND	9031	0.00461	0.2	9.2	5.7E-06	2.9E-04
	9032	0.00622	0.2	12.4	7.8E-06	3.9E-04
	9033	0.03096	1.2	61.9	3.9E-05	1.9E-03

8 out of 10,000

2 mrem/hr.

500 mrem/year

Readings: MILLIREM PER HOUR



TLD Badge (Badge #)

LEGEND

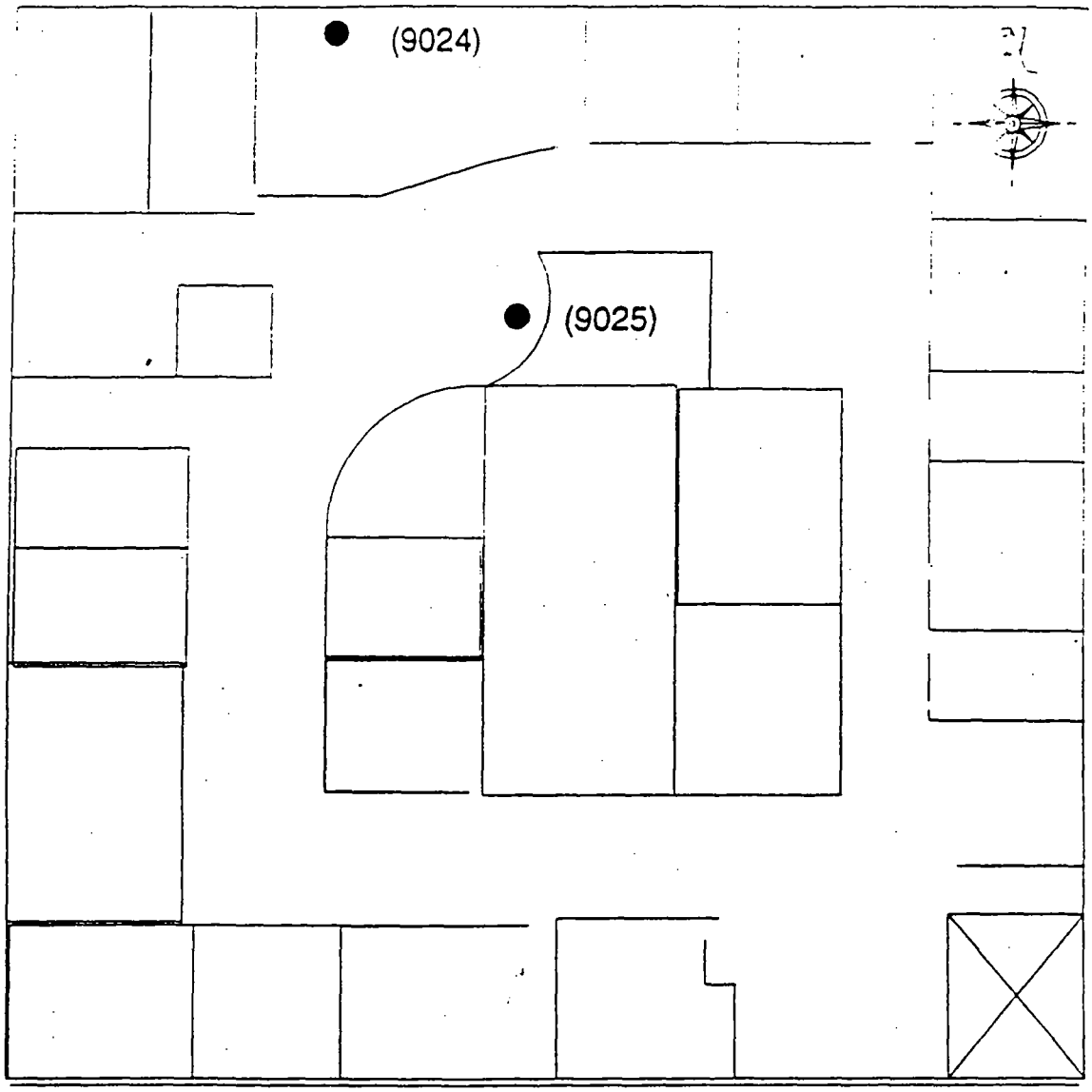
TLD EXPOSURE RESULTS

(9021)=4.28929 mrem/hr
(9022)=0.26751 mrem/hr
(9023)=0.02827 mrem/hr

EPA U.S. EPA REGION V

EMERGENCY AND ENFORCEMENT RESPONSE BRANCH

TITLE 161 E. Grand Ave. Basement (Optumus)	FIGURE # Figure 1
SITE Lindsay Light Company	T0&O T05-9305-014
CITY Chicago STATE IL	SCALE Not to Scale
SOURCE	DATE July 16, 1993
	REVISED



● TLD Badge (Badge #)

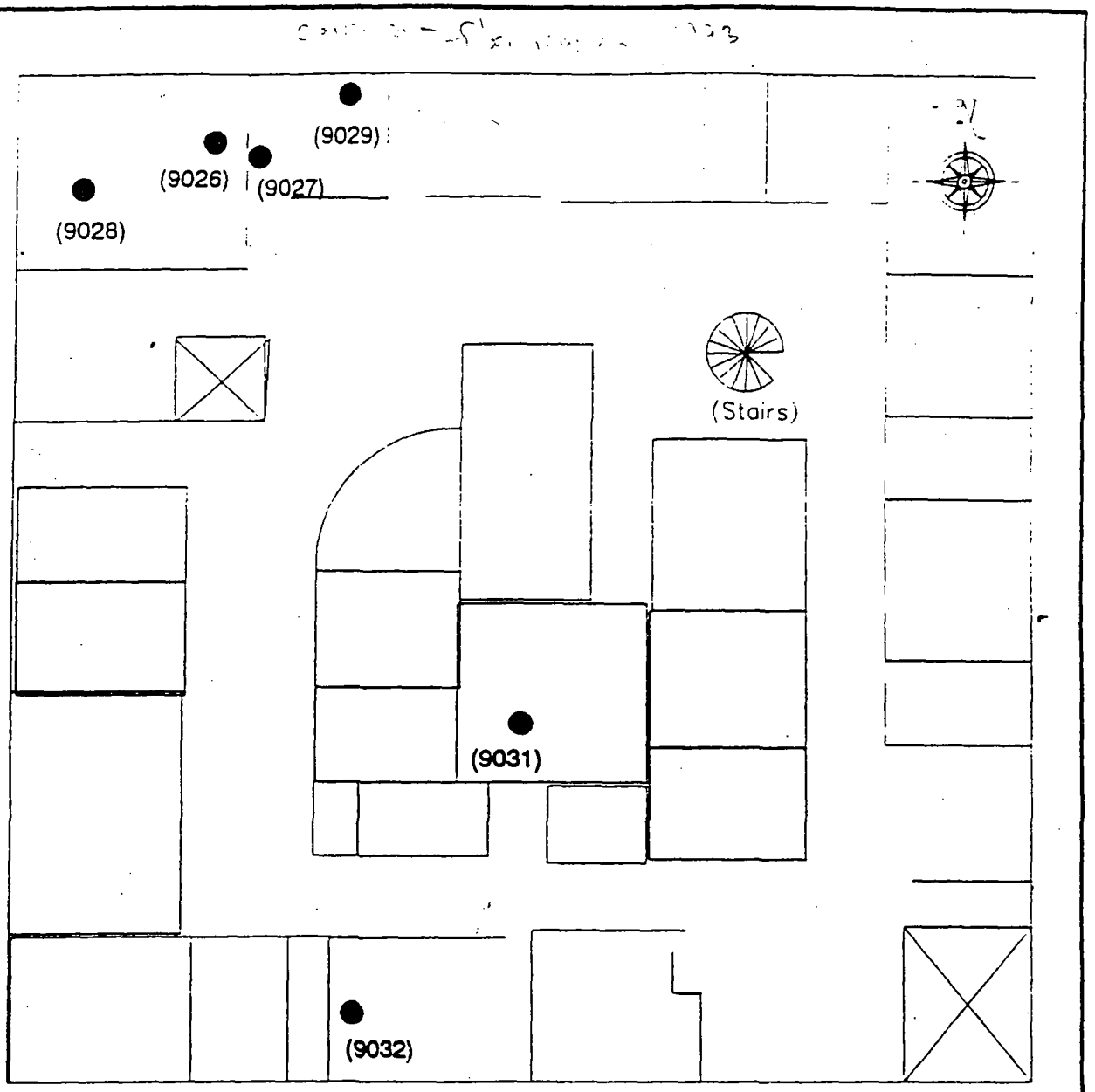
LEGEND

TLD Results

Reading: millirem per hour
(9024)=0.03364
(9025)=0.03768

EPA U.S. EPA REGION V
EMERGENCY AND ENFORCEMENT RESPONSE BRANCH

TITLE 161 E. Grand Ave. 1st Floor Readings Optumus	FIGURE # Figure 2
SITE Lindsay Light Co.	SCALE T05-9305-014
CITY Chicago STATE IL	PAN Not to Scale
SOURCE	DATE
	REVISED



● TLD Badge (Badge #)

LEGEND

TLD Results

Reading: millirem per hour

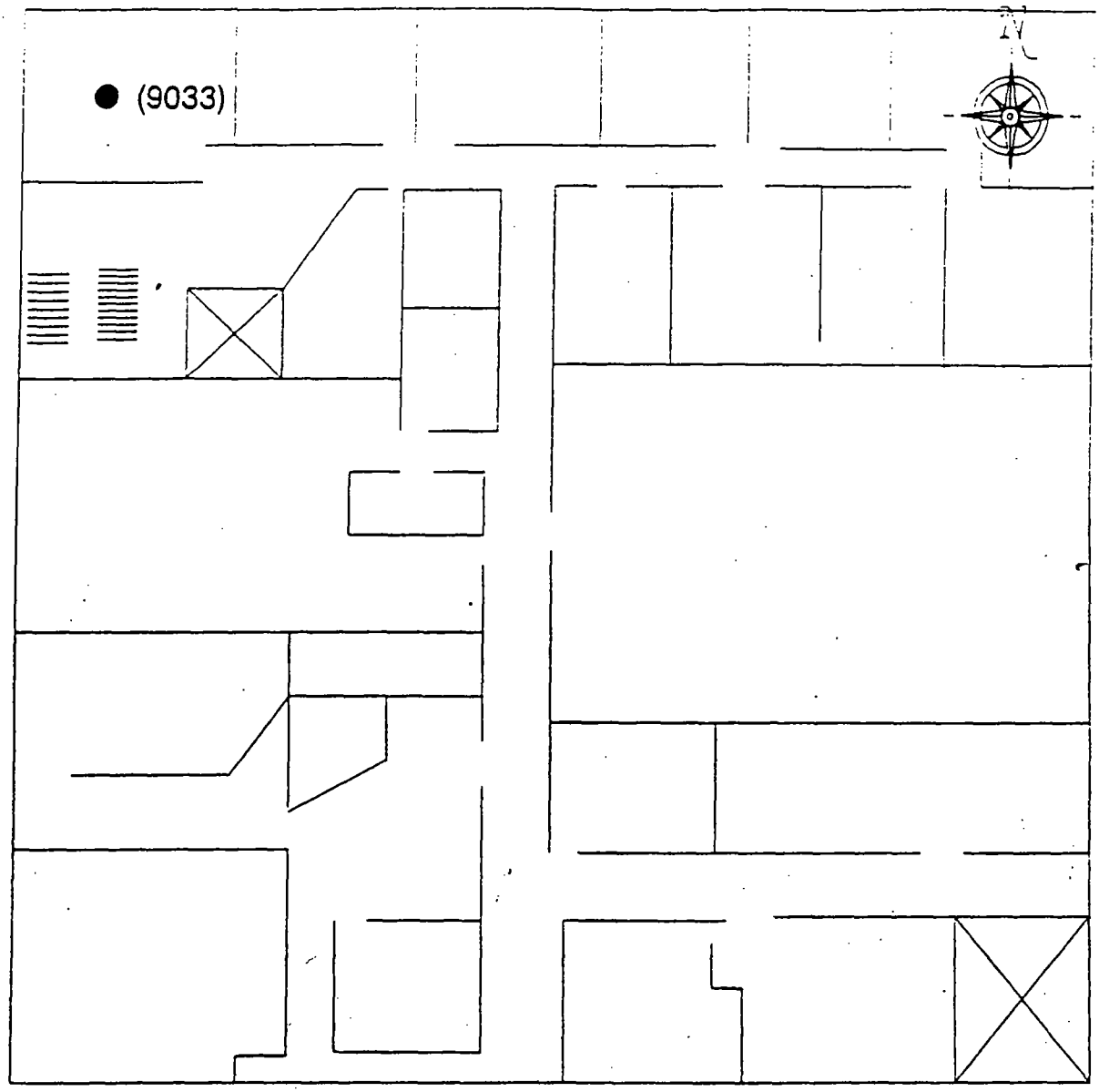
(9026)=0.25703 mrem/hr
(9027)=0.62827 mrem/hr
(9028)=0.05192 mrem/hr
(9029)=0.03875 mrem/hr
(9031)=0.00461 mrem/hr
(9032)=0.00622 mrem/hr

EPA U.S. EPA REGION V

EMERGENCY AND ENFORCEMENT RESPONSE BRANCH

TITLE 161 E. Grand Ave. 2nd Floor (Optumus)	FIGURE # Figure 3
SITE Lindsay Light Company	TDD# 105-9305-014
CITY Chicago STATE IL	SCALE Not to Scale
SOURCE	DATE July 16, 1993
	REVISED

Readings: MILLIREM PER HOUR



● TLD BADGE (Badge #)

LEGEND

TLD RESULTS

(9033)=0.03096 mrem/hr

EPA U.S. EPA REGION V

EMERGENCY AND ENFORCEMENT RESPONSE BRANCH

TITLE 161 E. Grand 3rd Floor (Optumus)	FIGURE # Figure 4
SITE Lindsay Light Company	TEMO T05-9305-014
CITY Chicago STATE IL	SCALE Not to Scale
SOURCE	DATE July 16, 1993
	REVISED

...mo Analytic...
Eberline
...Jefferson Street NE
...uerque NM 87108
345 0837

TLD ENVI...ONMENTAL MONITOR REPORT

ROSE MARIE TAUCHE

DATE ISSUED 07/01/93 DATE ANNEALED 06/18/93 CUSTOMER NO. 7472 DOSIMETRY SERVICES
DATE RETURNED 08/25/93 DATE READ 08/26/93 PAGE 2 OF 3 DATE 08/26/93

10C FR 20
Limits = 100

...ADGE ...UMBER	IDENTIFICATION	DOSIMETER READINGS (mrem) FIRST	SECOND	THIRD	FOURTH	FIFTH	AVERAGE ±	2 σ	MREM/WEEK
...6		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
...3	3- Corner Off (NW)	33	34	29	40	35	34.2	7.9	3.[illegible]
...8		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
...9		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
...0		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
...1	B- Chimney	3280	3224	3253	3334	2921	3202.4	324.9	320.2
...2	B- Shelving (By Chimney)	182	245	208	226	190	210.2	51.7	21.0
...3	B- Shipping	33	26	32	39	31	32.2	9.3	3.2
...4	1- Window (200)	28	36	35	42	40	36.2	10.8	3.6
...5	1- Reception	35	36	44	42	39	39.2	7.7	3.9
...6	2- NE Office Corner	199	183	231	194	185	202.4	95.9	20.2
...7	2- Sm Office	432	548	436	442	535	478.6	115.4	47.8
...8	2- Center "	49	51	36	46	47	49.8	7.9	4.9
...9	2- Sm Office	46	43	35	41	35	40.0	9.8	4.0
...1	2- Core	17	14	14	12	16	14.6	3.9	1.4
...2	2- S Office	15	20	16	13	15	15.6	5.2	1.5

DOSIMETER DAMAGED

BASED ON ELAPSED TIME FROM DATE ANNEALED TO DATE READ

FREQUENCY CODES

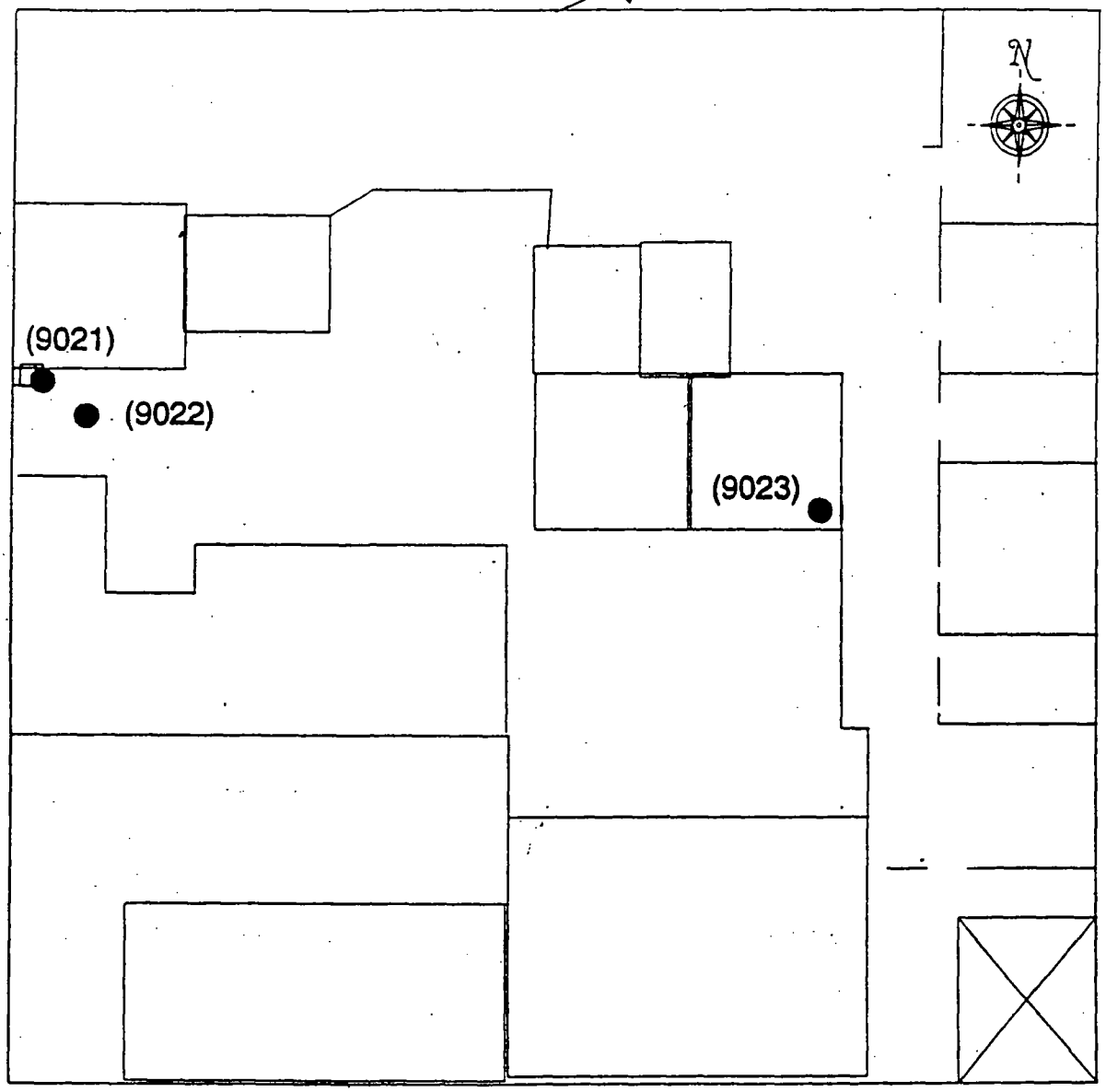
M - MONTHLY
Q - QUARTERLY
S - SEMI-ANNUAL
A - ANNUAL

CUSTOMER ECOLOGY & ENVIRONMENT
ATTENTION SALLY IMES/12TH FLOOR
ADDRESS 111 W JACKSON BLVD
CITY CHICAGO IL 60604

09/07/1993 09:09 FROM US EPA EMERGENCY RESP. BR 15807268 P.02

0 021

Readings: ~~MicroR/hr~~ millirem



● TLD Badge (Badge #)

LEGEND

TLD EXPOSURE RESULTS

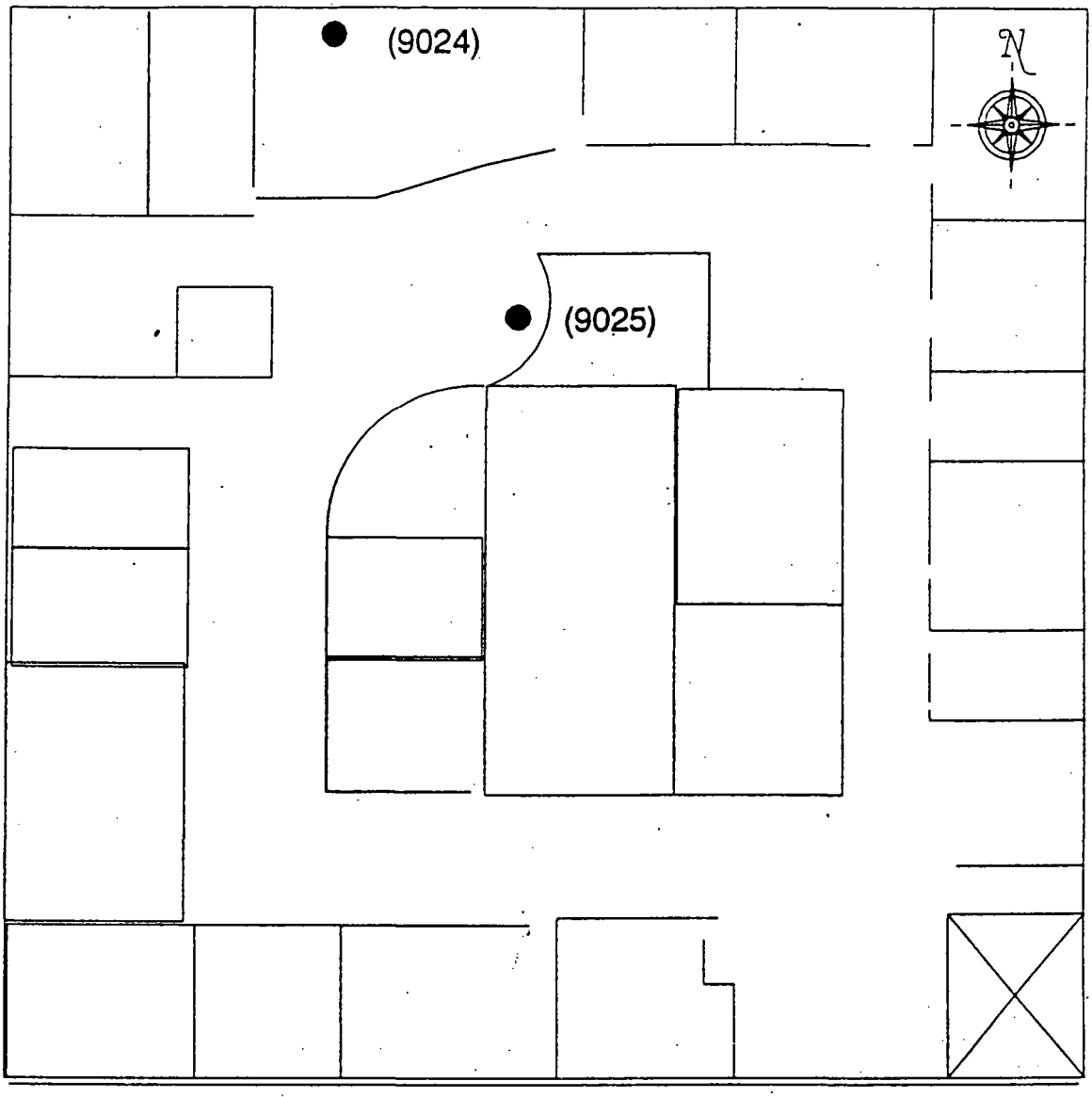
(9021) = 4.289 ~~uR~~ mrem/hr

(9022) = 0.275 ~~uR~~ mrem/hr

(9023) = 0.028 ~~uR~~ mrem/hr

ecology and environment, inc.
Technical Assistance Team
Region V

TITLE: 161 E. Grand Ave. Basement (Optumus)	FIGURE #: Figure 6
SITE: Lindsay Light Company	TDD#: T05-9305-014
CITY: Chicago STATE: IL	SCALE: Not to Scale
SOURCE:	DATE: July 16, 1993
	REVISED:



● TLD Badge (Badge #)

LEGEND

TLD Results

Readings: ~~MicroR/Hr~~ mrem

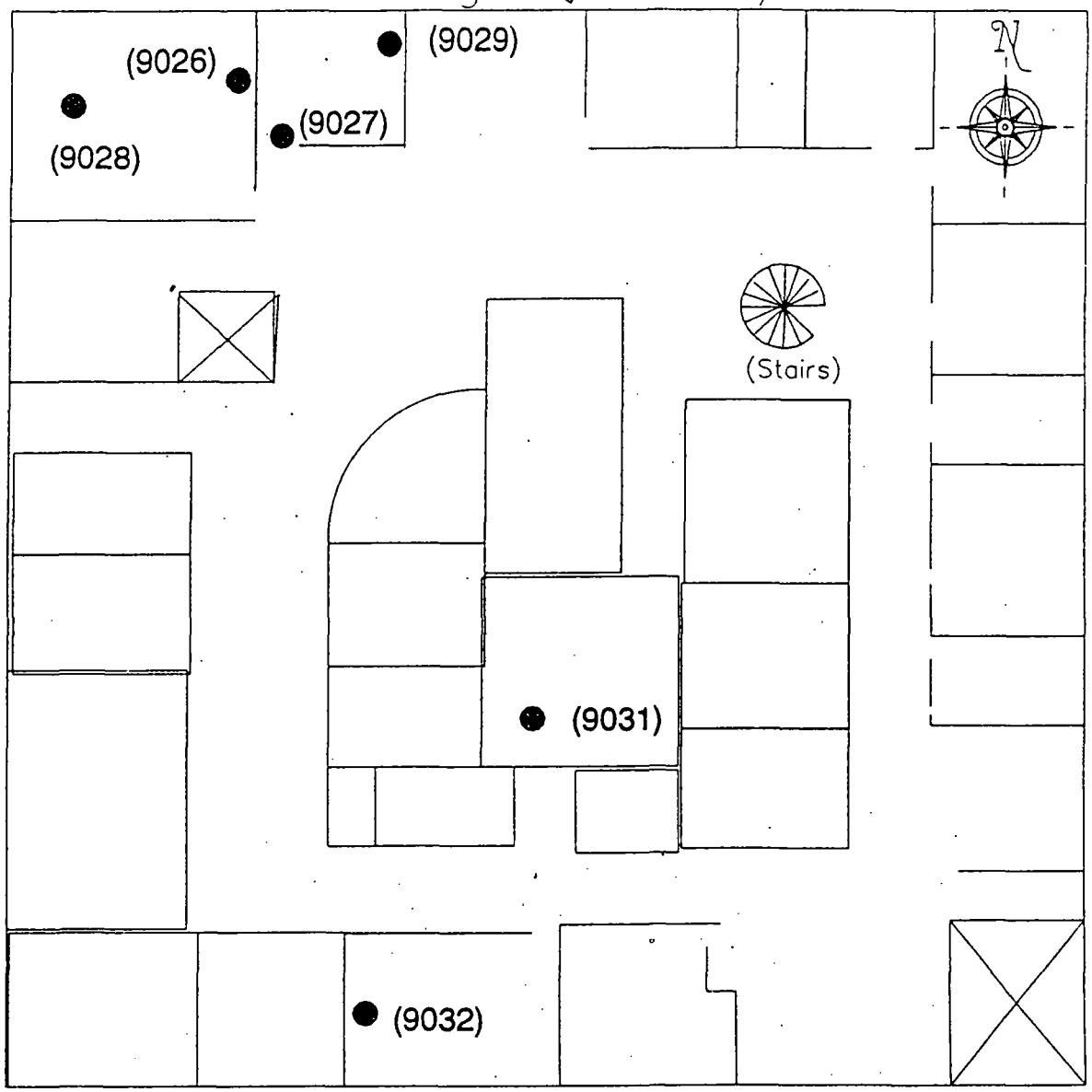
(9024) = 0.034 ~~uR/hr~~ mrem

(9025) = 0.037 ~~uR/hr~~ mrem

ecology and environment, inc.
Technical Assistance Team
Region V
111 W. Jackson Blvd., Chicago, Illinois 60604

TITLE: 161 E. Grand Ave. 1st Floor Readings Optumus	FIGURE #: Figure 5
SITE: Lindsay Light Co.	SCALE: T05-9305-014
CITY: Chicago STATE: IL	PAN: Not to Scale
SOURCE:	DATE:
	REVISED:

Reading: ~~MICROR/hr~~ millirem/hr



● TLD BADGES (Badge #)

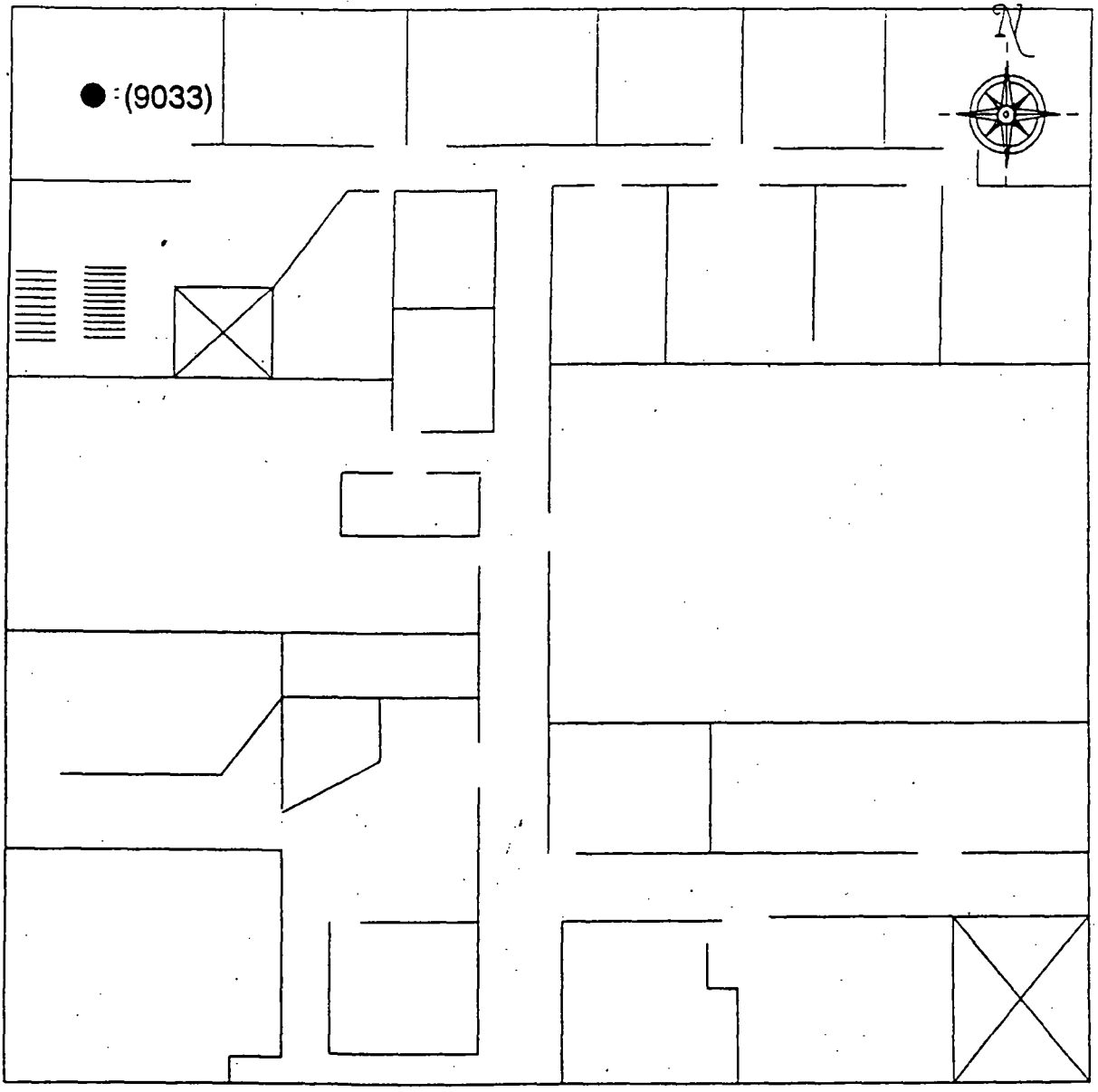
LEGEND
TLD RESULTS

(9026) = 0.257 ~~uR~~ mrem/hr
(9027) = 0.628 ~~uR~~ mrem/hr
(9028) = 0.052 ~~uR~~ mrem/hr
(9029) = 0.039 ~~uR~~ mrem/hr
(9031) = 0.005 ~~uR~~ mrem/hr
(9032) = 0.006 ~~uR~~ mrem/hr

ecology and environment, inc.
Technical Assistance Team
Region V

TITLE 161 E. Grand Ave. 2nd Floor (Optumus)	FIGURE # Figure 2
SITE Lindsay Light Company	TDD# T05-9305-014
CITY Chicago STATE IL	SCALE Not to Scale
SOURCE	DATE July 16, 199
	REVISED

Readings: ~~Micro R/hr~~ millirem/hr



● TLD BADGE (Badge #)

LEGEND

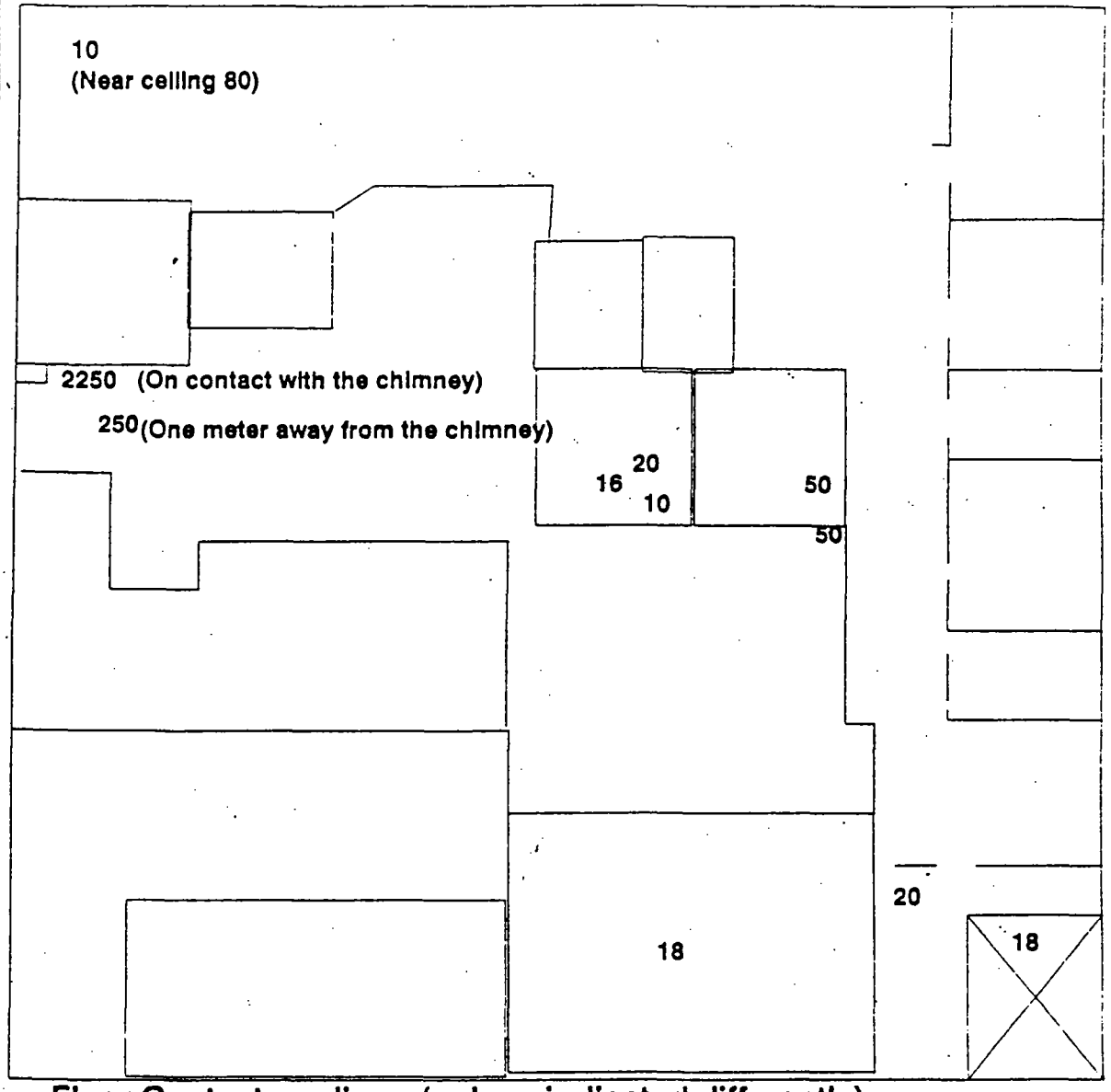
TLD RESULTS

(9033) = 0.031 ~~uR~~/hr
mrem/hr

ecology and environment, inc.
Technical Assistance Team
Region V

TITLE 161 E. Grand 3rd Floor (Optumus)	FIGURE # Figure 3
SITE Lindsay Light Company	TDD# T05-9305-014
CITY Chicago STATE IL	SCALE Not to Scale
SOURCE	DATE July 16, 1993
	REVISED

Readings: Micro-R/hr

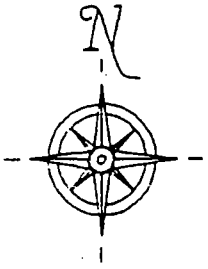


Floor Contact readings (unless indicated differently)

Readings include the correction factor

The instrument reads higher by a factor of 2

LEGEND



ecology and environment, inc.
Technical Assistance Team
Region V

TITLE 161 E. Grand Ave. Basement (Optumus)	FIGURE # Figure 6
SITE Lindsay Light Company	TDD# T05-9305-014
CITY Chicago STATE IL	SCALE Not to Scale
SOURCE Instrument: Ludlum Model 19	DATE July 16, 1993
	REVISED

ATSDR Record of Activity

0 0226

ID #: P A C 4 Date: 9/14/ 93 Time: 8:30 am

Site Name: Lindsey Light City: Chicago Cnty: ____ State: IL

CE LIS #: _____ Cost Recovery #: 60YL Region: V

Site Status (1) _ NPL _ Federal _ Non-NPL _ RCRA _ Non-Site specific
(2) _ Emergency Response _ Remedial _ Other

Activities

_ Incoming Call _ Public Meeting* _ Health Consult* _ Site Visit*
X Outgoing Call _ Other Meeting _ Health Referral _ Info Provided
_ Conference Call _ Data Review _ Written Response _ Training
_ Incoming Mail _ Other

Requestor and Affiliation: (1) Vernita Simon, OSC
Phone: 312 886-3601 Address: _____
City: _____ State: _____ Zip Code: _____

Contacts and Affilation

( ) _____ ( ) _____
( ) _____ ( ) _____

1-EPA	2-USCG	3-OTHER FED	4-STATE ENV	5-STATE HLT
6-COUNTY HLTH	7-CITY HLTH	8-HOSPITAL	9-LAW ENFORCE	10-FIRE DEPT
11-POISON CTR	12-PRIV CITZ	13-OTHER	14-UNKNOWN	15-DOD
16-DOE	17-NOAA	18-OTHR STATE	19-OTHR COUNTY	20-OTHR CITY
21-INTL	22-CITZ GROUP	23-ELECT. OFF	24-PRIV. CO	25-NEWS MEDIA
ARMY	27-NAVY	28-AIR FORCE	29-DEF LOG AGCY	30-NRC
31-ATSDR				

_ Health Assessment _ Health Studies _ Tox Info-profile _ Worker Hlth
_ Petition Assessment _ Health Survellnc _ Tox Info-Nonprofil _ Admin
X Emergency Response _ Disease Regstry _ Subst-Spec Resch _ Other
_ Health Consultation _ Exposr Regstry _ Health Education

Narrative Summary: As a follow-up to the site visit to Lindsey Light, EPA has supplied the results of the TLD monitoring at several locations around the city of Chicago that may have radiological contamination. The TLD results were supplied as a function of exposure per week (24 hour exposure). To equate this to exposure of individuals who may receive excessive levels of exposure, the following procedure was used. I used 2000 hours per year for a worker (50 weeks per year, 40 hours per week). The current exposure limit is 100 millirem per year or 0.05 mrem per hour. Since there are 168 hours in a week, any TLD with an exposure of 8.4 millirem per week was considered excessive (168 x 0.05). Using this procedure, 4 TLDs in the 161 E. Grand Avenue location were considered excessive. These were TLD numbers 9021, 9022, 9026, and 9027. 9021 and 9022 appear to be in the basement and it is unlikely that excessive exposures could occur. However, 9026 and 9027 appear to be within an office on the second floor. I would recommend that either that office be vacated and sealed or the office be remediated to a level that is considered radiologically safe (<100 millirem per year).

A ion Required/Recommendations/Info Provided: None at this time.

Signature: Robert Williams for Paul A. Charp, Ph.D. Date: September 14, 1993

cc:
Robert L. Williams, Region V (via email)
RIMB

RSSI

0 0228

SURVEY REPORT

BUILDING: 1616 Grand ROOM: Presidents Office DATE: 9/30/93 BY: [signature]

Routine ☐ Spot Check ☐ Special ☐ Equipment ☐

Survey Instrument HIPI 1010 Calibrated 8/3/93 Source of Ionizing Radiation

P	P	60	60	40	60	80	80		200
P	P	80	100	100	80	60	140	160	200
20	40	60	80	40	80	100	120	120	340
20	60	60	60	80	80	220	100	360	360
O	40	60	D	D.	80	340	100	140	120
O	60	60	D	D	120	100	60	80	80
O	40	60	D	D	160	120	60	40	80
							40	40	80

To Scale

240 1'1"

TYPE	FORM	ACTIVITY
r	Th-230 Decay	

Ventilation:

Comments: – = Dose Rate - μR/hr at floor surfa

D = Oak Desk (could not be moved)

P = Plants + Stereo (" " " ")

O = Oak Vanity (" " " ")

Each Square = 2' x 2'

SURVEY FINDINGS

AREA

Background

RECOMMENDATIONS:

Radiation Safety Services, Inc.

0 0229

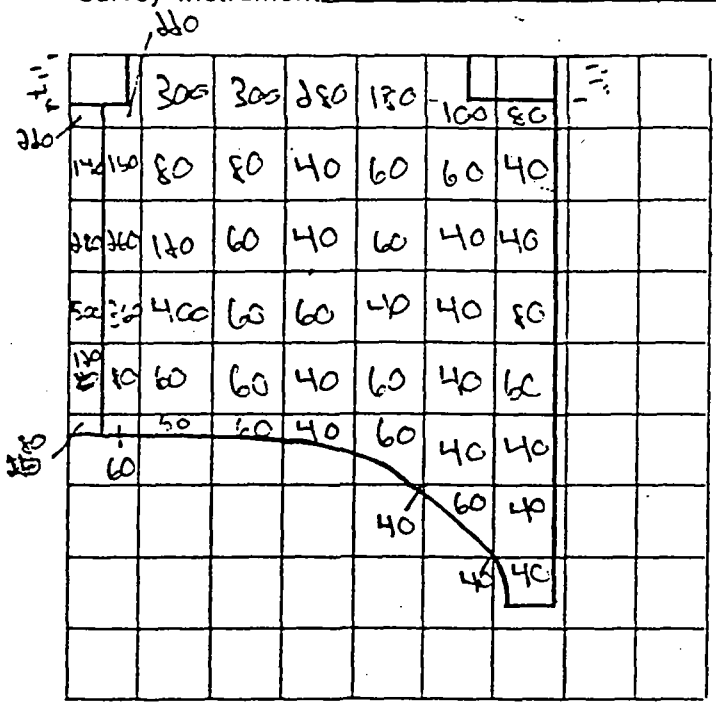
SURVEY REPORT

BUILDING: 161 E. Grand ROOM: Secretary's Office DATE: 9/30/93 BY: [signature]

Routine ☐ Spot Check ☐ Special ☐ Equipment ☐

Survey Instrument HIPI 1010 Calibrated 8/3/93 Source of Ionizing Radiation

		300	300	280	180	100	80		
140	160	80	80	40	60	60	40		
280	260	170	60	40	60	40	40		
500	360	400	60	60	40	40	80		
170	80	60	60	40	60	40	60		
	60	50	60	40	60	40	40		
					40	60	40		
						40	40		



To Scale

TYPE	FORM	ACTIVITY
r	Th-230 Decay	

Ventilation:

Comments: -: Dose Rate - 4R/hr at floor surface

Each Square = 2' x 2'

414-762-5100 **SURVEY FINDINGS**

AREA

Background

RECOMMENDATIONS:

Radiation Safety Services, Inc.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

HSE3-5J

2 2 1993

Mr. Ron Steele
Building Manger
205 East Grand Avenue
Chicago, Illinois 60611

RE: Lindsay Light Building
161 East Grand Avenue
Chicago, Illinois

Dear Mr. Steele:

As you may recall, the U.S. Environmental Protection Agency (U.S. EPA) placed twelve thermoluminescent dosimeter (TLD) badges in your building on June 30, 1993 to monitor radiation levels in work spaces and removed them after a month. TLD results for the locations shown on the enclosed figures were as follows:

	TLD #	millirem per hour	millirem per year
	9021	4.29	8,579
	9022	0.27	535
	9023	0.028	56
	9024	0.033	67
	9025	0.037	75
	9026	0.26	514
	9027	0.63	1257
	9028	0.052	104
	9029	0.039	78
Background	**9031**	**0.0046**	**9**
	9032	0.0062	12
	9033	0.031	62

These work space results were compared to background and to the Nuclear Regulatory Commission (NRC) regulations in the new Title 10, Part 20.1301, Code of Federal Regulations of 100 millirem per year and 2 millirem per hour for individual members of the general public. Your TLD results did exceed these relevant NRC levels in five locations.

In the opinion of U.S. EPA's Regional Radiation Expert and Superfund Toxicologist, these conditions present a threat to persons working in the contaminated areas. Since this contamination is limited to the indoors, it can not be remediated

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under U.S. EPA's Superfund program. The Superfund law usually applies to releases of hazardous substances into the outdoor environment. We do think it would be prudent to decontaminate and whenever possible reduce exposure by limiting exposure times, increasing the distance between work sites and exposure points, and using furniture or other items as absorbers. Also, the Agency for Toxic Substances and Disease Registry (ATSDR) recommended vacating and sealing the President's office on the second floor or remediating it to a radiologically safe level. A copy of ATSDR's recommendation is enclosed, which we understand you are already following. Furthermore, we would like to reiterate that the janitor's supplies should remain away from the chimney.

U.S. EPA would still be willing to advise, review any cleanup plans and survey remediated areas at no charge, if you decide it is prudent to take any action. If you need additional information or want to discuss this matter further, please contact Verneta Simon at (312) 886-3601.

Sincerely,

Jodi Traub

Jodi Traub
Acting Associate Division Director

Enclosures

cc: Candy Morin, Illinois Environmental Protection Agency
Tim Runyon, Illinois Department of Nuclear Safety
Lafayette Robertson, City of Chicago

bcc: Larry Jensen, AT-18J
Marc Radell, CM-3T
Frank Rollins, HSE3-5J
Verneta Simon, HSE3-5J
Heidi Valetkevitch, P-19J
Patricia Van Leeuwen, HSRL-5J

0 0233

RSSI

6312 West Oakton Street
Morton Grove, IL 60053-2723
708-965-1999
Fax 708-965-1991

May 9, 1994

Ron Steele
161 East Grand
Chicago, IL 60611

VIA FAX 312-467-0867

Re: Thoron Measurements

Dear Ron:

This letter summarizes the discussions I have had with the Department of Labor (OSHA), the EPA and the NRC, regarding interpretation of the thoron standard being used as the basis for the proposed notice of violation and civil penalty at 161 East Grand which you and I discussed in our April 4, 1994, telephone conversation.

In this April 4 conversation you told me that you had been informed by Barbara Smith of OSHA that thoron measurements exceeded what she thought was the applicable standard and that a civil penalty of $7,000 was being proposed. When I spoke with Ms. Smith, she discussed the standard that she thought was applicable with me and told me that there would be a close-out meeting at 161 East Grand on April 13th. I told Ms. Smith that she was misinterpreting the standard which was for thoron daughters and that I did not think that the highest concentration, she reported at 161, 18 pCi/l exceeded what I thought was the applicable standard for thoron concentrations. Ms. Smith provided me with the telephone number of Kevin Cummings, the individual at the OSHA laboratory in Salt Lake City who had provided her with the monitoring devices, results, and assistance in interpreting the standard.

Kevin Cummings told me that Larry Jensen of the USEPA had provided guidance in interpreting the standards and the custom electret device OSHA used measured thoron and its daughters. We contacted RadElec, the device vendor who stated that the device measured only thoron gas and was insensitive to thoron daughters. When I explained that Jensen was in error, Cummings began to talk about many different types of hazards to which workers might be exposed. When I pointed out that these were not applicable concerns in this building he acknowledged he had been in error. Cummings then mentioned that he had received one day of training in interpreting radon results from a man who worked for Hal Langner at Rust Geotech in Boulder, Colorado. I offered to place

RSSI

a conference call so that he, I and Mr. Langner could discuss Mr. Cummings interpretation of the result. He refused to participate in the conference call and hung up. I spoke with Mr. Langner at Rust Geotech and then placed a conference call to Bob Curtis, Mr. Cummings' supervisor and Mr. Cummings. Mr. Cummings said he had not wanted to remain on the line to be embarrassed by his lack of knowledge and then continued to persist in stating that he was right in his interpretation of the results. Over a period of several days I had three more conversations with Mr. Curtis regarding results. He at first asked that I provide him with the name of the person who wrote the NRC regulations from which the standard comes. I told him that the regulations were written by an international standard setting organization more than 25 years ago and what he thought was leading edge science was mainstream health physics. I provided him with the names and telephone numbers of current and retired NRC staff members who have some responsibility for the standards. After several additional conversations Mr. Curtis acknowledged that the interpretation of NRC staff was closer to mine than to Larry Jensen's but that the final decision regarding compliance or noncompliance remained in the hands of Barbara Smith.

I called Larry Jensen at the EPA and spoke with him about radon and thoron standards. Mr. Jensen stated that he was confused by the standards and had never been able to understand them. When I asked him if he was not the region's radon expert, he at first dissembled and then acknowledged that he was the lead person on radon in EPA Region V. I brought up the subject of 161 East Grand, and Mr. Jensen said that when the EPA counsel had informed Superfund that it lacked jurisdiction at 161 East Grand, he, because of his perception of a substantial health hazard to individuals on the job, had to turn the file over to OSHA. I have heard an unsubstantiated story from another regulatory agency that Mr. Jensen may have referred these files to OSHA in the hope that if a substantial hazard to workers in the building could be demonstrated, the EPA would be forced to reverse their decision and permit Superfund action against 161 East Grand.

When I spoke with Ms. Smith on April 28, she told me that decisions regarding noncompliance had not yet been decided and that she was planning to use a equilibrium factor at the extreme limit of the range reported in the literature. She also told me that she planned to revisit 161 East Grand to determine if Optimus was an owner of the building. I asked her to notify you and me at that time indicating that we would like to be present when she revisited.

Although I don't think a violation has occurred, it is becoming apparent that if the Department of Labor continues to persist in attempting to identify an item of noncompliance, they are

RSSI

beginning to recognize that you, the building owner are not the employer of the individuals in the spaces where measurements were made. This may be an attempt to try to cite one of the tenants in the building for noncompliance rather than you as the building owner.

I recommend that we be as aggressive as possible in dealing with this issue and take action necessary to prevent its recurrence in the future. A helpful step will be our making independent measurements of thoron daughter concentrations. This will provide a direct measurement of what has been a disputed estimate of concentration. I would like to schedule the thoron daughter measurements tomorrow, before Ms. Smith returns to 161 East Grand. If you have any questions or would like additional information, please call me at 708-965-1999.

Sincerely,

Eli A. Port, CIH, CHP, P.E.
steele02.let

U.S.Department of Labor
Occupational Safety and Health Administration
Calumet City Area Office
1600 167th Street, Suite 12
Calumet City, Illinois 60409
(708) 891-3800

May 9, 1994

161 E. Grand association
161 E. Grand Avenue
Chicago, IL 60611

The results of the samples taken at the 161 E. Grand site on 2/23/94 indicated that employees in the facility were exposed to radon 220 (thoron) at levels above the normal background execpted in this type of enviroment. The radon 222 (natual occurring) levels were below the allowable limits. The sample results are as follows:

SAMPLE	CHEMICAL	RESULTS	PEL
1/12/94			Permissable Exposure Limit
SAMPLE/RADON 222			
4th floor (control room)	Radon 222	1.2 pCi/L	30 pCi/L
4th floor (post production)	Radon 222	0.7 pCi/L	30 pCi/L
3rd floor (Cleo's office)	Radon 222	1.5 pCi/L	30 pCi/L
2nd floor (hallway)	Radon 222	2.6 pCi/L	30 pCi/L
Basement (close to chimney)	Radon 222	4.4 pCi/L	30 pCi/L
Basement (aisleway)	Radon 222	1.0 pCi/L	30 pCi/L

2/24/94
SAMPLE

4th floor (post production)	Radon 222	1.2 pCi/L	30 pCi/L
	Radon 220	13.0 pCi/L*	9.0 pCi/L
3rd floor (Cleo's office)	Radon 222	1.5 pCi/L	30 pCi/L
	Radon 220	5.7 pCi/L*	9.0 pCi/L
2nd floor (Cat's office)	Radon 222	2.6 pCi/L	30 pCi/L
	Radon 220	18.0 pCi/L*	9.0 pCi/L
2nd floor (president's office)	Radon 222	3.1 pCi/L	30 pCi/L
	Radon 220	0.0 pCi/L*	9.0 pCi/L
1st floor (Terry's desk)	Radon 222	1.4 pCi/L	30 pCi/l
	Radon 220	3.7 pCi/L*	9.0 pCi/L
Basement (Lunchroom)	Radon 222	1.2 pCi/L	30 pCi/L
	Radon 220	5.5 pCi/L*	9.0 pCi/L

* These are the actual levels of thoron gas monitored, actual exposures may vary between 6-10% of the numbers presented.

pCi/L - pico curies per liter
Radon 222 - Radon
Radon 220 - Thoron

RSSI

6312 West Oakton Street
Morton Grove, IL 60053-2723
708-965-1999
Fax 708-965-1991

May 10, 1994

Ron Steele
161 East Grand Avenue
Chicago, IL 60611

Re: Thoron Measurements Results

Dear Mr. Steele:

The standard in 10 CFR 20, App. B, Table I, Column 20, for radon-222 (thoron) with daughters present is 1.0 working level (WL). The following are the results for measurements made at 161 East Grand Avenue on May 10, 1994. The modified Kusnetz method used has been approved and is used by both the US NRC and the US EPA.

Floor	Room	WL
4	Post production	0.03
2	Mike O'Neal	0.01
2	Trish Lindquist	0.006
2	Cat	0.007
2	Outside men's room	0.007
	Field Blank	<0.003

Limit of Detection = 0.003

These results are between 0.6-3% of the applicable standard. If you have any questions or would like additional information, please call me at 708-965-1999.

Sincerely,

Eli A. Port

Eli A. Port, CIH, CHP, P.E.
steele03.let

ıgraph designation	Referenced publication	Available from—
‹ B	"List of Personal Hearing Protectors and Attenuation Data," HEW Pub No. 76-120, 1975. NTIS-PB267461.	National Technical Information Service, Port Royal Road, Springfield, VA 22161.
‹ D.	"Specification for Sound Level Meters," S1.4-1971 (R1976).	American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.
ı5(k)(2), appendix E	"Specifications for Audiometers," S3 6-1969.	American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.
‹ D	"Specification for Octave, Half-Octave and Third-Octave Band Filter Sets," S1 11-1971 (R1976).	Back Numbers Department, Dept. STD, American Institute of Physics, 333 E. 45th St., New York, NY 10017; American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018

‹ referenced publications (or a micro- of the publications) are available for w at many universities and public li- es throughout the country. These pub- ons may also be examined at the A Technical Data Center, Room N2439, ed States Department of Labor, 200 ıtitution Avenue, NW., Washington, DC 0, (202) 523-9700 or at any OSHA Re- al Office (see telephone directories ır United States Government—Labor artment).

ıPPENDIX I TO § 1910.95—DEFINITIONS

ıese definitions apply to the following ıs as used in paragraphs (c) through (n) 9 CFR 1910.95.

ion level—An 8-hour time-weighted aver- ıe of 85 decibels measured on the A- ıale, slow response, or equivalently, a ose of fifty percent.

ıiogram—A chart, graph, or table result- ıg from an audiometric test showing an ıdividual's hearing threshold levels as a ınction of frequency.

diologist—A professional, specializing in he study and rehabilitation of hearing, who is certified by the American Speech- Language-Hearing Association or licensed by a state board of examiners.

seline audiogram—The audiogram ıgainst which future audiograms are com- pared.

iterion sound level—A sound level of 90 decibels.

ecibel (dB)—Unit of measurement of sound level.

ertz (Hz)—Unit of measurement of fre- quency, numerically equal to cycles per second.

edical pathology—A disorder or disease. For purposes of this regulation, a condi- tion or disease affecting the ear, which should be treated by a physician special- ist.

oise dose—The ratio, expressed as a per- centage, of (1) the time integral, over a stated time or event, of the 0.6 power of the measured SLOW exponential time-averaged, squared A-weighted sound pressure and (2) the product of the criterion duration (8 hours) and the 0.6 power of the squared sound pressure corresponding to the criterion sound level (90 dB).

Noise dosimeter—An instrument that integrates a function of sound pressure over a period of time in such a manner that it directly indicates a noise dose.

Otolaryngologist—A physician specializing in diagnosis and treatment of disorders of the ear, nose and throat.

Representative exposure—Measurements of an employee's noise dose or 8-hour time-weighted average sound level that the employers deem to be representative of the exposures of other employees in the workplace.

Sound level—Ten times the common logarithm of the ratio of the square of the measured A-weighted sound pressure to the square of the standard reference pressure of 20 micropascals. Unit: decibels (dB). For use with this regulation, SLOW time response, in accordance with ANSI S1.4-1971 (R1976), is required.

Sound level meter—An instrument for the measurement of sound level.

Time-weighted average sound level—That sound level, which if constant over an 8-hour exposure, would result in the same noise dose as is measured.

[39 FR 23502, June 27, 1974, as amended at 46 FR 4161, Jan. 16, 1981; 46 FR 62845, Dec. 29, 1981; 48 FR 9776, Mar. 8, 1983; 48 FR 29687, June 28, 1983; 54 FR 24333, June 7, 1989]

§ 1910.96 Ionizing radiation.

(a) *Definitions applicable to this section.* (1) "Radiation" includes alpha rays, beta rays, gamma rays, X-rays, neutrons, high-speed electrons, high-speed protons, and other atomic particles; but such term does not include sound or radio waves, or visible light, or infrared or ultraviolet light.

(2) "Radioactive material" means any material which emits, by spontaneous nuclear disintegration, corpuscular or electromagnetic emanations.

(3) "Restricted area" means any area access to which is controlled by the employer for purposes of protection of individuals from exposure to radiation or radioactive materials.

(4) "Unrestricted area" means any area access to which is not controlled by the employer for purposes of protection of individuals from exposure to radiation or radioactive materials.

(5) "Dose" means the quantity of ionizing radiation absorbed, per unit of mass, by the body or by any portion of the body. When the provisions in this section specify a dose during a period of time, the dose is the total quantity of radiation absorbed, per unit of mass, by the body or by any portion of the body during such period of time. Several different units of dose are in current use. Definitions of units used in this section are set forth in paragraphs (a) (6) and (7) of this section.

(6) "Rad" means a measure of the dose of any ionizing radiation to body tissues in terms of the energy absorbed per unit of mass of the tissue. One rad is the dose corresponding to the absorption of 100 ergs per gram of tissue (1 millirad (mrad)=0.001 rad).

(7) "Rem" means a measure of the dose of any ionizing radiation to body tissue in terms of its estimated biological effect relative to a dose of 1 roentgen (r) of X-rays (1 millirem (mrem)=0.001 rem). The relation of the rem to other dose units depends upon the biological effect under consideration and upon the conditions for irradiation. Each of the following is considered to be equivalent to a dose of 1 rem:

(i) A dose of 1 roentgen due to X- or gamma radiation;

(ii) A dose of 1 rad due to X-, gamma, or beta radiation;

(iii) A dose of 0.1 rad due to neutrons or high energy protons;

(iv) A dose of 0.05 rad due to particles heavier than protons and with sufficient energy to reach the lens of the eye;

(v) If it is more convenient to measure the neutron flux, or equivalent, than to determine the neutron dose in rads, as provided in subdivision (iii) of this subparagraph, 1 rem of neutron radiation may, for purposes of the provisions in this section be assumed to be equivalent to 14 million neutrons per square centimeter incident upon the body; or, if there is sufficient information to estimate with reasonable accuracy the approximate distribution in energy of the neutrons, the incident number of neutrons per square centimeter equivalent to 1 rem may be estimated from Table G-17:

TABLE G-17—NEUTRON FLUX DOSE EQUIVALENTS

Neutron energy (million electron volts (Mev))	Number of neutrons per square centimeter equivalent to a dose of 1 rem (neutrons/cm²)	Average flux to deliver 100 millirem in 40 hours (neutrons/cm² per sec.)
Thermal	970 × 10⁶	670
0.0001	720 × 10⁶	500
0.005	820 × 10⁶	570
0.02	400 × 10⁶	280
0.1	120 × 10⁶	80
0.5	43 × 10⁶	30
1.0	26 × 10⁶	18
2.5	29 × 10⁶	20
5.0	26 × 10⁶	18
7.5	24 × 10⁶	17
10	24 × 10⁶	17
10 to 30	14 × 10⁶	10

(8) For determining exposures to X- or gamma rays up to 3 Mev., the dose limits specified in this section may be assumed to be equivalent to the "air dose". For the purpose of this section "air dose" means that the dose is measured by a properly calibrated appropriate instrument in air at or near the body surface in the region of the highest dosage rate.

(b) *Exposure of individuals to radiation in restricted areas.* (1) Except as provided in paragraph (b)(2) of this section, no employer shall possess, use, or transfer sources of ionizing radiation in such a manner as to cause any individual in a restricted area to receive in any period of one calendar quarter from sources in the employer's possession or control a dose in excess of the limits specified in Table G-18:

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TABLE G-18

	Rems per calendar quarter
Whole body, Head and trunk, active blood-forming organs; lens of eyes; or gonads	1¼
Hands and forearms, feet and ankles	18¾
Skin of whole body	7½

(2) An employer may permit an individual in a restricted area to receive doses to the whole body greater than those permitted under subparagraph (1) of this paragraph, so long as:

(i) During any calendar quarter the dose to the whole body shall not exceed 3 rems; and

(ii) The dose to the whole body, when added to the accumulated occupational dose to the whole body, shall not exceed 5 (N-18) rems, where "N" equals the individual's age in years at his last birthday; and

(iii) The employer maintains adequate past and current exposure records which show that the addition of such a dose will not cause the individual to exceed the amount authorized in this subparagraph. As used in this subparagraph "Dose to the whole body" shall be deemed to include any dose to the whole body, gonad, active bloodforming organs, head and trunk, or lens of the eye.

(3) No employer shall permit any employee who is under 18 years of age to receive in any period of one calendar quarter a dose in excess of 10 percent of the limits specified in Table G-18.

(4) "Calendar quarter" means any 3-month period determined as follows:

(i) The first period of any year may begin on any date in January: *Provided*, That the second, third, and fourth periods accordingly begin on the same date in April, July, and October, respectively, and that the fourth period extends into January of the succeeding year, if necessary to complete a 3-month quarter. During the first year of use of this method of determination, the first period for that year shall also include any additional days in January preceding the starting date for the first period; or

(ii) The first period in a calendar year of 13 complete, consecutive calendar weeks; the second period in a calendar year of 13 complete, consecutive weeks; the third period in a calendar year of 13 complete, consecutive calendar weeks; the fourth period in a calendar year of 13 complete, consecutive calendar weeks. If at the end of a calendar year there are any days not falling within a complete calendar week of that year, such days shall be included within the last complete calendar week of that year. If at the beginning of any calendar year there are days not falling within a complete calendar week of that year, such days shall be included within the last complete calendar week of the previous year; or

(iii) The four periods in a calendar year may consist of the first 14 complete, consecutive calendar weeks; the next 12 complete, consecutive calendar weeks, the next 14 complete, consecutive calendar weeks, and the last 12 complete, consecutive calendar weeks. If at the end of a calendar year there are any days not falling within a complete calendar week of that year, such days shall be included (for purposes of this section) within the last complete calendar week of the year. If at the beginning of any calendar year there are days not falling within a complete calendar week of that year, such days shall be included (for purposes of this section) within the last complete week of the previous year.

(c) *Exposure to airborne radioactive material.* (1) No employer shall possess, use or transport radioactive material in such a manner as to cause any employee, within a restricted area, to be exposed to airborne radioactive material in an average concentration in excess of the limits specified in Table 1 of Appendix B to 10 CFR Part 20. The limits given in Table 1 are for exposure to the concentrations specified for 40 hours in any workweek of 7 consecutive days. In any such period where the number of hours of exposure is less than 40, the limits specified in the table may be increased proportionately. In any such period where the number of hours of exposure is greater than 40, the limits specified in the table shall be decreased proportionately.

(2) No employer shall possess, use, or transfer radioactive material in such a

manner as to cause any individual within a restricted area, who is under 18 years of age, to be exposed to airborne radioactive material in an average concentration in excess of the limits specified in Table II of Appendix B to 10 CFR Part 20. For purposes of this paragraph, concentrations may be averaged over periods not greater than 1 week.

(3) "Exposed" as used in this paragraph means that the individual is present in an airborne concentration. No allowance shall be made for the use of protective clothing or equipment, or particle size.

(d) *Precautionary procedures and personal monitoring.* (1) Every employer shall make such surveys as may be necessary for him to comply with the provisions in this section. "Survey" means an evaluation of the radiation hazards incident to the production, use, release, disposal, or presence of radioactive materials or other sources of radiation under a specific set of conditions. When appropriate, such evaluation includes a physical survey of the location of materials and equipment, and measurements of levels of radiation or concentrations of radioactive material present.

(2) Every employer shall supply appropriate personnel monitoring equipment, such as film badges, pocket chambers, pocket dosimeters, or film rings, and shall require the use of such equipment by:

(i) Each employee who enters a restricted area under such circumstances that he receives, or is likely to receive, a dose in any calendar quarter in excess of 25 percent of the applicable value specified in paragraph (b)(1) of this section; and

(ii) Each employee under 18 years of age who enters a restricted area under such circumstances that he receives, or is likely to receive, a dose in any calendar quarter in excess of 5 percent of the applicable value specified in paragraph (b)(1) of this section; and

(iii) Each employee who enters a high radiation area.

(3) As used in this section:

(i) "Personnel monitoring equipment" means devices designed to be worn or carried by an individual for the purpose of measuring the dose received (e.g., film badges, pocket chambers, pocket dosimeters, film rings, etc.);

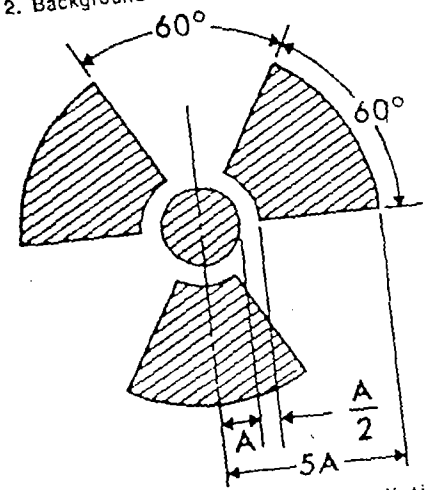
(ii) "Radiation area" means any area, accessible to personnel, in which there exists radiation at such levels that a major portion of the body could receive in any 1 hour a dose in excess of 5 millirem, or in any 5 consecutive days a dose in excess of 100 millirem; and

(iii) "High radiation area" means any area, accessible to personnel, in which there exists radiation at such levels that a major portion of the body could receive in any one hour a dose in excess of 100 millirem.

(e) *Caution signs, labels, and signals*—(1) *General.* (i) Symbols prescribed by this paragraph shall use the conventional radiation caution colors (magenta or purple on yellow background). The symbol prescribed by this paragraph is the conventional three-bladed design:

RADIATION SYMBOL

1. Cross-hatched area is to be magenta or purple.
2. Background is to be yellow.



(2) *Radiation area.* Each radiation area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol described in subparagraph (1) of this paragraph and the words:

CAUTION

RADIATION AREA

(3) *High radiation area.* (i) Each high radiation area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol and the words:

CAUTION

HIGH RADIATION AREA

(ii) Each high radiation area shall be equipped with a control device which shall either cause the level of radiation to be reduced below that at which an individual might receive a dose of 100 millirems in 1 hour upon entry into the area or shall energize a conspicuous visible or audible alarm signal in such a manner that the individual entering and the employer or a supervisor of the activity are made aware of the entry. In the case of a high radiation area established for a period of 30 days or less, such control device is not required.

(4) *Airborne radioactivity area.* (i) As used in the provisions of this section, "airborne radioactivity area" means:

(*a*) Any room, enclosure, or operating area in which airborne radioactive materials, composed wholly or partly of radioactive material, exist in concentrations in excess of the amounts specified in column 1 of Table 1 of Appendix B to 10 CFR Part 20 or

(*b*) Any room, enclosure, or operating area in which airborne radioactive materials exist in concentrations which, averaged over the number of hours in any week during which individuals are in the area, exceed 25 percent of the amounts specified in column 1 of Table 1 of Appendix B to 10 CFR Part 20.

(ii) Each airborne radioactivity area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol described in paragraph (e)(1) of this section and the words:

CAUTION

AIRBORNE RADIOACTIVITY AREA

(5) *Additional requirements.*

(i) Each area or room in which radioactive material is used or stored and which contains any radioactive material (other than natural uranium or thorium) in any amount exceeding 10 times the quantity of such material specified in Appendix C to 10 CFR Part 20 shall be conspicuously posted with a sign or signs bearing the radiation caution symbol described in paragraph (e)(1) of this section and the words:

CAUTION

RADIOACTIVE MATERIALS

(ii) Each area or room in which natural uranium or thorium is used or stored in an amount exceeding 100 times the quantity of such material specified in 10 CFR Part 20 shall be conspicuously posted with a sign or signs bearing the radiation caution symbol described in paragraph (e)(1) of this section and the words:

CAUTION

RADIOACTIVE MATERIALS

(6) *Containers.* (i) Each container in which is transported, stored, or used a quantity of any radioactive material (other than natural uranium or thorium) greater than the quantity of such material specified in Appendix C to 10 CFR Part 20 shall bear a durable, clearly visible label bearing the radiation caution symbol described in paragraph (e)(1) of this section and the words:

CAUTION

RADIOACTIVE MATERIALS

(ii) Each container in which natural uranium or thorium is transported, stored, or used in a quantity greater than 10 times the quantity specified in Appendix C to 10 CFR Part 20 shall bear a durable, clearly visible label bearing the radiation caution symbol described in paragraph (e)(1) of this section and the words:

CAUTION

RADIOACTIVE MATERIALS

(iii) Notwithstanding the provisions of paragraphs (e)(6) (i) and (ii) of this section a label shall not be required:

(*a*) If the concentration of the material in the container does not exceed that specified in column 2 of Table 1 of Appendix B to 10 CFR Part 20, or

(*b*) For laboratory containers, such as beakers, flasks, and test tubes, used transiently in laboratory procedures, when the user is present.

(iv) Where containers are used for storage, the labels required in this subparagraph shall state also the quantities and kinds of radioactive materials in the containers and the date of measurement of the quantities.

(f) *Immediate evacuation warning signal*—(1) *Signal characteristics.* (i) The signal shall be a midfrequency complex sound wave amplitude modulated at a subsonic frequency. The complex sound wave in free space shall have a fundamental frequency (f_1) between 450 and 500 hertz (Hz) modulated at a subsonic rate between 4 and 5 hertz.

(ii) The signal generator shall not be less than 75 decibels at every location where an individual may be present whose immediate, rapid, and complete evacuation is essential.

(iii) A sufficient number of signal units shall be installed such that the requirements of paragraph (f)(1)(ii) of this section are met at every location where an individual may be present whose immediate, rapid, and complete evacuation is essential.

(iv) The signal shall be unique in the plant or facility in which it is installed.

(v) The minimum duration of the signal shall be sufficient to insure that all affected persons hear the signal.

(vi) The signal-generating system shall respond automatically to an initiating event without requiring any human action to sound the signal.

(2) *Design objectives.* (i) The signal-generating system shall be designed to incorporate components which enable the system to produce the desired signal each time it is activated within one-half second of activation.

(ii) The signal-generating system shall be provided with an automatically activated secondary power supply which is adequate to simultaneously power all emergency equipment to which it is connected, if operation during power failure is necessary, except in those systems using batteries as the primary source of power.

(iii) All components of the signal-generating system shall be located to provide maximum practicable protection against damage in case of fire, explosion, corrosive atmosphere, or other environmental extremes consistent with adequate system performance.

(iv) The signal-generating system shall be designed with the minimum number of components necessary to make it function as intended, and should utilize components which do not require frequent servicing such as lubrication or cleaning.

(v) Where several activating devices feed activating information to a central signal generator, failure of any activating device shall not render the signal-generator system inoperable to activating information from the remaining devices.

(vi) The signal-generating system shall be designed to enhance the probability that alarm occurs only when immediate evacuation is warranted. The number of false alarms shall not be so great that the signal will come to be disregarded and shall be low enough to minimize personal injuries or excessive property damage that might result from such evacuation.

(3) *Testing.* (i) Initial tests, inspections, and checks of the signal-generating system shall be made to verify that the fabrication and installation were made in accordance with design plans and specifications and to develop a thorough knowledge of the performance of the system and all components under normal and hostile conditions.

(ii) Once the system has been placed in service, periodic tests, inspections, and checks shall be made to minimize the possibility of malfunction.

(iii) Following significant alterations or revisions to the system, tests and checks similar to the initial installation tests shall be made.

(iv) Tests shall be designed to minimize hazards while conducting the tests.

(v) Prior to normal operation the signal-generating system shall be checked physically and functionally to assure reliability and to demonstrate accuracy and performance. Specific tests shall include:

(*a*) All power sources.

(*b*) Calibration and calibration stability.

(c) Trip levels and stability.

(d) Continuity of function with loss and return of required services such as AC or DC power, air pressure, etc.

(e) All indicators.

(f) Trouble indicator circuits and signals, where used.

(g) Air pressure (if used)

(h) Determine that sound level of the signal is within the limit of paragraph (f)(1)(ii) of this section at all points that require immediate evacuation.

(vi) In addition to the initial startup and operating tests, periodic scheduled performance tests and status checks must be made to insure that the system is at all times operating within design limits and capable of the required response. Specific periodic tests or checks or both shall include:

(a) Adequacy of signal activation device.

(b) All power sources.

(c) Function of all alarm circuits and trouble indicator circuits including trip levels.

(d) Air pressure (if used).

(e) Function of entire system including operation without power where required.

(f) Complete operational tests including sounding of the signal and determination that sound levels are adequate.

(vii) Periodic tests shall be scheduled on the basis of need, experience, difficulty, and disruption of operations. The entire system should be operationally tested at least quarterly.

(viii) All employees whose work may necessitate their presence in an area covered by the signal shall be made familiar with the actual sound of the signal—preferably as it sounds at their work location. Before placing the system into operation, all employees normally working in the area shall be made acquainted with the signal by actual demonstration at their work locations.

(g) *Exceptions from posting requirements.* Notwithstanding the provisions of paragraph (e) of this section:

(1) A room or area is not required to be posted with a caution sign because of the presence of a sealed source, provided the radiation level 12 inches from the surface of the source container or housing does not exceed 5 millirem per hour.

(2) Rooms or other areas in onsite medical facilities are not required to be posted with caution signs because of the presence of patients containing radioactive material, provided that there are personnel in attendance who shall take the precautions necessary to prevent the exposure of any individual to radiation or radioactive material in excess of the limits established in the provisions of this section.

(3) Caution signs are not required to be posted at areas or rooms containing radioactive materials for periods of less than 8 hours: *Provided*, That

(i) The materials are constantly attended during such periods by an individual who shall take the precautions necessary to prevent the exposure of any individual to radiation or radioactive materials in excess of the limits established in the provisions of this section; and

(ii) Such area or room is subject to the employer's control.

(h) *Exemptions for radioactive materials packaged for shipment.* Radioactive materials packaged and labeled in accordance with regulations of the Department of Transportation published in 49 CFR Chapter I, are exempt from the labeling and posting requirements of this subpart during shipment, provided that the inside containers are labeled in accordance with the provisions of paragraph (e) of this section.

(i) *Instruction of personnel, posting.* (1) Employers regulated by the Atomic Energy Commission shall be governed by 10 CFR Part 20 standards. Employers in a State named in paragraph (p)(3) of this section shall be governed by the requirements of the laws and regulations of that State. All other employers shall be regulated by the following:

(2) All individuals working in or frequenting any portion of a radiation area shall be informed of the occurrence of radioactive materials or of radiation in such portions of the radiation area; shall be instructed in the safety problems associated with exposure to such materials or radiation and in precautions or devices to minimize exposure; shall be instructed in the applicable provisions of this section for the protection of employees from exposure to radiation or radioactive materials; and shall be advised of reports of radiation exposure which employees may request pursuant to the regulations in this section.

(3) Each employer to whom this section applies shall post a current copy of its provisions and a copy of the operating procedures applicable to the work conspicuously in such locations as to insure that employees working in or frequenting radiation areas will observe these documents on the way to and from their place of employment, or shall keep such documents available for examination of employees upon request.

(j) *Storage of radioactive materials.* Radioactive materials stored in a nonradiation area shall be secured against unauthorized removal from the place of storage.

(k) *Waste disposal.* No employer shall dispose of radioactive material except by transfer to an authorized recipient, or in a manner approved by the Atomic Energy Commission or a State named in paragraph (p)(3) of this section.

(l) *Notification of incidents*—(1) *Immediate notification.* Each employer shall immediately notify the Assistant Secretary of Labor or his duly authorized representative, for employees not protected by the Atomic Energy Commission by means of 10 CFR Part 20; paragraph (p)(2) of this section, or the requirements of the laws and regulations of States named in paragraph (p)(3) of this section, by telephone or telegraph of any incident involving radiation which may have caused or threatens to cause:

(i) Exposure of the whole body of any individual to 25 rems or more of radiation; exposure of the skin of the whole body of any individual to 150 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms of any individual to 375 rems or more of radiation; or

(ii) The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 5,000 times the limit specified for such materials in Table II of Appendix B to 10 CFR Part 20.

(2) *Twenty-four hour notification.* Each employer shall within 24 hours following its occurrence notify the Assistant Secretary of Labor or his duly authorized representative for employees not protected by the Atomic Energy Commission by means of 10 CFR Part 20; paragraph (p)(2) of this section, or the requirements of the laws and applicable regulations of States named in paragraph (p)(3) of this section, by telephone or telegraph of any incident involving radiation which may have caused or threatens to cause:

(i) Exposure of the whole body of any individual to 5 rems or more of radiation; exposure of the skin of the whole body of any individual to 30 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms to 75 rems or more of radiation; or

(m) *Reports of overexposure and excessive levels and concentrations.* (1) In addition to any notification required by paragraph (l) of this section each employer shall make a report in writing within 30 days to the Assistant Secretary of Labor or his duly authorized representative, for employees not protected by the Atomic Energy Commission by means of 10 CFR Part 20; or under paragraph (p)(2) of this section, or the requirements of the laws and regulations of States named in paragraph (p)(3) of this section, of each exposure of an individual to radiation or concentrations of radioactive material in excess of any applicable limit in this section. Each report required under this paragraph shall describe the extent of exposure of persons to radiation or to radioactive material; levels of radiation and concentration of radioactive material involved, the cause of the exposure, levels of concentrations; and corrective steps taken or planned to assure against a recurrence.

(2) In any case where an employer is required pursuant to the provisions of this paragraph to report to the U.S. Department of Labor any exposure of an individual to radiation or to concentrations of radioactive material, the employer shall also notify such individual of the nature and extent of exposure. Such notice shall be in writing and shall contain the following

statement: "You should preserve this report for future reference."

(n) *Records.* (1) Every employer shall maintain records of the radiation exposure of all employees for whom personnel monitoring is required under paragraph (d) of this section and advise each of his employees of his individual exposure on at least an annual basis.

(2) Every employer shall maintain records in the same units used in tables in paragraph (b) of this section and Appendix B to 10 CFR Part 20.

(o) *Disclosure to former employee of individual employee's record.* (1) At the request of a former employee an employer shall furnish to the employee a report of the employee's exposure to radiation as shown in records maintained by the employer pursuant to paragraph (n)(1) of this section. Such report shall be furnished within 30 days from the time the request is made, and shall cover each calendar quarter of the individual's employment involving exposure to radiation or such lesser period as may be requested by the employee. The report shall also include the results of any calculations and analysis of radioactive material deposited in the body of the employee. The report shall be in writing and contain the following statement: "You should preserve this report for future reference."

(p) *Atomic Energy Commission licensees—AEC contractors operating AEC plants and facilities—AEC Agreement State licensees or registrants.* (1) Any employer who possesses or uses source material, byproduct material, or special nuclear material, as defined in the Atomic Energy Act of 1954, as amended; under a license issued by the Atomic Energy Commission and in accordance with the requirements of 10 CFR Part 20 shall be deemed to be in compliance with the requirements of this section with respect to such possession and use.

(2) AEC contractors operating AEC plants and facilities: Any employer who possesses or uses source material, byproduct material, special nuclear material, or other radiation sources under a contract with the Atomic Energy Commission for the operation of AEC plants and facilities and in accordance with the standards, procedures, and other requirements for radiation protection established by the Commission for such contract pursuant to the Atomic Energy Act of 1954 as amended (42 U.S.C. 2011 et seq.), shall be deemed to be in compliance with the requirements of this section with respect to such possession and use.

(3) AEC-agreement State licensees or registrants:

(i) *Atomic Energy Act sources.* Any employer who possesses or uses source material, byproduct material, or special nuclear material, as defined in the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), and has either registered such sources with, or is operating under a license issued by, a State which has an agreement in effect with the Atomic Energy Commission pursuant to section 274(b) (42 U.S.C. 2021(b)) of the Atomic Energy Act of 1954, as amended, and in accordance with the requirements of that State's laws and regulations shall be deemed to be in compliance with the radiation requirements of this section, insofar as his possession and use of such material is concerned, unless the Secretary of Labor, after conference with the Atomic Energy Commission, shall determine that the State's program for control of these radiation sources is incompatible with the requirements of this section. Such agreements currently are in effect only in the States of Alabama, Arkansas, California, Kansas, Kentucky, Florida, Mississippi, New Hampshire, New York, North Carolina, Texas, Tennessee, Oregon, Idaho, Arizona, Colorado, Louisiana, Nebraska, Washington, Maryland, North Dakota, South Carolina, and Georgia.

(ii) *Other sources.* Any employer who possesses or uses radiation sources other than source material, byproduct material, or special nuclear material, as defined in the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), and has either registered such sources with, or is operating under a license issued by a State which has an agreement in effect with the Atomic Energy Commission pursuant to section 274(b) (42 U.S.C. 2021(b)) of the Atomic Energy Act of 1954, as amended, and in accordance with the requirements of that State's laws and regulations shall be deemed to be in compliance with the radiation requirements of this section, insofar as his possession and use of such material is concerned, provided the State's program for control of these radiation sources is the subject of a currently effective determination by the Assistant Secretary of Labor that such program is compatible with the requirements of this section. Such determinations currently are in effect only in the States of Alabama, Arkansas, California, Kansas, Kentucky, Florida, Mississippi, New Hampshire, New York, North Carolina, Texas, Tennessee, Oregon, Idaho, Arizona, Colorado, Louisiana, Nebraska, Washington, Maryland, North Dakota, South Carolina, and Georgia.

(Approved by the Office of Management and Budget under control number 1218-0103)

[39 FR 23502, June 27, 1974, as amended at 43 FR 49746, Oct. 24, 1978; 43 FR 51759, Nov. 7, 1978; 49 FR 18295, Apr. 30, 1984]

§ 1910.97 Nonionizing radiation.

(a) *Electromagnetic radiation*—(1) *Definitions applicable to this paragraph.* (i) The term "electromagnetic radiation" is restricted to that portion of the spectrum commonly defined as the radio frequency region, which for the purpose of this specification shall include the microwave frequency region.

(ii) *Partial body irradiation.* Pertains to the case in which part of the body is exposed to the incident electromagnetic energy.

(iii) *Radiation protection guide.* Radiation level which should not be exceeded without careful consideration of the reasons for doing so.

(iv) The word "symbol" as used in this specification refers to the overall design, shape, and coloring of the rf radiation sign shown in figure G-11.

(v) *Whole body irradiation.* Pertains to the case in which the entire body is exposed to the incident electromagnetic energy or in which the cross section of the body is smaller than the cross section of the incident radiation beam.

(2) *Radiation protection guide.* (i) For normal environmental conditions and for incident electromagnetic energy of frequencies from 10 MHz to 100 GHz, the radiation protection guide is 10 mW/cm.^{2} (milliwatt per square centimeter) as averaged over any possible 0.1-hour period. This means the following:

Power density: 10 mW./cm.^{2} for periods of 0.1-hour or more.

Energy density: 1 mW.-hr./cm.^{2} (milliwatt hour per square centimeter) during any 0.1-hour period.

This guide applies whether the radiation is continuous or intermittent.

(ii) These formulated recommendations pertain to both whole body irradiation and partial body irradiation. Partial body irradiation must be included since it has been shown that some parts of the human body (e.g., eyes, testicles) may be harmed if exposed to incident radiation levels significantly in excess of the recommended levels.

(3) *Warning symbol.* (i) The warning symbol for radio frequency radiation hazards shall consist of a red isosceles triangle above an inverted black isosceles triangle, separated and outlined by an aluminum color border. The words "Warning—Radio-Frequency Radiation Hazard" shall appear in the upper triangle. See figure G-11.

(ii) American National Standard Safety Color Code for Marking Physical Hazards and the Identification of Certain Equipment, Z53.1-1953, shall be used for color specification. All lettering and the border shall be of aluminum color.

(iii) The inclusion and choice of warning information or precautionary instructions is at the discretion of the user. If such information is included it shall appear in the lower triangle of the warning symbol.

0 0243

U.S. Department of Labor Occupational Safety and Health Administration
1600 167th Street, Suite 12
Calumet City, IL 60409
(708) 891 - 3800
(708) 862 - 9659 (FAX)

June 1, 1994

Ron Steele
161 E. Grand Association
161 E. Grand Avenue
Chicago, IL 60611

Dear Mr. Steele:

The results of the samples taken at the 161 E. Grand site on 1/12/94 and 2/23/94 indicated that employees in the facility were exposed to radon 220 (thoron) and radon 222 at Derived Air Concentrations (DAC) below the Nuclear Regulatory Commission's Ionizing Radiation Standards published in 10 CFR 20, Table 1 of Appendix B. Therefore no citation concerning ionizing radiation will be issued. The sampling result values are a conservative estimate which indicate the highest expected exposure, actual exposures are believed to be considerably lower. The sample results are as follows:

SAMPLE	CHEMICAL	RESULTS	DAC
1/12/94			
SAMPLE/RADON 222			
4th floor (control room)	Radon 222	1.2 pCi/L	30 pCi/L
4th floor (post production)	Radon 222	0.7 pCi/L	30 pCi/L
3rd floor (Cleo's office)	Radon 222	1.5 pCi/L	30 pCi/L
2nd floor (hallway)	Radon 222	2.6 pCi/L	30 pCi/L
Basement (close to chimney)	Radon 222	4.4 pCi/L	30 pCi/L
Basement (aisleway)	Radon 222	1.0 pCi/L	30 pCi/L

2/24/94
SAMPLE

4th floor (post production)	Radon 222	1.2 pCi/L	30 pCi/L
	Radon 220	0.10 WL* 13.0 pCi/L**	1.0 WL
3rd floor (Cleo's office)	Radon 222	1.5 pCi/L	30 pCi/L
	Radon 220	0.046 WL* 5.7 pCi/L**	1.0 WL
2nd floor (Cat's office)	Radon 222	2.6 pCi/L	30 pCi/L
	Radon 220	0.14 WL* 18.0 pCi/L**	1.0 WL
2nd floor (president's office)	Radon 222	3.1 pCi/L	30 pCi/L
	Radon 220	0.00 WL* 0.0 pCi/L*	1.0 WL
1st floor (Terry's desk)	Radon 222	1.4 pCi/L	30 pCi/l
	Radon 220	0.03 WL* 3.7 pCi/L**	1.0 WL
Basement (Lunchroom)	Radon 222	1.2 pCi/L	30 pCi/L
	Radon 220	0.04 WL* 5.5 pCi/L**	1.0 WL

* - Exposure level after adjusting sample results with an factor of 125 pCi/L for a 6% equilibrium factor. This is a conservative estimate and represents the **highest** level expected in the building. Actual exposure is believed to be considerably less.

** - Actual measurement of thoron gas sampled.

WL - Working levels
pCi/L - pico curies per liter
Radon 222 - Radon
Radon 220 - Thoron
DAC - Derived Air Concentration

Pursuant to 29 CFR 1910.20 you are required to provide your employees with a copy of these sampling results. If there are any additional questions regarding these sampling results, please feel free to contact the Calumet City Area Office.

Sincerely,

Gary J. Anderson
Area Director

GJA/bls

cc:
Eli Porte
Tom Nolan
Jim Dolan

161 E. Grand Associates

161 E. Grand
Chicago, IL 60611
(312) 644-6112

312-886-3601

TO: Ms. Vernita Simons 353-9176

FROM: Ron Steele

DATE: July 9, 1996

NUMBER OF PAGES: 4 INCLUDING COVER SHEET

RE: Here is the final OSHA Ruling and data regarding the 161 E. Grand building. As you can see, there is no problem at the building. If you have any other questions, give me a call.

Sincerely
Ron Steele
Mgr. Partner

Please call us at 312-467-5440 if you have problem with the transmittal of this fax.

0 0248

RSSI

6312 West Oakton Street
Morton Grove, IL 60053-2723
847-965-1999
Fax 847-965-199[illegible]

FAX COVER SHEET

DATE: Oct 20, 1999

TO: Ron Steele

COMPANY: 161 Grand

FAX#: 312-467-0867

FROM: Eli Port

COMMENTS: Kerr-McGee requested that we submit a notice to IDNS regarding the planned chimney removal. Please review & comment so it can be sent to IDNS. By copy of this fax, the draft letter is being sent to Kerr-McGee and their attorney. fc Mark Krippel KM 630-231-3990
Richard Maurice CSB 202-778-5304

Total number of pages _____ *(including this page)*

If you have trouble receiving this transmission, please call _____ at 847-965-1999.

gpe\faxtran.doc

DRAFT

October 20, 1999

Richard A. Allen, CHP
Illinois Department of Nuclear Safety
1035 Outer Park Drive
Springfield, IL 62704

RE: 161 East Grand, Chicago, IL

Dear Mr. Allen:

During the week of October 11, we spoke by telephone about the 161 Grand Avenue building, also known as Lindsay Light I. I am providing an informal courtesy notification of the planned action to remove a chimney. The chimney is suspected of containing unlicensed thorium residuals from former operations of the Lindsay Light Company.

A May 1981, US EPA report discussed a basement area with elevated exposure levels in the vicinity of the chimney. The elevated levels were attributed by the EPA to residual Lindsay Light material in the chimney. The owner of the property has asked RSSI to remove the chimney and any contained material.

The 161 Grand building is not the subject of a license or other regulatory action. Nonetheless, exposure of workers and releases to the environment shall be controlled so the limits in 32 IAC

340and 29 CFR 1910.1096 will not be exceeded. Removed material shall be transferred for disposal at Envirocare of Utah, Inc. If you have any questions or require additional information, please contact me at 847-965-1999.

Sincerely,

Eli A. Port, CHP, CIH, P.E.

FAX

Date 6/21/00

Number of pages including cover sheet 7

TO: DIANE

Kerr-Mcgee

Phone

Fax Phone 405-270-3787

FROM: Ron Steele
161 E. Grand Associates
205 East Grand Avenue
Chicago, Illinois 60611

Phone 312-467-5440

Fax Phone 312-467-0867

CC:

REMARKS: ☐ Urgent ☒ For your review ☐ Reply ASAP ☐ Please Comment

Diane, I'm at 708-366-1222 if you have any questions. I would like to no the status of this ,since rhe contractor wants to be paid.

405-775-3788 Diane Bell
Dan White

FAX

Date 6/23/00

Number of pages including cover sheet 2

TO: Diana Bell

Kerr -Mcgee
Chemical LLC

Phone

Fax Phone 405-270-3787

FROM: Ron Steele
161 E. Grand Associates
205 East Grand Avenue
Chicago, Illinois 60611

Phone 312-467-5440

Fax Phone 312-467-0867

CC:

REMARKS: ☐ Urgent ☒ For your review ☐ Reply ASAP ☐ Please Comment

Dear Diana,

Attached is a letter regarding the disposal of the thorium materials from 161 E. Grand, Chicago,Il. It certifies that they will be properly disposed of.

Sincerely,

Ron Steele

0 0253

DEM Services, Inc.

Proposal

An Environmental Contractor
1018 S. Oakley Blvd
Lower Level
Chicago, IL 60612

161 E. Grand Associates

To: Ron Steel
1025 N Jackson
River Forest, IL 60305

Attn: Ron Steel

Work Site: 161 East Grand
Chicago, IL 60611

Proposal: P 2000-634

Date: 4/24/00

Prepared: Paul Middleton

Project: Cleanup Services

DEM Services, Inc. hereby agrees to furnish all necessary labor, materials, and equipment to complete the following work:

Work Summary: Set-up contained area around the base of the chimney located in the basement. Remove the brick around the base of the chimney (demolition). Clean area inside of chimney and as far up the chimney as possible. Bag all waste in clear bags and place in a 55 gallon drum. All filters associated and consumables with this work will be disposed of as waste. At the conclusion of the work the remaining chimney structure will be shored with 2'x4's. If the work requires additional time as outlined in the schedule, an hourly rate charge will be applied.

Note 1: DEM Services cannot guarantee the integrity of the chimney at completion of the work.

Note 2: All required monitoring will be conducted by RSSI and a copy will be provided to DEM Services upon completion of the work.

Schedule: Set up on Friday, 4/28/00, as much time as needed to complete the contained area. Saturday, 4/29/00, actual clean-up two workers and one supervisor for an eight hour shift.

Hourly Rate: $56.00 an hour for workers, $62.00 and hour for supervisor.

Base Bid: $2,786

If there are any questions regarding this proposal, please contact me at the office. Thank you for the opportunity.

All of the above work is to be completed in a substantial and workmanlike manner, to be paid as follows:

[x] for the sum of ..... See above

[ ] at the previously agreed upon rates for time and material, and not-to-exceed $0.00

Payment is to made within 30 days of completion, or an assessment of 1.50 % will be applied.
Any alteration or deviation from the original scope of work, plans, or specifications will be executed only upon written orders for same and will be added to, or deducted from the amount quoted in this proposal. All changes must be in writing.

Respectfully Submitted:

Paul Middleton, Estimator / Project Manager

Accepted by:

Printed Name & Signature (Mgr.) 4/24/00 Date

161 E. Grand Associates
Company (Please Print)

161 E. Grand Associates
161 E. Grand
Chicago,Il. 60611

May 24, 2000 VIA FAX 405-270-3787

Dan White, Senior Project Manager
Kerr-McGee Corporation
Kerr-McGee Center
123 Robert S. Kerr Ave., MT 2003
Oklahoma City, OK 73102-6406

RE: Thorium Contamination at Lindsay Light Building, 161 E. Grand

Dear Mr. White:

The thorium contaminated chimney at the 161 E. Grand building has been removed and the rubble has been transferred to ADCO Services Incorporated (ADCO) for ultimate disposal as radioactive waste at Envirocare of Utah. A copy of the ADCO waste manifest is attached.

We have received the attached bill from ADCO and ask that, as agreed upon, Kerr-McGee issue a check to pay this bill. The check may be payable either to ADCO or to 161 E. Grand Associates. In either case, please mail the check to me at:

Ronald Steele
C/O EKO, 2nd Floor
205 E Grand Ave
Chicago, IL 60611

If you have any questions or require additional information, please contact me at 312-467-5440.

Sincerely,

Ron Steele

Ron Steele

May 18.00 7:43 No.001 P.01
0 0255

TEL:

ADCO Services, Inc.

17650 Duvan Drive, Tinley Park, IL 60477 • (708) 429-1660 FAX (708) 429-9759

INVOICE

064416 Page 1 of 1

CUSTOMER ORDER NO. Verbal Eli Port

LOT NO. 01-0183

DATE 05/11/00

161 East Grand Associates
Attn: Ron Steele
161 East Grand Ave.
Chicago, IL 60611

161 East Grand Associates
161 East Grand Ave.
Chicago, IL 60611

TERMS: Net 10 Account Number: 3582

DESCRIPTION AND SIZE OF CONTAINER	DATE OF PICK-UP	SPECIAL REMARKS OR COMMENTS	T	UNIT	AMOUNT
1,330.00 Ea.	05/10/00	Disposal of Solid Rubble 1,330 Lbs. @ 7.75/Lb.		7.75	10,307.50

PLEASE RETURN GOLD COPY WITH YOUR PAYMENT

F.E.I.N. #36-2652895

DISCLAIMER: Title to all materials which were previously owned by the customer or supplier contained in w[illegible] furnished for b[illegible] as listed on this form or under this contract shall be deemed to be vested in Adco Services upon delivery [illegible] facilities or placed aboard our vehicle. The customer or supplier shall have no right to [illegible]

MAKE CHECKS PAYABLE TO: ADCO SERVICES, INC.

TOTAL AMOUNT 10,307.50

ATG

FORM 541 ADCO SERVICES, INC.

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION

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

1. MANIFEST TOTALS

NUMBER OF PACKAGES/ DISPOSAL CONTAINERS	NET WASTE VOLUME	NET WASTE WEIGHT	SPECIAL NUCLEAR MATERIAL (grams) U-233	U-235	Pu	TOTAL
5	m3 1.0620 / ft3 37.5000	kg 453.5926 / lb 1000.0000	NP	NP	NP	NP

ACTIVITY	ALL NUCLIDES	TRITIUM	C-14	Tc-99	I-129	SOURCE	
MBq	1.1137E+01	NP	NP	NP	NP	(kgs)	NA
mCi	3.0100E-01	NP	NP	NP	NP	(lbs)	NA

2. MANIFEST NUMBER 01-0183 L

3. PAGE 1 OF 1 PAGE(S)

4. SHIPPER NAME 161 PARTNERS /FOR THE ACCO

SHIPMENT ID NUMBER 01-0183 L

DISPOSAL CONTAINER DESCRIPTION: 5 CONTAINER IDENTIFICATION NUMBER / SC PERMIT	6 CONTAINER DESCRIPTION (See Note 1 & Note 1A)	7. VOLUME (m3) (ft3)	8 WASTE AND CONTAINER WEIGHT (kg) (lb)	9 SURFACE RADIATION LEVEL mSv/hr mrem/hr	10 SURFACE CONTAMINATION MBq/100 cm2 dpm/100 cm2 ALPHA	BETA-GAMMA
01-0183-01 .15 161 EAST GRAND CHICAGO, IL	4	0.2124	90.7185	.15	NP	NP
		7.5000	200.0000	15.0	NP	NP
01-0183-02/ 161 EAST GRAND CHICAGO, IL	4	0.2124	90.7185	.03	NP	NP
		7.5000	200.0000	3.0	NP	NP
01-0183-03/ 161 EAST GRAND CHICAGO, IL	4	0.2124	90.7185	.01	NP	NP
		7.5000	200.0000	1.0	NP	NP
01-0183-04/ 161 EAST GRAND CHICAGO, IL	4	0.2124	90.7185	.03	NP	NP
		7.5000	200.0000	3.0	NP	NP
01-0183-05 .01 161 EAST GRAND CHICAGO, IL	4	0.2124	90.7185	.002	NP	NP
		7.5000	200.0000	.2	NP	NP
Shipment Totals		1.0620	453.5926			
		37.5000	1000.0000			

WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER: 11. WASTE DESCRIPTOR (See Note 2 & Note 2A)	12. APPROXIMATE WASTE VOLUME(S) IN CONTAINER (m3) (FT3)	13 SOLIDIFICATION OR STABILIZATION MEDIA (See Note 3 & Note 3A)	14. CHEMICAL DESCRIPTION: CHEMICAL FORM CHELATING AGENT	WEIGHT % CHELATING AGENT IF>0.1%	15 RADIOLOGICAL DESCRIPTION: INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT: RADIONUCLIDES	MBq	mCi	16 WASTE CLASSIFICATION AS-Class A Stable AU-Class A Unstable B-Class B C-Class C
39-H	0.2124	100 100	RUBBLE NP	0.00	Th-232	3.7000E+00	1.0000E-01	AU
	7.5000				Subtotal	3.7000E+00	1.0000E-01	
					Total	3.7000E+00	1.0000E-01	
39-H	0.2124	100 100	RUBBLE NPO	0.00	Th-232	3.7000E+00	1.0000E-01	AU
	7.5000				Subtotal	3.7000E+00	1.0000E-01	
					Total	3.7000E+00	1.0000E-01	
39-H	0.2124	100 100	RUBBLE NP	0.00	Th-232	1.8500E+00	5.0000E-02	AU
	7.5000				Subtotal	1.8500E+00	5.0000E-02	
					Total	1.8500E+00	5.0000E-02	
39-H	0.2124	100 100	RUBBLE NP	0.00	Th-232	1.8500E+00	5.0000E-02	AU
	7.5000				Subtotal	1.8500E+00	5.0000E-02	
					Total	1.8500E+00	5.0000E-02	
39-H	0.2124	100 100	RUBBLE NP	0.00	Th-232	3.7000E-02	1.0000E-03	AU
	7.5000				Subtotal	3.7000E-02	1.0000E-03	
					Total	3.7000E-02	1.0000E-03	
						1.1137E+01	3.0100E-01	

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

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

Note 1A: Barnwell Specific Container Description Codes. (Choose one code as may be applicable.)

A High Integrity Container - Poly
B High Integrity Container - Poly with Steel Shell
C High Integrity Drum Overpack - Poly
D High Integrity Container - Stainless Steel
E High Integrity Container - Fiberglass
F Liner - Steel

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

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

Note 2A: Barnwell Specific Waste Descriptor Codes (Choose all applicable codes.)

G Dewatered
H Solid
I Combustible
J Non-combustible
K Air Filtration Filters
L Asbestos

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

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

Note 3A: Barnwell Specific Solidification and Stabilization Media Codes (Choose this code if applicable)

M Waste Binder

FORM 541 (10-90)

0 0256

ATG

01-0183

161 E. GRAND ASSOCIATES

FORM 540 — ADCO SERVICES, INC.

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

SHIPPING PAPER

1. EMERGENCY TELEPHONE NUMBER (Include Area Code): 847-965-1990
ORGANIZATION: 161 PARTNERS

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

3. TOTAL NUMBER OF PACKAGES IDENTIFIED ON THIS MANIFEST ==>> 5

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

5. SHIPPER – NAME AND FACILITY
[redacted] (FOR THE ACCOUNT OF
ADCO SERVICES, INC.
161 EAST GRAND
CHICAGO, IL
SC PERMIT: NA
SHIPMENT NUMBER: 01-0183 L
CONTACT: ELI PORT

6. CARRIER – Name and Address
ADCOM EXPRESS, INC.
17650 DUVAN DRIVE
TINLEY PARK, IL 60477
CONTACT: BOB BASSETT
SIGNATURE – Authorized carrier acknowledging waste receipt: [signature]

SHIPMENT I.D. NUMBER: 01-0183 L
COLLECTOR
PROCESSOR
[X] GENERATOR TYPE (Specify): I
TELEPHONE NUMBER (Include Area Code): 847-965-1990
EPA I.D. NUMBER: ILD 047267364
SHIPPING DATE: 5-10-00
TELEPHONE NUMBER (Include Area Code): 708-429-3013
DATE: 5-10-00

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

8. MANIFEST NUMBER (Use this number on all continuation pages): 01-0183 L

9. CONSIGNEE – Name and Facility Address
ADCO SERVICES, INC.
17650 DUVAN DRIVE
TINLEY PARK, IL 60477
CONTACT: LEN WARBIANY
TELEPHONE NUMBER (Include Area Code): 708-429-1660
SIGNATURE – Authorized consignee acknowledging waste receipt:
DATE:

10. CERTIFICATION
This is to certify that the hereon-named materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation. This also certifies that the materials are classified, packaged, marked and labeled and are in proper condition for transportation and disposal as described in accordance with the requirements of 10 CFR Parts 20 and 61, or equivalent state regulations.
AUTHORIZED SIGNATURE: [signature]
TITLE:
DATE: 5-10-00

11. U.S. DEPARTMENT OF TRANSPORTATION DESCRIPTION (Including proper shipping name, hazard class, UN ID number, and any additional information)	12. DOT LABEL "RADIOACTIVE"	13. TRANSPORT INDEX	14. PHYSICAL AND CHEMICAL FORM	15. INDIVIDUAL RADIONUCLIDES	16. TOTAL PACKAGE ACTIVITY MBq	mCi	17. LSA/SCO CLASS	18. TOTAL WEIGHT OR VOLUME (Use appropriate units)	19. IDENTIFICATION NUMBER OF PACKAGE
~~NON-REGULATED MATERIAL~~ RADIOACTIVE MATERIAL, LSA, NOS, 7, UN2912	NA	NA	Solid RUBBLE	Th-232	3.7000E+00	1.0000E-01	NA II	200. LBS; 7.6 FT3	01-0183-03 05
~~NON-REGULATED MATERIAL~~ RADIOACTIVE MATERIAL, LSA, NOS, 7, UN2912	NA	NA	Solid RUBBLE	Th-232	3.7000E+00	1.0000E-01	NA II	200. LBS; 7.6 FT3	01-0183-02
~~NON-REGULATED MATERIAL~~ RADIOACTIVE MATERIAL, LSA, NOS, 7, UN2912	NA	NA	Solid RUBBLE	Th-232	1.8500E+00	5.0000E-02	NA II	200. LBS; 7.6 FT3	01-0183-03
~~NON-REGULATED MATERIAL~~ RADIOACTIVE MATERIAL, LSA, NOS, 7, UN2912	NA	NA	Solid RUBBLE	Th-232	1.8500E+00	5.0000E-02	NA II	200. LBS; 7.6 FT3	01-0183-04
NON-REGULATED MATERIAL	NA	NA	Solid RUBBLE	Th-232	3.7000E-02	1.0000E-03	NA	200. LBS; 7.6 FT3	01-0183-05 01

FOR CONSIGNEE USE ONLY

Packages listed as "NON-REGULATED" MATERIAL" on this manifest are classified in accordance with 49 CFR 173.403 (Definition of Radioactive Material). These materials must still be disposed of at a licensed disposal facility.

20. Customer represents and warrants that all data set forth in this Uniform Low-Level Radioactive Manifest is true and correct in all respects.
Date: 5-10-00 Signature: [signature]
Title and Organization:
Telephone No. (____) _____

FORM 540 (10-95)

0 0257

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

ISOTOPES REPORT

For Manifest # 01-0183 L
ADCO SERVICES, INC.

ATG

Isotope	Total Activity (mCi)
Th-232	3.0100E-01

0 0258

TOTAL P.05

ADCO Services, Inc.

0 0259

Agreement,

Adco Services, Inc. reserves the right to open, inspect, and sample the contents of containers we accept for disposal, and if found to be other than stated on the Uniform Low-Level Radioactive Disposal Manifest, we will charge for any repackaging, the difference in disposal costs, or return the material to the generator.

ADCO SERVICES, INC.	161 E. Grand Associates
Company	Generator
R Barsch	
Signature	Signature
Tech 1	
Title	Title
5-10-00	5-10-00
Date	Date

17650 Duvan Drive • Tinley Park, Illinois 60477 • (708) 429-1660 • Fax (708) 429-9759

0 026

ADCO Services, Inc.

June 23, 2000

Mr. Ron Steele
161 East Grand Association
161 East Grand Avenue
Chicago, IL 60611

Dear Mr. Steele,

This letter is to certify to you that the material contaminated with Thorium that was removed from your facility will and must be disposed of at a Low Level Radioactive Waste disposal site. As of this writing I can not give you a date as to when this occur. Once a radioactive waste is manifested and received by a waste broker, a paper trial is started and that broker is responsible to local, state and federal agencies to prove, if questioned, as to location of said waste at any time.

If you should have any further question, please feel free to contact me.

Sincerely,

Len Warbiany
Customer Service Manager

KERR-McGEE
KERR-McGEE CENTER • P.O. BOX 25861 • OKLAHOMA CITY, OKLAHOMA 73125

November 30, 1999

BY FEDERAL EXPRESS

Mr. Ronald Steele
% EKO, Second Floor
205 East Grand Avenue
Chicago, IL 60611

Re: 161 E. Grand Avenue, Chicago, Illinois

Dear Mr. Steele:

This letter is simply to confirm the arrangements that have been made with your consultant, Eli Port, concerning removal of certain radiological material from your building at 161 E. Grand Avenue, Chicago, Illinois. Kerr-McGee Chemical L.L.C. ("Kerr-McGee") agrees to reimburse the costs, up to a maximum of forty thousand ($40,000.00) for waste profile testing as required by a licensed disposal site and the transportation of such material to, and its disposal at, a properly licensed disposal site. Your contractor under your supervision will perform the work, and you will pay all other costs associated with the remediation. Kerr-McGee understands that you are the owner of the aforementioned real property.

It is agreed by you that Kerr-McGee's undertaking to reimburse these costs does not constitute an admission or a denial by Kerr-McGee that it has any liability or responsibility for the presence of radiological material at or about the property at 161 E. Avenue or for its remediation.

I would appreciate it if you would countersign this letter and return it to me.

Very truly yours,

George D. Christiansen
Vice President

AGREED TO: Ronald Steele
Ronald Steele, ~~OWNER~~ PARTNER 161 E. GRAND ASSOCIATES

3/3/00
Dated

cc: Mark Krippel

BCC: W.O. Green
T.P. Goresen

161 E. Grand Associates
c/o EKO
205 E. Grand
Chicago, Il. 60611

Mr.George D. Christianson
Vice President
Kerr- McGee Chemical LLC
Kerr-McGee Center
P.O. Box 25861
Oklahoma City, Oklahoma 73125

May 17,2000

Invoice:

Costs for disposal of radiolgical material from the building at 161 E. Grand Ave., Chicago, Il. per attached invoice from ADCO Services, Inc. and our agreement dated November 30, 1999 (attached).

$10,307.50

This was paid by Kerr-McGee

United States
Environmental Protection
Agency

Region 5
77 West Jackson Blvd.
Chicago, Illinois 60604

Illinois, Indiana
Michigan, Minnesota
Ohio, Wisconsin

EPA Answers Questions Most Often Asked by Residents

Lindsay Light II/RV3 North Columbus Drive Site

Chicago, Illinois

May 2000

INTRODUCTION

The purpose of this fact sheet is to provide community residents and other interested individuals with responses to questions frequently asked about the Lindsay Light II /RV3 North Columbus Drive Site cleanup.

What is Thorium?

Thorium is a metallic element. It is part of the Thorium Decay Series, which is a series of radioactively decaying elements. Both thorium and the Thorium Decay Series are found naturally.

Where did the Thorium come from?

Thorium used on this site probably came from India, Brazil, South Africa, Florida, the Carolinas and Idaho in an ore called Monazite. Monazite is found in beach and river deposits of minerals that eroded from larger deposits and washed downstream. These were mined, shipped to Chicago, and chemically purified to obtain the thorium and other elements necessary to produce gas mantles. Unused ore and chemical wastes are the site contaminants.

How was the radiation at the site discovered?

U.S. EPA had removed thorium contaminated soil from an adjacent property over several past years. When the ground was broken on the North Columbus property, U.S. EPA obtained access on the potential that it might also contain thorium contaminants. Surveys showed there was also contamination on this property.

How did U.S. EPA get involved?

U.S. EPA used its authority under the Comprehensive Environmental Response, and Compensation, Liability Act (CERCLA). CERCLA, also know as "Superfund," is a law designed to help cleanup abandoned waste facilities. Under CERCLA, potentially responsible parties include the owner and operator of a facility, any person who at the time of the disposal owned or operated the facility. In 1996, U.S. EPA ordered companies to conduct the cleanup activities at 316 East Illinois. In March 2000, U.S. EPA amended the Order to include the North Columbus Drive site and the owner of that property.

What is U.S. EPA's cleanup level and how was it determined?

U.S. EPA relied upon a soil radium standard for uranium and thorium sites found in Part 40, Title 192 of the Code of Federal Regulations (40 CFR 192). This standard is 5 picocuries per gram (pCi/g) of total radium (radium-226 plus radium 228) over background in each 6-inch layer below ground. 5 pCi/g is 11 radioactive decays per minute per gram of soil. The background total radium level near North Columbus Drive is 2.1 pCi/g. Therefore, the clean-up level for this site is 5 + 2.1 or 7.1 pCi/g.

What is involved in the cleanup?

Contaminated soils are first located using hand-held gamma-ray detectors. These sites are excavated with construction equipment until the gamma ray detectors indicate the cleanup criterion had been met. Soil samples are taken to confirm this. U.S. EPA is then called to perform a verification survey, which includes independently performing a gamma ray survey and taking soil samples. Each 100 square meter (about 120 square yard) area must meet the cleanup criterion of 5 pCi/g of total radium (radium-226 plus radium-228) over background (altogether 7.1 pCi/g). If the cleanup criterion is met, the area is released for unrestricted use. If the cleanup criterion is not met, excavation continues until the criterion is met.

What is the nature and extent of contamination?

The primary contaminant is believed to be radioactive thorium, but uranium and radium have also been measured in these soils. All of these are believed to have been present in Monazite ore processed for thorium.

The original survey showed contamination in an area about 125 feet by 125 feet in southwest part of the site and contamination in scattered pockets throughout the rest of the site. Excavations in the eastern and southern parts of the site have shown more contamination, which is now known to extend under the sidewalks on Columbus Drive, Illinois Street, and Grand Avenue.

What is being done to remedy the situation?

Contaminated soils are being excavated, put in metal boxes on flatbed semis and shipped via railroad to the licensed disposal site in Utah. The developer and potentially responsible parties are cooperating with U.S. EPA in surveying the site, providing health and safety surveillance, and disposing of the contaminated soils.

Is the contamination contained?

Contaminated soils on site are being removed. Materials have been found at the perimeter of the site, and under sidewalks. These will be handled under surveillance agreements and removed when sidewalks, streets or utilities must be worked on. So long as they remain covered by concrete and asphalt they do not present a health and safety concern. U.S. EPA hopes to survey perimeter properties in the near future.

Some contaminated material was sent to an offsite landfill. U.S. EPA will require a site survey to determine the extent of contamination and will require a remediation plan.

The City of Chicago has agreed to restrict access to anyone exposing or working in the soils covered by the sidewalks and streets. The City will give U.S. EPA notice of anyone proposing to work there and require anyone who must expose or work in the soils beneath the sidewalks and street to implement a health and safety plan, conduct radiation surveillance and dispose of any excavated contaminated materials.

How long do you estimate it will take to complete the remediation?

The remediation program will continue as long as necessary to remove the contamination. Originally, this was projected to take eight weeks, starting from early April. Potentially, the project may take longer, therefore, an exact estimated time frame can not given at this time.

What is the probability that adjacent lots are also contaminated?

U.S. EPA knows that there is contamination under some adjacent streets and in one nearby building. A surveillance project is contemplated for other perimeter properties to determine if additional contamination is present beyond the known sites.

What are the potential health risks to the environment?

U.S. EPA has required a health and safety plan that should allow site cleanup to proceed without danger to site workers, the general public and the environment. Potential health risks include exposure to gamma rays, inhalation of radioactive dusts, ingestion of contaminated soil, skin contamination and spreading of the contaminants beyond where they are now. Controls for these potential risks include maintaining levels As Low As Reasonably Achievable so that doses to workers are minimal and doses to the general public are kept to background levels. There must be no visible dust onsite, air concentrations to workers and at the fence of the property must be kept below regulatory levels, workers onsite must not pick up contaminated soil on their skin or clothes, and vehicles or equipment leaving the site must not contain radioactivity above regulatory levels. Other measures to control dust include the "watering down" of the site during working hours.

What, if any, are the human health hazards?

The contaminants of concern are radioactive and can raise the risk of cancer in specific organs and can raise the risk for the body as a whole. This may occur by exposure of the body to gamma rays, by ingestion and inhalation of radioactive materials, and by skin exposure to contaminants. Since

radiation exposure is a statistical risk there will not be a certainty of cancer from exposure and there will be no immediate, observable reactions.

Is there a danger to the water supply (ground and surface)?

Groundwater under the site is not used for drinking. Additionally, the thorium materials are very insoluble and past measurements have not shown groundwater contamination. To be prudent, U.S. EPA plans additional groundwater measurements on this site. No water, whether surface water or ground water, will be allowed to leave the site without meeting release standards.

Is there the threat of runoff?

U.S. EPA's oversight has not shown runoff to be an issue. If runoff was evident, U.S. EPA would require that it be contained and dealt with in a safe and healthful way.

If I walk by the site will I be in danger.

Using radiation meters, it has been determined, that gamma rays on the surrounding sidewalks are at background levels. Required air monitoring has shown that concentrations are well below regulatory levels for the general public. Fences assure that a person passing by does not get close enough to the contaminants to ingest them or get them on their skin. U.S. EPA feels that the public is well protected, but would take corrective measures, if perimeter conditions showed significant changes.

WEB SITES

This and additional updates can be found at the following web sites:

www.epa.gov/region5/sites/

Scroll down through the list to find the Lindsay Light II/RV3 North Columbus Drive site.

FOR ADDITIONAL INFORMATION

If you have questions about the information in this fact sheet or would like additional information about the Lindsay Light Sites, please contact the individuals listed below:

Derrick Kimbrough
Community Involvement Coordinator
Office of Public Affairs (P-19J)
(312) 886-9749
kimbrough.derrick@epa.gov

Verneta Simon
On-Scene Coordinator
Superfund Division (SE-5J)
(312) 886-3601
simon.verneta@epa.gov

Fred Micke
On-Scene Coordinator
Superfund Division (SE-5J)
(312) 886-5123
micke.fredrick@epa.gov

U.S. EPA Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604-3590
(800) 621-8431

24-hour response number (312) 353-2318

Lindsay Light site-related information is available at the following location:

Harold Washington Public Library
400 South State
Chicago, Illinois

Monday: 9:00 a.m. to 7:00 p.m.
Tues. and Thurs.: 11:00 a.m. to 7:00 p.m.
Wed., Fri., and Sat.: 9:00 a.m. to 5:00 p.m.
Sunday: 1:00 p.m to 5:00 p.m.

United States Environmental Protection Agency
Office of Public Affairs
Region 5
77 West Jackson Boulevard (P-19J)
Chicago, IL 60604-3590

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0 0265

United States
Enviromental Protection
Agency

Air and Radiation
(6602J)

EPA 402-K-92-004
August 1993

EPA

Radiation: Risks and Realities

Vernita Simon
312-886-3601

PAY TO THE ORDER OF
LAKE SHORE NATIONAL BANK
CHICAGO, ILL. 60601
FOR [illegible]
161 [illegible]
[illegible] 4

It comes from outer space, the ground, and even from within our own bodies. Radiation is all around us and has been present since the birth of this planet. Naturally-occurring radioactive materials were discovered in 1896. Less than 50 years later, the physicist Enrico Fermi split the atom, producing the first man-made radioactive materials. Today, both man-made and natural radiation are part of our lives. We use radioactive materials for beneficial purposes, such as generating electricity and diagnosing and treating medical problems. For example, Americans receive 200 million x-rays every year. Though radiation offers many benefits, exposure to it can also threaten our health and the quality of our environment. ■ *We cannot eliminate radiation from our environment. We can, however, reduce our risks by controlling our exposure to it. This booklet discusses the major sources and uses of radiation, the risks from exposure, and how we can limit and reduce these risks.*

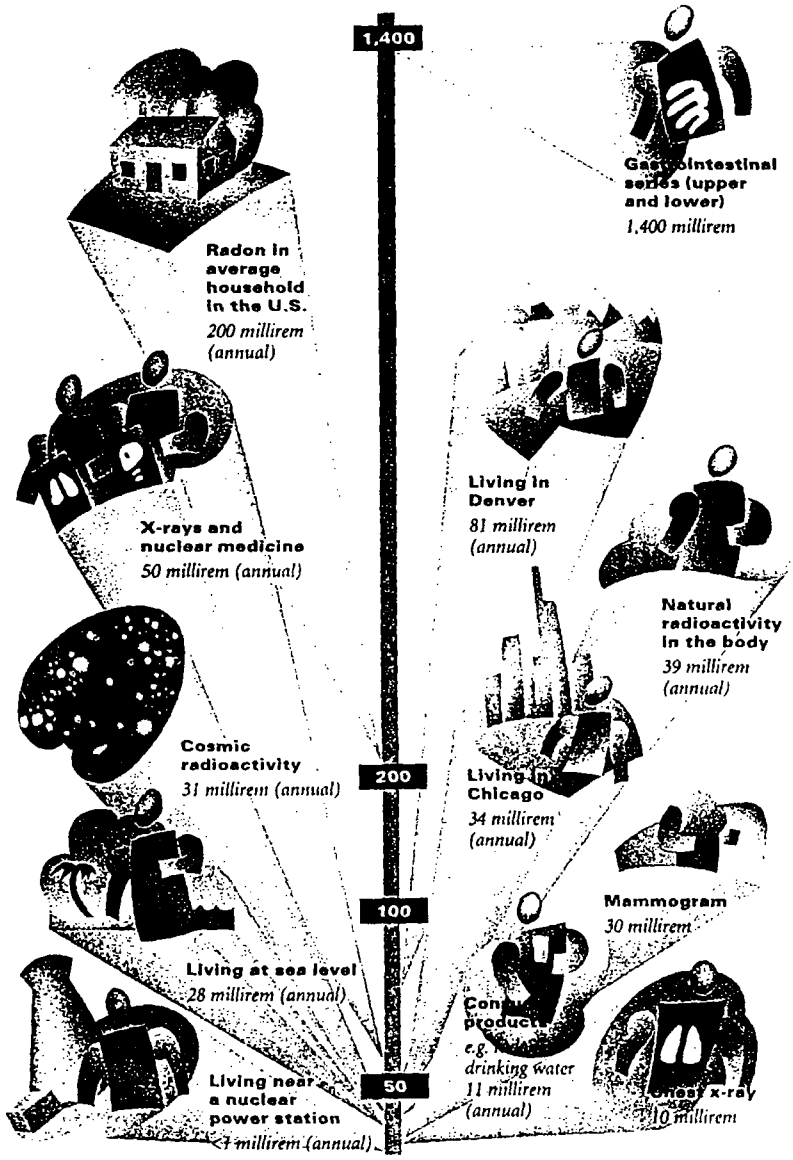
Matter is composed of atoms. Some atoms are unstable. As these atoms change to become more stable, they give off invisible energy waves or particles called radiation.

There are different types of radiation, some more energetic than others. One type of radiation, non-ionizing radiation, has enough energy to move atoms but not enough to alter them chemically. This booklet discusses the most energetic form, known as ionizing radiation, which from here on will be referred to simply as radiation.

We measure radiation dose in units called rem[1] (small doses are measured in millirem; one rem = 1,000 millirem). Scientists estimate that the average person in the United States receives a dose of about 360 millirem of radiation per year. Eighty percent of that exposure comes from natural sources: radon gas, the human body, outer space, and rocks and soil. The remaining 20 percent comes from man-made radiation sources, primarily medical x-rays.

RELATIVE DOSES FROM RADIATION SOURCES

Millirem Doses

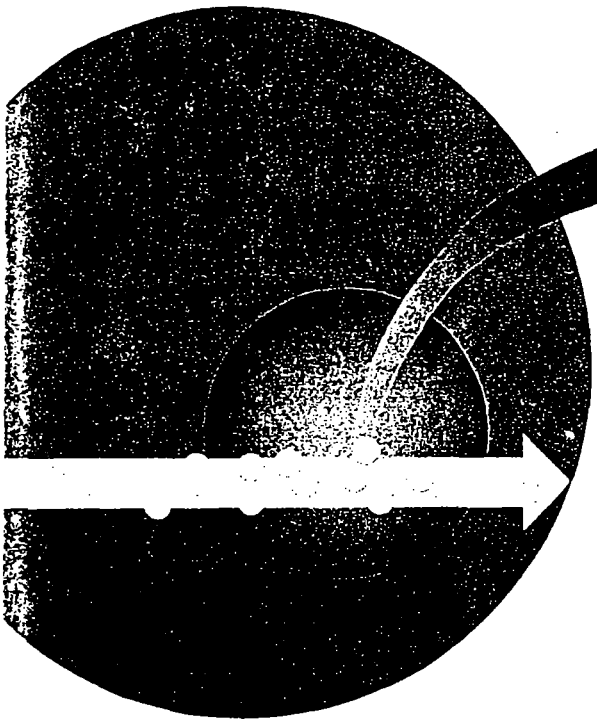


The average annual radiation exposure for a person living in the U.S.A. is 360 millirem.

Over 80 percent of our exposure to radiation comes from natural sources. Our own bodies, which contain the radioactive element potassium, account for 11 percent of our total exposure. Another three percent of our exposure to radiation comes from consumer products. Many of the sources of radiation shown here are discussed in this booklet.

[1] Other countries, as well as the scientific community in the U.S., measure radiation dose in units called sieverts.

▼ *1. When radiation penetrates a human cell, it may damage molecules in its path.*



▲ DNA MOLECULE

▼ *2. If a DNA molecule is damaged, the chromosome containing that DNA molecule may break apart.*

▲ *3. The chromosome may then recombine abnormally.*

This change in chromosome structure may lead to the death of the cell or the formation of a cancerous cell.

RISKS FROM EXPOSURE TO RADIATION

Radiation is a carcinogen. In this respect, it is similar to many hazardous chemicals found in the environment that can cause cancer. It may also cause other adverse health effects, including genetic defects in the children of exposed parents or mental retardation in the children of mothers exposed during pregnancy. However, the risk of developing cancer due to radiation exposure is much higher than the risk of these other effects.

Much of our knowledge about the risks from radiation is based on studies of over 100,000 survivors of the atomic bombs at Hiroshima and Nagasaki. In these studies, which have continued over the last 40 years, scientists have been able to observe the effects of a wide range of radiation doses, including doses comparable to an average person's lifetime dose from naturally-occurring background radiation (about 20,000 millirem). We have learned many things from these studies. The most important are:

1. The more radiation dose a person receives, the greater the chance of developing cancer.
2. It is the *chance* of cancer occurring, not the *kind* or *severity* of cancer, that increases as the radiation dose increases.
3. Most cancers do not appear until many years after the radiation dose is received (typically 10 to 40 years).

Current evidence suggests that any exposure to radiation poses some risk, i.e., there is no level below which we can say an exposure poses no risk. For the entire dose of radiation we accumulate over a lifetime from natural background radiation, the risk of developing cancer is estimated to be about one in one hundred. Based on this estimate, several percent of all fatal cancers in the U.S. are caused by background radiation. The additional contribution from all *man-made* sources of radiation is much smaller.

NATURAL RADIATION

Naturally-occurring radiation accounts for approximately 80 percent of our exposure. Most of our exposure is to indoor radon, followed by radiation from outer space and from the earth's crust.

Radon accounts for over half of the radiation dose we receive. It can enter a house through cracks in basement walls or floors, construction joints, or gaps around pipes. Nearly one out of every 15 homes in the United States is estimated to have elevated radon levels.

RADON

Fifty-five percent of our exposure to natural sources of radiation usually comes from radon. Radon is a colorless, tasteless, and odorless gas that comes from the decay of uranium found in nearly all soils. Levels of radon vary throughout the country. Radon usually moves from the ground up and migrates into homes and other buildings through cracks and other holes in their foundations. The buildings trap radon inside, where it accumulates and may become a health hazard if the building is not properly ventilated.

When you breathe air containing a large amount of radon, the radiation can damage your lungs and eventually cause lung cancer. Scientists believe that radon is the second leading cause of lung cancer in the United States. It is estimated that 7,000 to 30,000 Americans die each year from radon-induced lung cancer. Only smoking causes more lung cancer deaths and smokers exposed to radon are at higher risk than nonsmokers.

CONTROLLING THE RISKS FROM RADON EXPOSURE

Radon is found all over the United States. Scientists estimate that nearly one out of every 15 homes in this country has radon levels higher than four picocuries per liter, the level above which EPA recommends that homeowners take corrective action. Picocuries per liter is how radon in the air is measured. Testing your home is the only way to know if you and your family are at risk from radon.

Testing for radon is easy and only takes a few minutes of your time. There are many kinds of low-cost, "do-it-yourself," EPA-approved or state-certified radon test kits available through the mail or from retail outlets. You can also hire a professional to do the testing. EPA recommends choosing a state-certified and/or EPA-listed measurement company.

If you find high radon concentrations, you can reduce them in a variety of ways. Reduction methods can be as simple as sealing cracks in floors and walls or as complex as installing systems that use pipes and fans to draw radon out of the building.

EPA has a National Radon Program to inform the public about radon risks, train radon mitigation contractors, provide grants for state radon programs, and develop standards for radon-resistant buildings. EPA works with health organizations, state radon programs, and other federal agencies to make the program as effective as possible.

For more information about radon, its risks, and what you can do to protect yourself, call 1-800-SOS-RADON or contact your state's radon office and request a free copy of EPA's *A Citizen's Guide to Radon*. A list of state radon contacts is provided on the back cover of this booklet.

RADIATION FROM THE GROUND AND OUTER SPACE

Radon gas is not the only source of natural radioactivity. We receive about eight percent of our exposure to radiation from other radioactive elements in the earth's crust, such as thorium and potassium. Radiation levels from these sources vary in different areas of the country.

Another eight percent of our radiation exposure comes from outer space. This cosmic radiation originates in our galaxy, other galaxies, and our own sun. Our exposure to cosmic radiation depends in part on the elevation where we live. For example, people who live in Denver, Colorado, which is more than 5,000 feet above sea level, are exposed to more cosmic radiation than people living in Chicago, Illinois. Because Chicago is only approximately 1,000 feet above sea level, it has a thicker atmosphere, which can filter out more cosmic radiation than Denver's thinner atmosphere.

Controlling exposure to these forms of natural radiation would not be practical.

C 027

Since the discovery of radiation, people have benefited from the use of radiation in medicine and industry. Man-made sources of radiation account for about 20 percent of our total exposure to radiation.

X-rays are a type of radiation and are also an important tool in medical diagnoses. Doctors and patients should weigh the benefits and risks of medical treatment involving radiation.

RADIATION IN MEDICINE

Radiation used in medicine is the largest source of man-made radiation to which people in the United States are exposed. Most of our exposure is from diagnostic x-rays. Physicians use x-rays in more than half of all medical diagnoses to determine the extent of disease or physical injury. Radiation is also used in cancer treatments, where precisely targeted radiation destroys diseased cells without killing nearby healthy cells. Radiopharmaceuticals, another medical treatment, are used to locate tumors in a patient's body and to treat cancer. One-third of all successful cancer treatments involve radiation.

CONTROLLING THE RISKS OF MEDICAL RADIATION

The Food and Drug Administration (FDA) and other federal and state agencies regulate medical procedures that use radiation. EPA and these agencies also issue guidance designed to reduce unnecessary use of radiation in diagnosis and treatment and to ensure that technicians, equipment, and techniques meet standards that minimize radiation exposure.

Patients and health care providers must make the decision to use radiation on a case-by-case basis. Since any radiation exposure carries some risk, it is necessary to decide whether the benefits of radiation justify its use. Before receiving x-rays or any other type of medical treatment involving radiation exposure or dose, it is sensible to discuss the need for and benefits of the procedure and its alternatives with your physician.

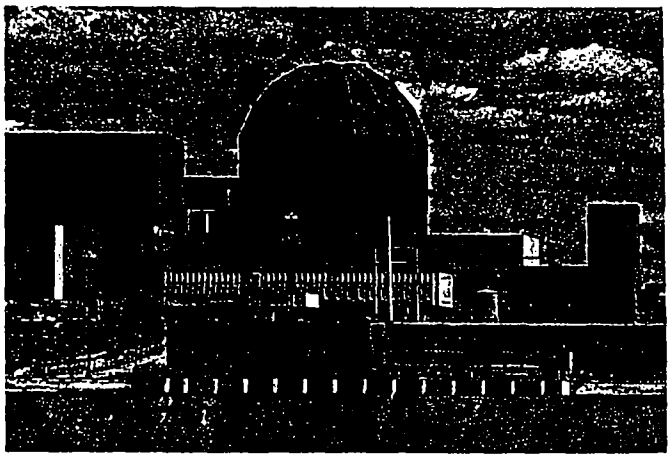
NUCLEAR POWER

Nuclear power reactors, which use uranium, supply the United States with about 20 percent of its electricity. Our ability to produce power using radioactive materials reduces our reliance on fossil fuels. Nuclear power plant operations account for less than a hundredth of a percent of the average American's total radiation exposure. Workers at nuclear power plants receive higher doses of radiation, but the overall risk to the population is extremely low.

CONTROLLING THE RISKS OF NUCLEAR POWER

In 1979, EPA issued environmental standards that protect the public from radiation from the many kinds of facilities that contribute to the production of electricity through the use of nuclear energy. Additionally, in 1987, EPA issued guidance for Federal agencies to use in the development of radiation exposure standards for workers. These standards limit the amount of radiation that workers in medicine, nuclear power, industry, mining, and waste management may receive. Finally, in 1989, under the Clean Air Act, EPA published standards limiting radionuclide emissions from all Federal and industrial facilities.

The Nuclear Regulatory Commission (NRC) is the federal agency responsible for implementing EPA's radiation exposure standards through regulation of nuclear power reactors and many other uses of radiation. The Department of Energy (DOE) also implements these standards at facilities under their supervision.



RADIOLOGICAL EMERGENCIES

Although accidents at nuclear power plants are rare, past emergencies have contributed to public perceptions that nuclear power is unsafe. One such emergency was the release of radioactive material from the nuclear reactor core at Three Mile Island (TMI) in 1979.

Since the TMI accident, the NRC has strengthened regulations governing plant design, training, and operations. In addition, all domestic nuclear power plants now must have emergency plans that protect the public from radiation exposure. EPA determines the exposure level at which actions to protect the public in the event of a release or potential release of radioactive material into the environment are recommended. Several federal agencies respond to radiological emergencies, including EPA, NRC, the Federal Emergency Management Agency, the DOE, the Department of Health and Human Services, and the Department of Agriculture. In addition, state and local governments have primary responsibility for protecting the public and environment in the case of a radiological emergency.

Even if a release has not occurred, a nuclear power plant may temporarily shut down to prevent a release from occurring. If a release does occur, regulations require the facility to notify proper authorities.

The Department of Energy's nuclear weapons complex consists of 16 major sites across the United States, such as this one in Hanford, Washington. Many of these sites are contaminated with radioactive wastes from nuclear weapons production. EPA is setting the criteria that DOE and the states will use to clean up the contamination at these facilities.

RADIOACTIVE WASTE

Any activity that uses radioactive materials generates radioactive waste. Mining, nuclear power, defense, nuclear medicine, and scientific research all produce radioactive waste that must be disposed of properly. Some activities produce low-level waste, which includes rags, equipment, and protective clothing contaminated with radioactive material. Others generate more highly radioactive waste, such as used fuel from reactors or waste from the manufacture of nuclear weapons.

Radioactive waste can remain radioactive for anywhere from days to hundreds or even thousands of years. If this waste is not properly isolated from the public and the environment, it may contaminate air, soil, and water supplies.

CONTROLLING THE RISKS OF RADIOACTIVE WASTE

Several federal agencies and some states control the risks of radioactive waste by establishing appropriate disposal regulations and applying these to disposal facilities to effectively isolate the waste. EPA has already established environmental standards for the cleanup and disposal of radioactive mining wastes. EPA is also responsible for setting generally applicable environmental standards for disposal of other radioactive wastes, which will be implemented by NRC and DOE.

Federal agencies regulate storage of high-level waste, which is currently placed in underground tanks or stored in pools of water. DOE is evaluating potential disposal sites for radioactive waste at Yucca Mountain, Nevada, and Carlsbad, New Mexico. These sites would be located thousands of feet underground and be subject to EPA performance requirements issued to prevent waste from escaping. In October 1992, Congress passed the Waste Isolation Pilot Plant (WIPP) Land Withdrawal Act. This Act gives EPA the responsibility to oversee DOE in the testing and operation of the WIPP. EPA is also charged with ensuring that WIPP complies with all federal environmental laws and regulations.

In addition to these disposal options, the federal government is investigating new technologies and disposal methods to treat or dispose of these wastes safely.

CONCLUSION

Natural sources of radioactivity are all around us, and man-made radioactive materials are a vital part of medicine and industry. Exposure to some radiation, natural or man-made, is inevitable. In living with radiation, we must understand the risks and benefits. It is also important to remember that many federal and state programs exist to protect the public from avoidable exposures to radiation.

MANY FEDERAL AGENCIES AND THE STATES HAVE IMPORTANT ROLES IN PROTECTION OF THE PUBLIC AND THE ENVIRONMENT FROM RADIATION

STATES

The states have agencies responsible for regulating the use of radiation and for addressing radiation questions and problems. They are the best first source of information about radiation issues which affect their constituents. The states regulate the use of x-ray machines. Some are also licensed to regulate other sources of radiation within their state on behalf of EPA, NRC, or the Occupational Safety and Health Administration (OSHA).

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA issues standards and guidance to limit human exposure to radiation. EPA works with the public, industry, the states and other government agencies to inform people about radiation's risks and to promote actions that reduce human exposure. EPA also measures environmental levels of radiation and assesses radiation's effects on people and the environment.

NUCLEAR REGULATORY COMMISSION (NRC)

NRC implements EPA's and its own standards for protecting the public from radiation. NRC regulates the civilian uses of nuclear materials in the United States by: licensing facilities that possess, use, or dispose of nuclear materials; establishing standards governing the activities of licensees; and inspecting licensed facilities to ensure compliance with its requirements. These regulatory functions relate to both nuclear power plants and to other users of nuclear materials for purposes such as nuclear medicine at hospitals, academic activities at educational institutions, research work, and industrial applications such as gauges and testing equipment.

DEPARTMENT OF HEALTH AND HUMAN SERVICES (HHS)

HHS's Food and Drug Administration's Center for Devices and Radiological Health establishes standards for x-ray machines and other electronic products to ensure that human health is protected from the radiation produced by these products.

DEPARTMENT OF ENERGY (DOE)

DOE is responsible for the development of the disposal system for spent nuclear fuel from the nation's civilian nuclear power plants. This activity is totally funded by a tax paid by the users of nuclear-generated electricity. DOE is also responsible for the management and disposal of nuclear waste and other radioactive materials associated with nuclear weapons production. Federally owned facilities in the Department are working to clean up its present and former nuclear sites. DOE is cooperating with state governments and private industry to clean up other locations around the United States that were contaminated with radiation as a result of government programs. DOE also provides technical advice and assistance to states and the private sector in the management and disposal of low-level radioactive waste.

DEPARTMENT OF DEFENSE (DOD)

While DOE is responsible for the safe handling of radioactive material at defense production facilities, DOD is responsible for the safe handling and storage of nuclear weapons and other military uses of nuclear energy.

DEPARTMENT OF TRANSPORTATION (DOT)

DOT, in cooperation with NRC and the states, governs the packaging and transport of radioactive materials. The Department also regulates carriers of radioactive materials.

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

OSHA develops and enforces regulations to protect workers not covered by other agencies from radiation exposure.

0 0275

REGIONAL OFFICES

Providing Information on EPA's Radiation Protection Programs

REGION 1

U.S. EPA — Region 1
J.F.K. Federal Building
One Congress Street
Boston, MA 02203
617-565-4502

Connecticut

Maine

Massachusetts

New Hampshire

Rhode Island

Vermont

REGION 2

U.S. EPA — Region 2
26 Federal Plaza
New York, NY 10278
212-264-4110

New Jersey

New York

Puerto Rico

REGION 3

U.S. EPA — Region 3
841 Chestnut Street
Philadelphia, PA 19107
215-597-8326

Delaware

District of Columbia

Maryland

Pennsylvania

Virginia

West Virginia

REGION 4

U.S. EPA — Region 4
345 Courtland Street, NE
Atlanta, GA 30365
404-347-3907

Alabama

Florida

Georgia

Kentucky

Mississippi

North Carolina

South Carolina

Tennessee

REGION 5

U.S. EPA — Region 5
77 West Jackson Boulevard
Chicago, IL 60604
312-886-6175

Illinois

Indiana

Michigan

Minnesota

Ohio

Wisconsin

REGION 6

U.S. EPA — Region 6
1445 Ross Avenue
Dallas, TX 75202-2733
214-655-7223

Arkansas

Louisiana

New Mexico

Oklahoma

Texas

REGION 7

U.S. EPA — Region 7
726 Minnesota Avenue
Kansas City, KS 66101
913-551-7600

Iowa

Kansas

Missouri

Nebraska

REGION 8

U.S. EPA — Region 8
999 18th Street
Denver, CO 80202-2405
303-293-1713

Colorado

Montana

North Dakota

South Dakota

Utah

Wyoming

REGION 9

U.S. EPA — Region 9
75 Hawthorne Street
San Francisco, CA 94105
415-744-1048

Arizona

California

Hawaii

Nevada

REGION 10

U.S. EPA — Region 10
1200 Sixth Avenue
Seattle, WA 98101
206-442-7660

Alaska

Idaho

Oregon

Washington

FOR MORE INFORMATION

NATIONAL RADON HOTLINE: 800-SOS-RADON

STATE AGENCIES PROVIDING RADON INFORMATION

Alabama	[illegible]
Alaska	[illegible]
Arizona	[illegible]
Arkansas	[illegible]
California	[illegible]
Colorado	[illegible]
Connecticut	[illegible]
Delaware	[illegible]
District of Columbia	[illegible]
Florida	[illegible]
Georgia	[illegible]
Hawaii	[illegible]
Idaho	[illegible]
Illinois	[illegible]
Indiana	[illegible]
Iowa	[illegible]
Kansas	[illegible]
Kentucky	[illegible]
Louisiana	[illegible]
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New York	[illegible]
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Vermont	[illegible]
Virginia	[illegible]
Washington	[illegible]
West Virginia	[illegible]
Wisconsin	[illegible]
Wyoming	[illegible]

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Radiation Protection During The February 1984 Remodeling of the 2nd floor of the Lindsay Light Co. Building, 161 E Grand Ave, Chicago, Illinois.

Radiation Safety Services, Inc
1564 Ashland Ave.
Evanston, Ill. 60201

Introduction

Remodeling on the second floor of the 161 E Grand Ave building during February, 1984 included areas previously identified by the EPA as contaminated with natural thorium. Monitoring was performed to ~~identify~~ locate contamination on building materials disturbed during the remodeling. Protective actions were taken by workers as recommended by the City of Chicago Department of Inspectional Services.

Training:

A one hour training session was conducted by Eli A. Port, CHP. In attendance were _____.

[Describe Class here]

Protective Actions

Workers and ancillary personnel in the construction area were issued Tyvek coveralls and 3-M Brand dust masks. Instructions were given regarding proper use of the equipment. Workers clothing, gloves and shoes were checked for contamination at the end of each work period. As contaminated portions of the original floor were uncovered surface wipes ~~and direct~~ were taken to determine if the radioactive ~~material~~ contamination was removeable. While the contaminated floor was uncovered a rope was used as a barrier to prevent access. —(over)—

4

The exposed portion of the contaminated ~~floor~~ floor was painted with epoxy paint within a few hours after uncovering to permanently seal any loose contamination in the wood. s ~~should prevent migration of the contamination~~

Radiation Survey Results

Removeable contamination was not detected at the 95% confidence level on filter paper wipes taken from the contaminated floor. Contamination was not found on dust which had accumulated in the walls.

¶ A small amount of contamination was detected on several 2" x 4" wood beams in direct contact with the contaminated floor. Water stains on the beams suggest Water soluable contamination was transfered during a flood originating on the Roof in 19 ___? (Ask Ronk.) slightly contaminated Tar paper in direct contact with the floor.

was found under several layers of flooring overlying the original floor. From survey meter readings it was determined some of the contamination approached 5,000 dpm/100cm^2.

¶ Dose rate and surface contamination surveys were conducted after the contaminated floor was uncovered. From the data the size and shape of the contaminated area was determined. See Appendix for survey results

¶ No contamination was found on any shoes, coveralls, gloves or tools. Several dust masks surveyed also revealed no contamination.

Waste Disposal

Debris from contaminated areas was carefully surveyed with a Ludlum 6/ Eberline HP210T survey meter. Contaminated material was segregated pending disposal. Uncontaminated debris and debris from uncontaminated areas was collected in waste bins and surveyed with a Ludlum Model 2220 analyzer utilizing an Eberline SPA-2"x2" sodium iodide detector in a low background area. No additional contamination was detected on this material which was released to a scavanger service.

Eli → (Add info about disposal of contam. waste)

Conclusions

Radiation surveys demonstrate radioactive contamination in the construction area was not readily transferable. A small amount of contamination was transfered to building materials in intimate contact with the contaminated floor for many years. Any remaining removeable contamination was sealed into the floor with epoxy paint which should also eliminate Rn-220 emanation, a gaseous daughter of Th-232.

Contamination detected on a small quantity of debris slightly exceeded 3,000 dpm/100cm^2, the USNRC limit for release of thorium

contaminated facilities for unrestricted use. While consumer products containing significantly larger quantities of radioactive material are routinely disposed of as ordinary trash, this material was transfered to a USNRC licensed radioactive waste collector for disposal.

No contamination was detected on protective apparel or tools used during the construction. Results of air sampling by the EPA and RSSI did not indicate an increase in airborne radioactivity levels in the work area.

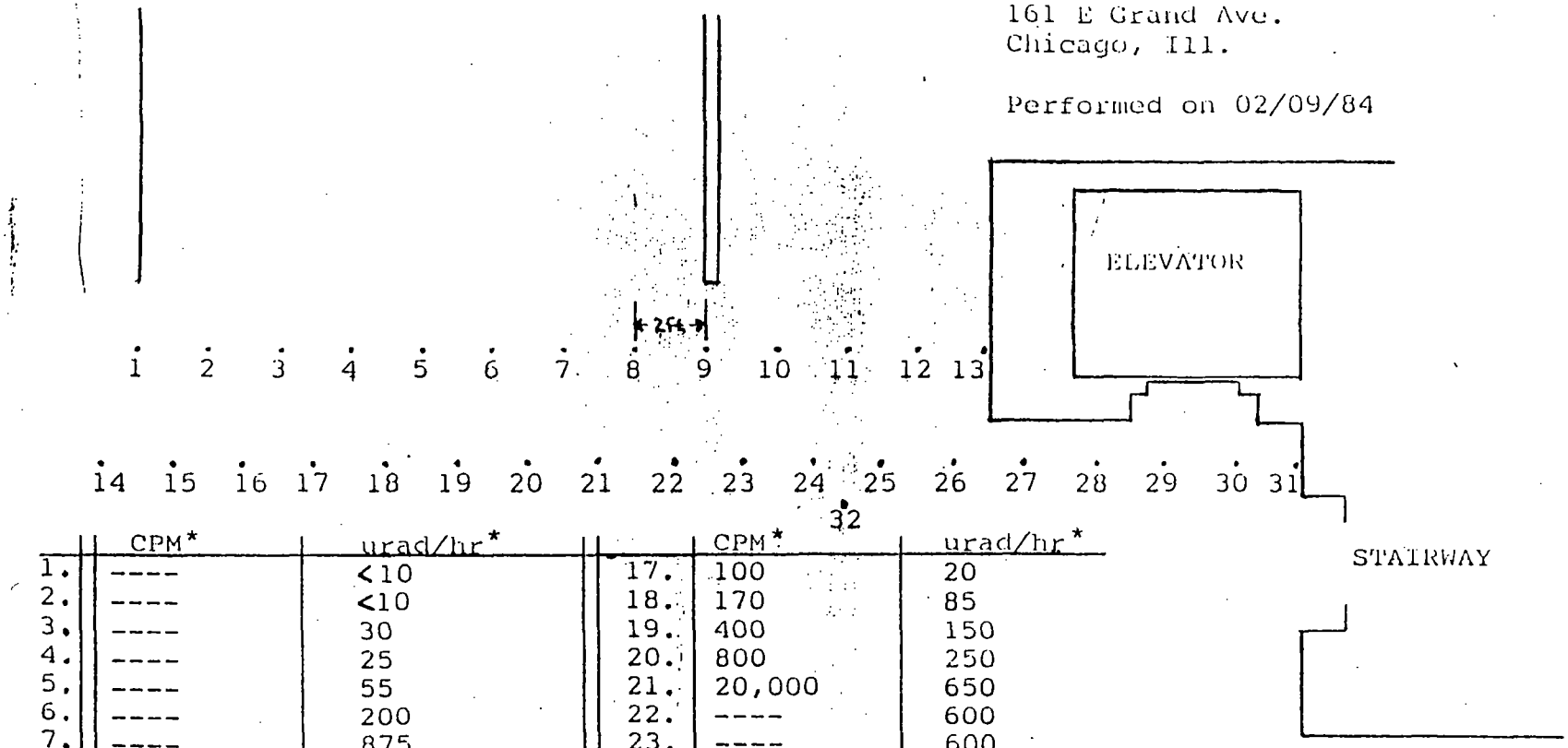
Appendix A

Radiation Survey Results

0 0287

2nd Floor
161 E Grand Ave.
Chicago, Ill.

Performed on 02/09/84



	CPM*	urad/hr*		CPM*	urad/hr*
1.	----	<10	17.	100	20
2.	----	<10	18.	170	85
3.	----	30	19.	400	150
4.	----	25	20.	800	250
5.	----	55	21.	20,000	650
6.	----	200	22.	----	600
7.	----	875	23.	----	600
8.	----	350	24.	----	400
9.	----	300	25.	16,000	300
10.	----	250	26.	2,000	100
11.	----	200	27.	1,100	60
12.	----	100	28.	2,100	80
13.	----	90	29.	900	65
14.	60	15	30.	2,000	50
15.	60	10	31.	1,300	60
16.	70	10	32.	90,000	---

PERFORMED BY:
Radiation Safety Services, Inc.
1564 Ashland Ave
Evanston, Ill. 60201
312-866-7744

DJD 02/13/84

INSTRUMENTS: All CPM readings taken with a Ludlum Model 16 using an Eberline HP-210T detector. All urad/hr readings taken with a Health Physics Instruments, Inc Model 1010.

BACKGROUND: The background in relatively uncontaminated portions of the building are 10 to 15 urad/hr. In these areas the Model 16/HP-210T background was 50-70 CPM.

SCALE
1"=5'

*Readings taken at the surface of the existing floor. The HPI 1010 chamber center is 2 5/16" from the floor with instrument on floor.

0 0288

SURVEY REPORT

BUILDING: 161 E. Grand ROOM: 2nd floor DATE 02/07&08/84 BY: Dave Derenzo & Eli A. Port

Routine ☐ Spot Check ☐ Special ☒ Equipment ☐

Wipes-Ludlum 2220/HP-210

Survey Instrument ~~Dose Rate- HPI 1010~~

Source of Ionizing Radiation Natural Thorium

See Attached Drawing

TYPE	FORM	ACTIVITY

Ventilation:

Comments:

SURVEY FINDINGS

AREA	WIPES		DOSE RATE
1 Floor	131 c/1min	→ 158 c/1min (After 2x4 removed)	See separate survey attached
2 Floor	125c/1min		
3 Floor	118c/1min		
4 Floor	105c/1min		
5 Floor after removal of tile	133 c/1min		
6 Floor after removal of tile	142c/1min		
7 Floor after removal of tile	123c/1min		
Background	680 c/6 min = 113 cpm		

RECOMMENDATIONS:

Ld 95% = 40.5 cpm ∴ Activity detected at 95% confidence level if 113 + 40.5 = 154 cpm is exceeded.

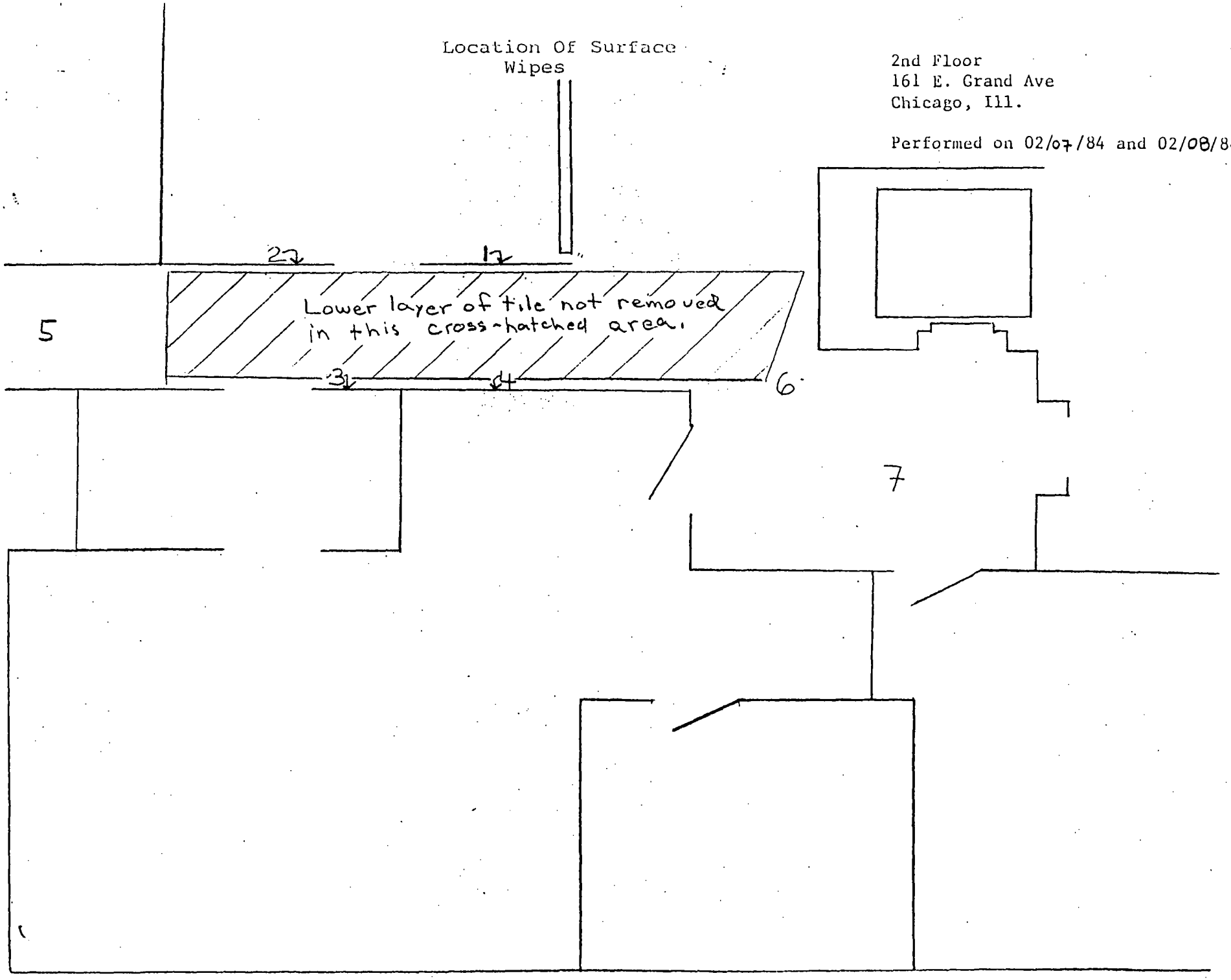
Radiation Safety Services, Inc.
827 Simpson, Evanston, IL 60201 (312) 866-7744

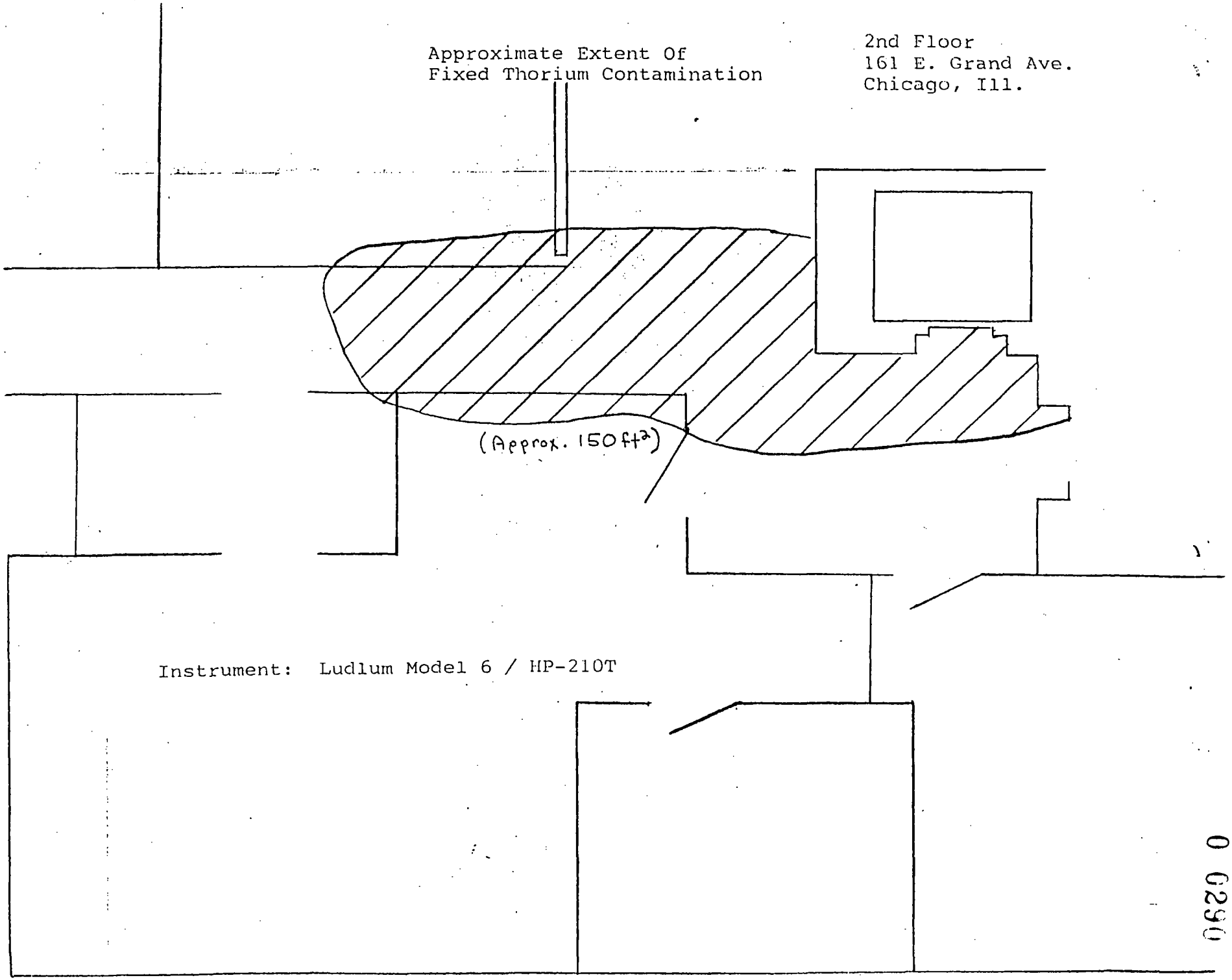
0 0289

Location Of Surface Wipes

2nd Floor
161 E. Grand Ave
Chicago, Ill.

Performed on 02/07/84 and 02/08/84



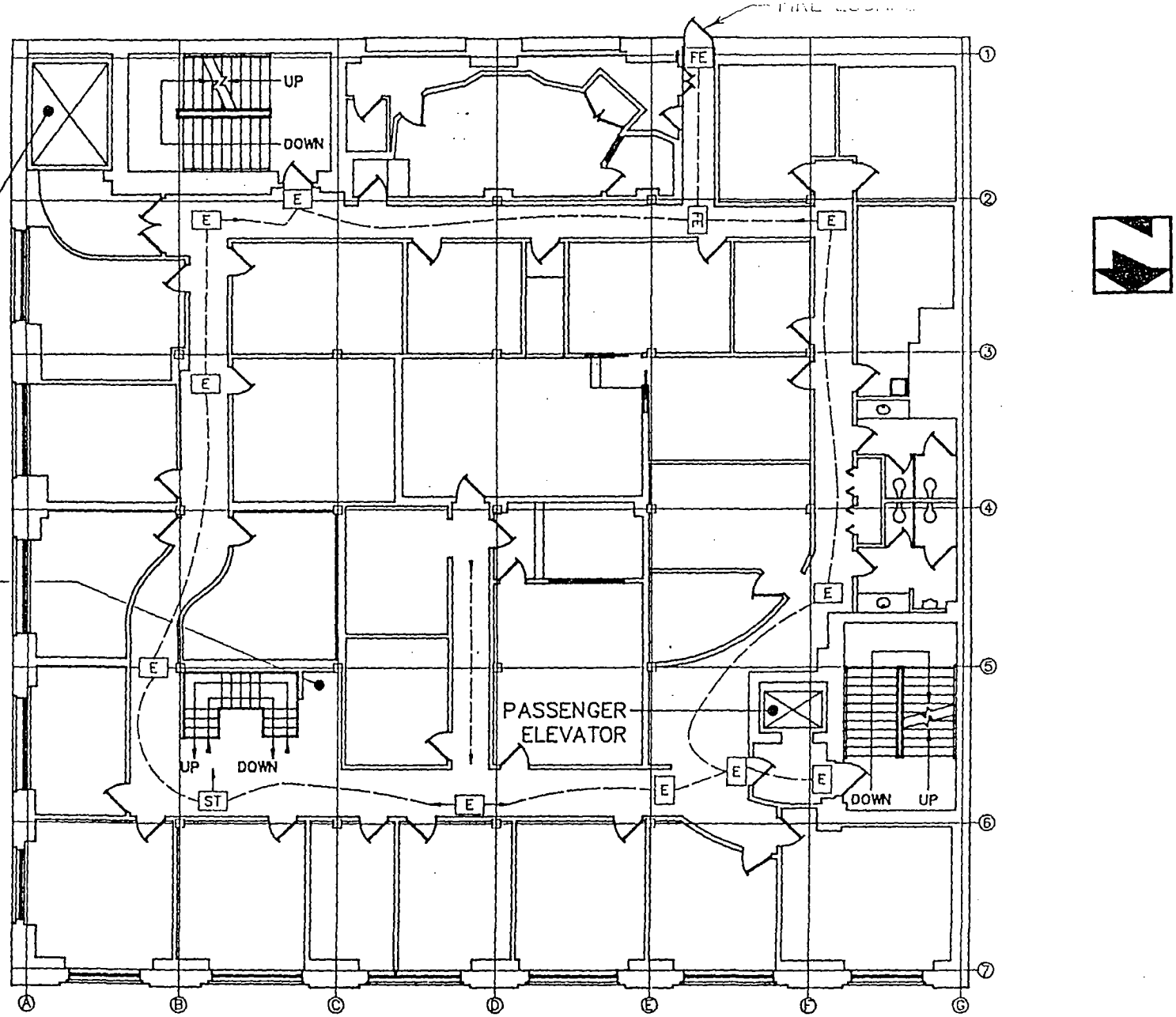

Approximate Extent Of
Fixed Thorium Contamination
2nd Floor
161 E. Grand Ave.
Chicago, Ill.
(Approx. 150 ft²)
Instrument: Ludlum Model 6 / HP-210T

0 0290

Appendix B.

USNRC Guidelines for the Release of Facilities for Unrestricted Use.

RE
CAPE
LAN



2nd FLOOR AREA
OPTIMUS
161 EAST GRAND AVE.
CHICAGO, IL. 60611

EXIT SIGNS
STAIR SIGN
FIRE ESCAPE SIGNS
HAZARDOUS MATERIALS

SCALE: 1/16"=1'

Ron Steele

Attachments

pc w/attachment: Eli Port, RSSI

\400001\161 Grand\white01.doc

To: ekoron@yahoo.com
From: Eli Port <eport@rssinc.org>
Subject: Payment for waste disposal
Cc:
Bcc:
Attached: H:\HOME\400001\161 Grand\white01.doc;

Ron:

Please print the attached letter on your stationary and fax it with the waste manifest and a copy of the ADCO invoice to Dan White at Kerr-McGee. Send a copy to me and advise me of payment or correspondence with Kerr-McGee. Call me at 847-965-1999 if you have any questions.

Eli

May 23, 2000 VIA FAX 405-270-3787

Dan White, Senior Project Manager
Kerr-McGee Corporation
Kerr-McGee Center
123 Robert S. Kerr Ave., MT 2003
Oklahoma City, OK 73102-6406

RE: Thorium Contamination at Lindsay Light Building, 161 E. Grand

Dear Mr. White:

The thorium contaminated chimney at the 161 E. Grand building has been removed and the rubble has been transferred to ADCO Services Incorporated (ADCO) for ultimate disposal as radioactive waste at Envirocare of Utah. A copy of the ADCO waste manifest is attached.

We have received the attached bill from ADCO and ask that, as agreed upon, Kerr-McGee issue a check to pay this bill. The check may be payable either to ADCO or to 161 E. Grand Associates. In either case, please mail the check to me at:

Ronald Steele
C/O EKO, 2nd Floor
205 E Grand Ave
Chicago, IL 60611

If you have any questions or require additional information, please contact me at 312-467-5440.

Sincerely,

Location or Name	RSSI Number	a Activity (mCi)	Duration (min)	Duration (hours)	Flow (lpm)	Volume (ml)	mCi/ml	mCi-hr/ml
Outside	1094	1.7E-05	340	5.7	9.35	3179000	5.35E-12	3.03×10^{-11}
Inside	1095	2.7E-05	340	5.7	9.43	3206200	8.42E-12	4.77×10^{-11}
Hernandez	1096	1.4E-06	332	5.5	1.96	650720	2.15E-12	1.19×10^{-11}
Castillo	1097	9.4E-05	332	5.5	1.93	640760	1.47E-10	8.12×10^{-10}
Port	1098	7.2E-06	336	5.6	1.94	651840	1.10E-11	6.19×10^{-11}

\40000\1\161grand\161grand.xls

0 0200

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

0 0297

DATE: JAN 10 1984

SUBJECT: Lindsay Light Company Building (161 East Grand Avenue, Chicago, Illinois)

FROM: David Kee, Director
Air Management Division
Larry F. Kilber, Acting for

TO: Basil Constantelos, Director
Waste Management Division

In May 1981, Region V radiation staff surveyed a building at 161 East Grand Avenue, Chicago. This is the original site of the gas mantle manufacturer that later moved to West Chicago and whose facility there is now owned by the Kerr-McGee Chemical Corporation. The Grand Avenue building was shown to be contaminated with thorium on portions of all four floors and the basement. Although the building is a fully occupied commercial building and gamma exposure levels near one work station reached 400 microroentgen per hour at one meter from the floor, the Office of General Counsel advised us then that EPA had no authority to require any action. Inquiries to the Nuclear Regulatory Commission, the Illinois Department of Nuclear Safety, the Occupational Safety and Health Administration and the City of Chicago also established they had no authority to act. Consequently, we have dealt with this building on an ad hoc basis since we have had cooperation of the tenant-owners. On December 2, we received a call from a tenant-owner seeking our recommendations on qualified health physics consultant firms to supervise remodeling work on the second floor. Such work could lead to innalation risks and might further spread contamination. We notified the Illinois Department of Nuclear Safety and the City of Chicago. The latter put a police stop order on the project through the building permit process. A health physics consultant has been hired to supervise work. The City will strongly advise the tenant-owner to take certain precautionary steps when they finally issue the building permit. Nevertheless, no City, State or Federal Agency appears to have any formal power to regulate the work. Although the Illinois Department of Nuclear Safety and EPA radiation staff hope to observe and monitor the remodeling project, the larger question of what to do about this radioactively contaminated building remains. Babette Neuberger, Assistant Regional Counsel, has reassessed the situation and has issued a preliminary opinion that, indeed, EPA has authority to deal with this site through CERCLA. Based upon this preliminary opinion (that opinion is attached) I urge you to act to deal with the total contamination problem at the Lindsay Light Company building.

DAILY LOG OF 161 E. GRAND ACTIVITIES

August 6. Resurveyed to confirm areas to be decontaminated. 1/2 day

August 7. Worked with laborer Norman. Removed thorium from basement and filled hole with concrete. Began to break floor on 4th floor. 9:00 to 4:30.

August 10. Arrived at 8 o'clock and waited for the laboror to arrive until 9:30. When he did not arrive, went to 4th floor and continued breaking up the concrete floor until noon.

August 12. Started job with laborer Todd and continued demolition of 4th floor concrete. Attempted to scrape thorium contamination with 1 1/2" plane. 10:00 to 4:15.

August 13. Arrived at 9 o'clock and waited for Bill until 9:30. Continued to plane the 4th floor. Began to break up floors in 202. 9:00 to 5:00.

August 18. Planed 4th floor, removed most of floor in 202. 9:15 to 5:15.

August 19. Planed 4th floor and then sanded floor with disc sander. Some hot spots remained on 4th floor and need to be removed. Removed floor covering in 202. 9:00 to 5:15.

August 20. Finished removing thorium from 4th floor. Some regions were chiseled 1/2" into subfloor planking. Began sanding floor in 202. Found alpha contamination was removed. However, gamma field still remained high. Started to remove floor boards to reach subfloor. 9:30 to 5:30.

August 25. Using new saw blades, cut through floor boards. At request of tenant, terminated work and began to pry up the floor boards and clean up radioactive dust generated by sawing. 8:15 to 12:15.

August 27. Removed all floor boards in 202, sanded entire subfloor and chiseled out remaining alpha activity in 202 conference room. Alpha was reduced from greater than 10,000 CPM to less than 500 CPM. Gamma field reduced over most of floor to 50% or less of the original values. Remaining activity in the subfloor planking. 12:00 a.m. to 8:45 a.m.

DECONTAMINATION ACTIVITIES

AT

LINDSAY LIGHT BUILDING
161 E. Grand Avenue
Chicago, Illinois

INTRODUCTION

The 161 E. Grand Avenue Building housed the Lindsay Light Company from about 1910 to the mid-1930's. The company first imported and then manufactured incandescent gas light mantles employing natural thorium compounds and incidental to its operations deposited thorium materials on surfaces, particularly floors, of the building.

The United States Environmental Protection Agency (EPA) reported on the results of several surveys performed at 161 E. Grand Avenue and recommended that, although there is no statutory requirement, the building be decontaminated where practicable. This recommendation was made to reduce the dose from radiation exposure to members of the general public who work in or frequent the building.

The building management chose Radiation Safety Services, Inc., to evaluate and, where appropriate, attempt to decontaminate the more heavily contaminated floors in the building. This was to be accomplished by removal of contaminated floor surfaces followed by replacement of the floors with new material. The work took place during the month of August, 1981.

Technical Approach.

The building management and Radiation Safety Services identified areas where the gamma dose rate at 1 meter above the floor was 100 microrads per hour or greater. These areas were candidates for decontamination.

The first step for most of the areas was the removal of the existing floor coverings, exposing the oak floors. These floors were surveyed and were frequently found to contain significant surface alpha contamination. The building engineer supplied laborers and tools with which the surface layer of the flooring could be removed.

When contamination was found to extend to a greater depth in the oak flooring, the floor boards were cut and removed. Frequently, the subfloor, which was the original plank flooring in the building, was found to be badly contaminated indicating the oak flooring had been installed subsequent to the initiation of Lindsay Light operations. Since the planking was structural, the decision was made to attempt to chisel out contamination to a depth of 1/2 inch. It was felt that removal of more material might compromise the structural integrity of the floors.

Where contamination did not appear to extend to a great depth into the floor the floors were power sanded. The dust from sanding operations was controlled by the use of plastic

sheets. Personnel respiratory protection and hearing protection was supplied to the building laborers.

The operations were terminated at the request of an owner-tenant. And the areas in which work had been performed were resurveyed. The survey reports are in Appendix A.

Results and Recommendations

Areas on the basement, second and fourth floor levels were decontaminated. The areas for decontamination were selected by the building management and decontamination was interrupted at the request of the owner-tenant. The areas decontaminated represent the most significant contamination for areas which are generally occupied and doses were significantly reduced or eliminated at a height of 1 meter from the floor.

The basement pump room, which is immediately north of the boiler room, had a hot spot due to contaminated material used as fill around a pipe. The contaminated material was removed and the created void was filled with concrete. This reduced the external gamma dose from 225 microrads per hour at contact with the floor to 60 microrads per hour at contact and 50 microrads per hour at 1 meter.

The highest readings in the building were found in the basement in Room 8 which was not decontaminated since this is an area which is not occupied. If this area is to be occupied in the future, decontamination is strongly recommended and would be mandated by State law.

The EPA reported dose rates of 800 microrads per hour at 1 meter from the floor in the vicinity of the secretary's desk in Room 202. The floor covering and oak flooring were removed and the planking chiseled to a depth of 1/2 inch reducing the dose rate in the vicinity of the secretary's desk to 250 microrads per hour at 1 meter from the floor.

We recommend that where possible the planking be sealed with bituminous material to retard radon escape and that a 1/2 inch plate of lead be installed prior to replacement of the floor and floor covering. This should further reduce the dose rate by approximately a factor of 2.

The conference room in 202 received treatment similar to the floor adjacent to the secretary's desk. This reduced the dose rate at 1 meter from the floor from the EPA reported maximum of 155 microrads per hour to a maximum of 90 microrads per hour.

We recommend that the floor be sealed with bituminous material to retard radon escape prior to the replacement of the floor and floor covering material.

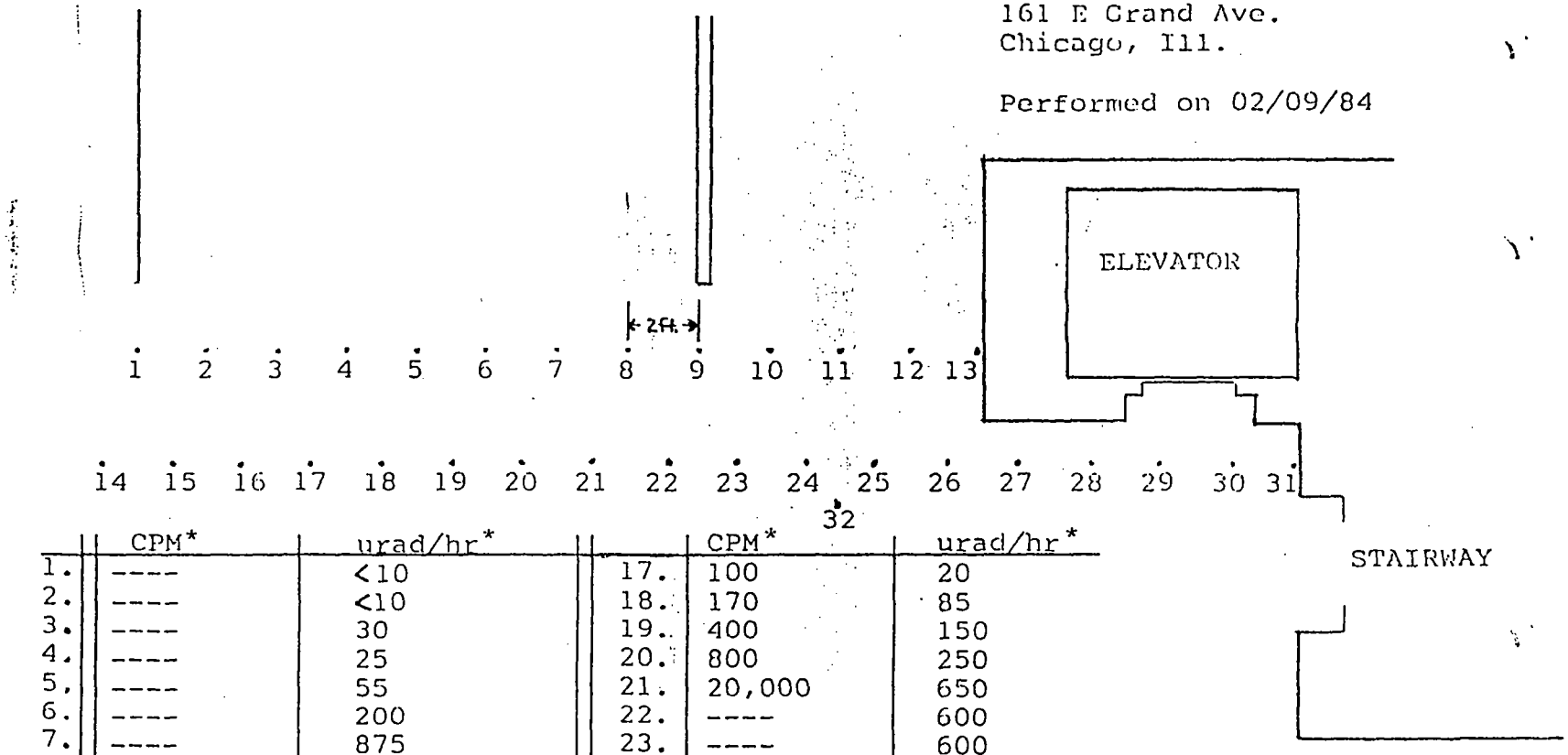
On the fourth floor Streeterville post-production room the thin concrete floor was broken up, the oak flooring removed, and the planking chiseled and sanded. This reduced the dose rate from the 300 microrads per hour reported by the EPA to 150 microrads per hour at 1 meter from the floor.

We recommend that the floor be sealed with bituminous material to retard the release of radon from this floor.

Although decontamination was terminated before completion, the most important occupied areas demonstrated a significant dose reduction consistent with the decontamination effort. Changing space utilization, particularly in the basement, may dictate further decontaminations to the levels recommended by the EPA. It is recognized that there is a very serious trade-off between reductions in already low doses and the expense of decontamination.

2nd Floor
161 E Grand Ave.
Chicago, Ill.

Performed on 02/09/84



	CPM*	urad/hr*		CPM*	urad/hr*
1.	----	<10	17.	100	20
2.	----	<10	18.	170	85
3.	----	30	19.	400	150
4.	----	25	20.	800	250
5.	----	55	21.	20,000	650
6.	----	200	22.	----	600
7.	----	875	23.	----	600
8.	----	350	24.	----	400
9.	----	300	25.	16,000	300
10.	----	250	26.	2,000	100
11.	----	200	27.	1,100	60
12.	----	100	28.	2,100	80
13.	----	90	29.	900	65
14.	60	15	30.	2,000	50
15.	60	10	31.	1,300	60
16.	70	10	32.	90,000	---

PERFORMED BY:
Radiation Safety Services, Inc
1504 Ashland Ave
Evanston, Ill. 60201
312-866-7744

DJD 02/13/84

INSTRUMENTS: All CPM readings taken with a Ludlum Model 16 using an Eberline HP-210T detector. All urad/hr readings taken with a Health Physics Instruments, Inc Model 1010.

BACKGROUND: The background in relatively uncontaminated portions of the building are 10 to 15 urad/hr. In these areas the Model 16/HP-210T background was 50-70 CPM.

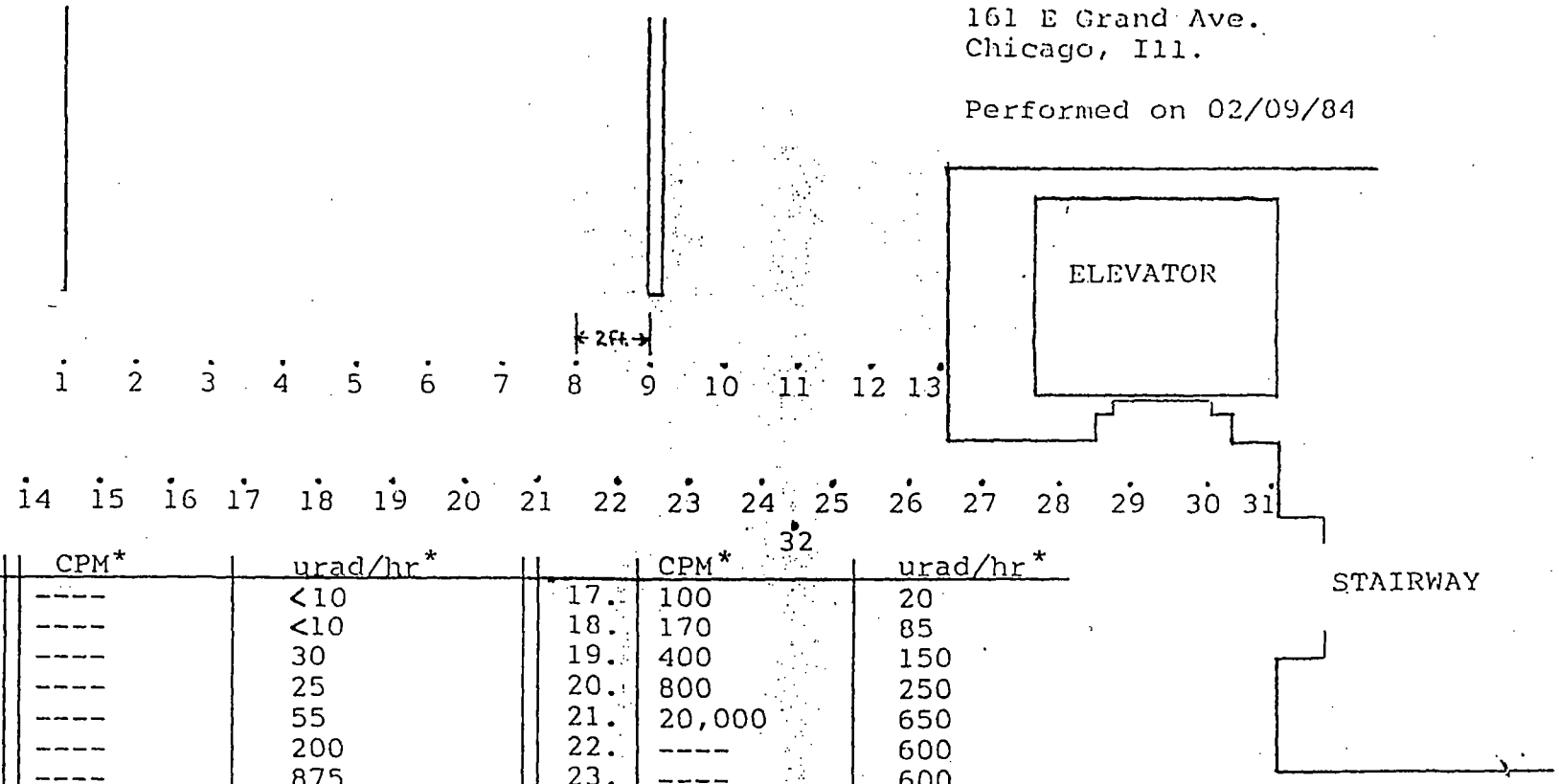
*Readings taken at the surface of the existing floor. The HPI 1010 chamber center is 2 5/16" from the floor with instrument on floor.

SCALE
1"=5'

0 0303

2nd Floor
161 E Grand Ave.
Chicago, Ill.

Performed on 02/09/84



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8.	----	350	24.	----	400
9.	----	300	25.	16,000	300
10.	----	250	26.	2,000	100
11.	----	200	27.	1,100	60
12.	----	100	28.	2,100	80
13.	----	90	29.	900	65
14.	60	15	30.	2,000	50
15.	60	10	31.	1,300	60
16.	70	10	32.	90,000	---

PERFORMED BY:
Radiation Safety Services, Inc.
1564 Ashland Ave
Evanston, Ill. 60201
312-866-7744

DJD 02/13/84

INSTRUMENTS: All CPM readings taken with a Ludlum Model 16 using an Eberline HP-210T detector. All urad/hr readings taken with a Health Physics Instruments, Inc Model 1010.

BACKGROUND: The background in relatively uncontaminated portions of the building are 10 to 15 urad/hr. In these areas the Model 16/HP-210T background was 50-70 CPM.

*Readings taken at the surface of the existing floor. The HPI 1010 chamber center is 2 5/16" from the floor with instrument on floor.

SCALE
1"=5'

0 G304

0 63U5

ADCO Services, Inc.

17650 Duvan Drive, Tinley Park, IL 60477 • (708) 429-1660 FAX (708) 429-9759

INVOICE

064416 Page 1 of 1

CUSTOMER ORDER NO. VERBAL ELI

LOT NO. 01-0193

DATE 05/11/00

BILL TO

RSSI
ATTN ELI PORT
6312 W. OAKTON STREET
MORTON GROVE IL 60053

SHIP TO

161 GRAND ASSOCIATES
161 EAST GRAND
CHICAGO IL

TERMS: Net 10

Account Number: 3582

DESCRIPTION AND SIZE OF CONTAINER	DATE OF PICK-UP	SPECIAL REMARKS OR COMMENTS	T	UNIT	AMOUNT
1,330.00 Ea	05/10/00	DISPOSAL OF SOLID RUBBLE 1,330 LBS. @ 7.75/LB.		7.75	10,307.50

F.E.I.N. #36-2658095

PLEASE RETURN GOLD COPY WITH YOUR PAYMENT

DISCLAIMER: Title to all materials which were previously owned by the customer or supplier contained in waste [illegible] on this form or under this contract shall be deemed to be vested in Adco Services, Inc. [illegible] customer or supplier shall have no right to the

MAKE CHECKS PAYABLE
ADCO SERVICES, INC.

TOTAL AMOUNT 10,307.50

0 0306

ADCO Services, Inc.

17650 Duvan Drive, Tinley Park, IL 60477 • (708) 429-1660 FAX (708) 429-9759

064415 Page 1 of 1

CUSTOMER ORDER NO. VERBAL ELI

LOT NO. 01-0183

DATE 05/11/00

Becky.

BILL TO

RSSI
ATTN ELI PORT
6312 W. OAKTON STREET
MORTON GROVE IL 60053

SHIP TO

161 GRAND ASSOCIATES
161 EAST GRAND
CHICAGO IL

TERMS: Net 10

Account Number: 3582

DESCRIPTION AND SIZE OF CONTAINER	DATE OF PICK-UP	SPECIAL REMARKS OR COMMENTS	T	UNIT	AMOUNT
1,330.00 Ea	05/10/00	DISPOSAL OF SOLID RUBBLE 1,330 LBS. @ 7.75/LB.		7.75	10,307.50

ADCO SERV. INC. 35 ANNIVERSARY 1965 2000 TINLEY PARK

✓ 5/15/00
address changed
to Ship to - 4th Ave Steele,
60611

F.E.I.N. #36-2652865

PLEASE RETURN GOLD COPY WITH YOUR PAYMENT

DISCLAIMER: Title to all materials which were previously owned by the customer or supplier contained in waste furnished for burial as listed on this form or under this contract shall be deemed to be vested in Adco Services, Inc. upon delivery to our facilities or placed aboard our vehicle. The customer or supplier shall have no right to the recovery of any material contained in such waste nor any credit for their potential value. If special nuclear material greater than 1 gram or source material greater than 1,000 kilograms that are being transfered.

MAKE CHECKS PAYABLE TO:
ADCO SERVICES, INC.
P.O. BOX 1129
TINLEY PARK, IL 60477

TOTAL AMOUNT 10,307.5

RADIATION SAFETY SERVICES, Inc.
1564 Ashland Avenue
Evanston, Illinois 60201
312/866-7744

0 0307

April 23, 1984

Ron Klyber
161 East Grand Associates
161 East Grand Avenue
Chicago, IL 60611

Dear Ron:

After we mailed a copy of the decontamination report to you, we discovered that a sentence in the first paragraph beginning on page 3, "The contaminated areas ranged up to 5,000 dpm/100 cm^2" should have appeared after the first sentence in the last paragraph starting on page 2. The paragraph starts with "Low-level contamination was detected . . . ."

At the time of the decontamination activities it was noted that the most substantial contamination appeared on a wall which was to be scraped following the completion of the activities. Do you still wish us to monitor scraping of the wall?

If you have any questions, please contact me at 866-7744.

Sincerely,

Eli A. Port
Certified, American Board of Health Physics
Registered Professional Engineer (Safety)

EAP:ts

RSSI

6312 West Oakton Street
Morton Grove, IL 60053-2723
708-965-1999
Fax 708-965-1991

August 31, 1992

Matthew Babich
Facilities Project Design Engineer
Optimus
161 East Grand Avenue
Chicago, Illinois 60611

RE: SURVEY RESULTS OF DEMOLITION PROJECT PERFORMED ON AUGUST 17, 1992

Dear Matt:

This letter summarizes the results of the thorium contamination survey performed at 161 East Grand Avenue by Bryan Bagg on August 17, 1992. Results of the survey indicate that no thorium contamination below detection limits was found on the demolition material and that the detection limits are below the Illinois Department of Nuclear Safety (IDNS) 32 IAC Chapter II, Part 340, Appendix C DECONTAMINATION GUIDES for release of facilities for unrestricted use. Significant activity was detected through a small opening between plywood sheets laid over the original floor, but this area was not disturbed during the demolition activity.

The survey consisted of monitoring for thorium contamination during demolition of part of a wall for a doorway in the second floor conference room and in the computer graphics client waiting room. Dose rates were also measured in these rooms and in the first floor reception area located below the demolition area.

A Health Physics Instruments Model 1010 Tissue Equivalent Ionization Chamber was used to measure dose rates. An Eberline Rascal Model PRS-1 with a Ludlum Model 43-5 Alpha Scintillation Probe was used to measure surface alpha emitter contamination.

Prior to demolition, the wall area for the doorway was surveyed for dose rates and alpha emitter contamination. Plastic sheets were laid on the floor to collect dust and debris generated by the demolition. During demolition, material was cut from the wall using a power saw in approximately two foot by two foot

RSSI

sections. Bob Ciske and Larry Benz of Benz Construction performed the demolition and were informed of the possibility of contamination. The sections were surveyed for alpha emitter contamination after removal from the wall. Generated dust and debris collected on the plastic sheet was also surveyed. After demolition was completed, the exposed inner wall surfaces were surveyed for alpha emitter contamination. At the request of George Slominski, dose rates were measured in the first floor reception room below the demolition area.

Survey report results are attached. With the exception of the small opening in the plywood floor, all alpha emitter contamination was below IDNS guidelines for unrestricted use. Demolition material was disposed as normal trash since no contamination was identified. Dose rates around the demolition site ranged from 20 μRad per hour (μRad/hr) to 700 μRad/hr. Dose rates in the first floor reception area ranged from 60 μRad/hr to 200 μRad/hr.

It is recommended that if additional demolition activity occurs in the building, a survey be performed before and during demolition activities since significant alpha emitter contamination was identified beneath the plywood floor covering in the second floor conference room.

If you have any questions or require additional information, please contact Terry Liaboe or myself at 708-965-1999.

Sincerely,

Bryan J. Bagg

Bryan J. Bagg

Enclosures

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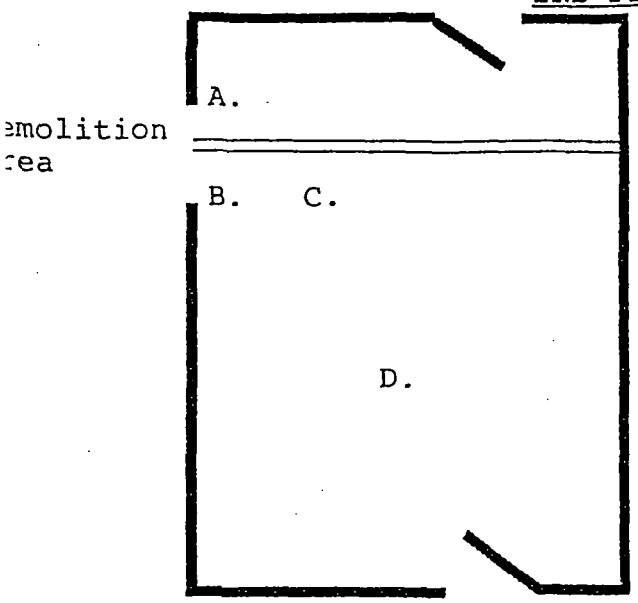
SURVEY REPORT

2ND FLOOR CONFERENCE ROOM



Source of Ionizing Radiation

Type	Form
Alpha	Th-230
Beta	Th-230 daughter products
Gamma	Th-230 daughter products

SURVEY FINDINGS

AREA	HPI 1010 µRad/Hour	RASCAL DPM/100 CM^2
A. Floor	700	< 51
B. Floor	400	< 51
1 meter above A.	200	< 51
1 meter above B.	200	< 51
Area between A & B down length of wall.	60*	< 51
C. Small slit in plywood floor 28 inches from wall.	-	24,000
D. Center of room on floor.	20	-

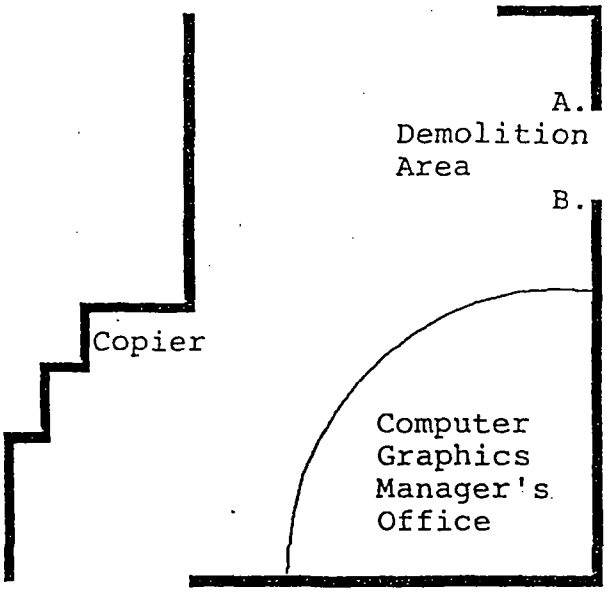
* Increases as floor is approached.

HPI 1010: Health Physics Instruments Model 1010 Tissue Equivalent Ionization Chamber. Calibrated 8/12/92. Room Background=20 µRad/Hour

RASCAL: Eberline Rascal with Ludlum 43-5 Alpha Scintillation Probe. Calibrated 7/31/92. Limit of Detection=51 dpm/100 cm^2

SURVEY REPORT

COMPUTER GRAPHICS CLIENT WAITING AREA



Source of Ionizing Radiation

Type	Form
Alpha	Th-230
Beta	Th-230 daughter products
Gamma	Th-230 daughter products

SURVEY FINDINGS

AREA	HPI 1010 µRad/Hour	RASCAL DPM/100 CM^2
A. Floor	500	< 51
B. Floor	200	< 51
1 meter above A.	100	< 51
1 meter above B.	100	< 51
Area between A & B down length of wall.	60*	< 51

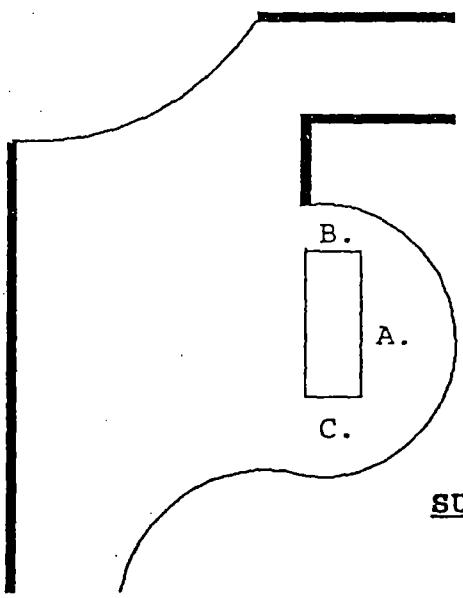
* Increases as floor is approached.

HPI 1010: Health Physics Instruments Model 1010 Tissue Equivalent Ionization Chamber. Calibrated 8/12/92. Room Background=20 µRad/Hour.

RASCAL: Eberline Rascal with Ludlum 43-5 Alpha Scintillation Probe. Calibrated 7/31/92. Limit of Detection=51 dpm/100 cm^2

SURVEY REPORT

FIRST FLOOR RECEPTION AREA



Source of Ionizing Radiation

Type	Form
Gamma	Th-230 daughter products

SURVEY FINDINGS

AREA	Floor µRad/Hour	4 feet above floor µRad/Hour
A. Desk Sitting Area	200	80
B. Edge of Desk	200	60
C. Edge of Desk	200	60

HPI 1010: Health Physics Instruments Model 1010 Tissue Equivalent Ionization Chamber. Calibrated 8/12/92. Room Background=60 µRad/Hour.

REGION V

AIR MANAGEMENT DIVISION

RECORD OF TELEPHONE CONVERSATION

0 0313

ATE: February 24, 1984 TIME: 10:00 A.M.

ECORDED BY: Larry Jensen TALKED WITH: Eli Port
Radiation Safety Services

IATURE OF CALL: X INCOMING ___ OUTGOING

SUBJECT: Memo of 2/21/84 on Renovation Activities at the Lindsay Light Company Building, Chicago, Illinois

SUMMARY: Mr. Port called to point out that a statement in my 2/21/84 memo to Gary Gulezian was incorrect. Page 2, paragraph 3, contains the sentence "Mr. Brown's helper did not receive training." Mr. Port states that this person did receive training and that his signature is on the course sign-up sheet.

FOLLOWUP ACTION: Copies of this Record of Communication will be sent to those who received copies of the 2/21/84 memo.

COPIES TO:

October 9, 1981

Mr. Chris Ball
Browne and Storch
100 E. Ohio
Chicago, IL 60611

Dear Mr. Ball:

Enclosed you will find a technical report of our activities at the 161 E. Grand Building, a log of daily activities and our invoice.

If you or the tenants in the building have questions, you or they are free to call me at 866-7744.

Sincerely,

Eli A. Port
Certified, American Board of
Health Physics
Registered Professional Engineer

EAP:ws

Enclosures

media design company

205 East Grand Avenue
Chicago, Illinois

Phone: 312-467-5440
Fax: 312-467-0867

847-965-1991

FAX COVER SHEET

To: Eli Port / RSSI

Re: Letter

From: Ron Steele

Fax: 312-467-0867
Phone: 312-467-5440

DATE:

This fax is 2 pages including cover sheet

Note: If you have any questions, call 312-467-5440

Revised letter attached
Ron

KERR-McGEE CORPORATION

SAFETY & ENVIRONMENTAL AFFAIRS DIVISION

123 Robert S. Kerr, MT-2003
Oklahoma City, Ok 73102

FAX (405) 270-3787
COVER SHEET

To: Eli Port Company: Fax: 847-965-1991

From: Dan White Total Pages: 2 Date: 3/2/00

Message:

Attached Letter

0 0318

KERR-McGEE CHEMICAL LLC
KERR-McGEE CENTER • P.O. BOX 25861 • OKLAHOMA CITY, OKLAHOMA 73125

November 30, 1999

BY FEDERAL EXPRESS

Mr. Ronald Steele
% EKO, Second Floor
205 East Grand Avenue
Chicago, IL 60611

Re: 161 E. Grand Avenue, Chicago, Illinois

Dear Mr. Steele:

This letter is simply to confirm the arrangements that have been made with your consultant, Eli Port, concerning removal of certain radiological material from your building at 161 E. Grand Avenue, Chicago, Illinois. Kerr-McGee Chemical L.L.C. ("Kerr-McGee") agrees to reimburse the costs, up to a maximum of forty thousand ($40,000.00) for waste profile testing as required by a licensed disposal site and the transportation of such material to, and its disposal at, a properly licensed disposal site. Your contractor under your supervision will perform the work, and you will pay all other costs associated with the remediation. Kerr-McGee understands that you are the owner of the aforementioned real property.

It is agreed by you that Kerr-McGee's undertaking to reimburse these costs does not constitute an admission or a denial by Kerr-McGee that it has any liability or responsibility for the presence of radiological material at or about the property at 161 E. Avenue or for its remediation.

I would appreciate it if you would countersign this letter and return it to me.

Very truly yours,

George D. Christiansen
Vice President

AGREED TO:_____
Ronald Steele, OWNER

_____
Dated

cc: Mark Krippel

BCC: W.O. Green
T.P. Goresen